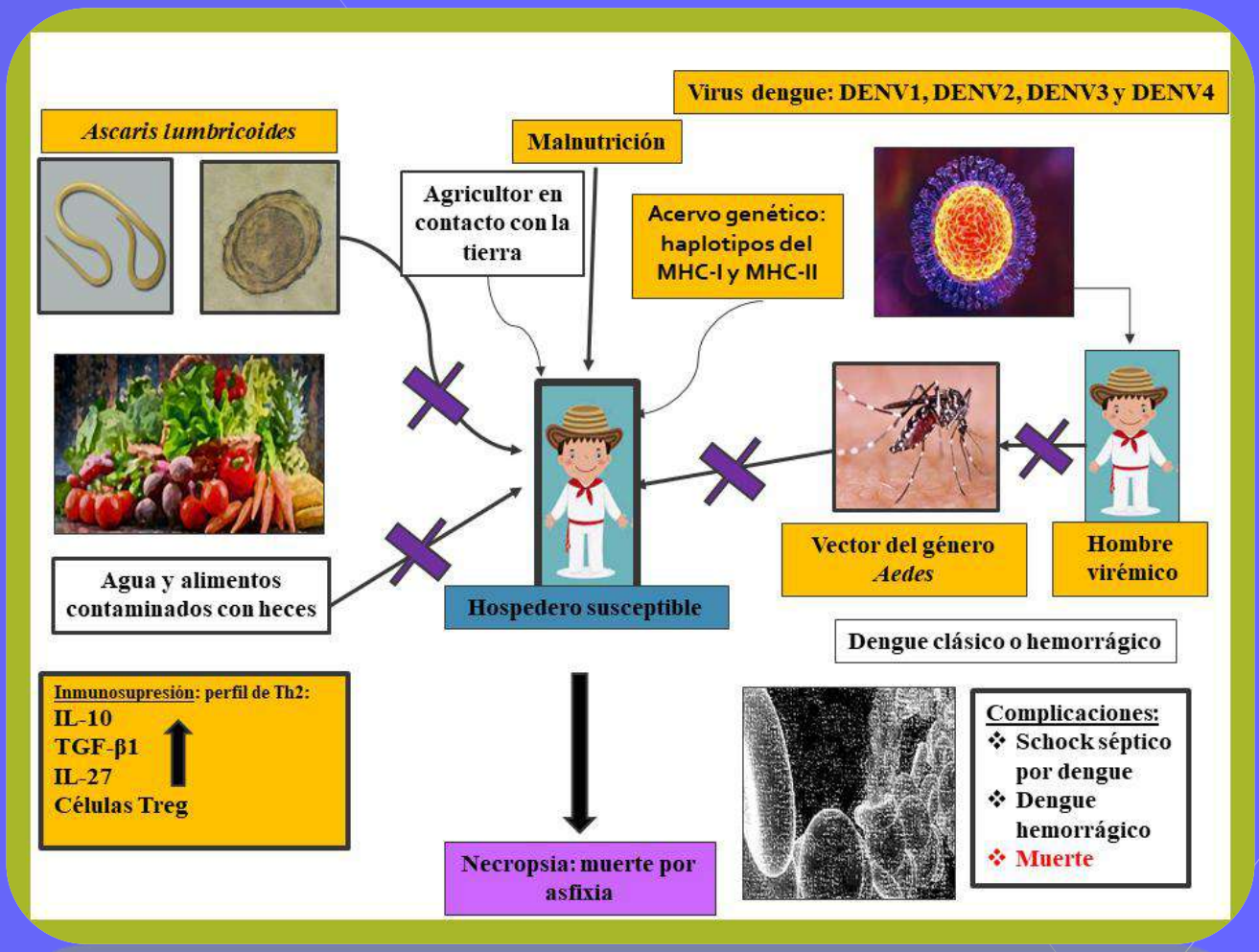
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Sobre la Portada

La portada resalta parte de la publicación titulada Coinfección de Ascaris lumbricoides y virus dengue. Casos clínicos y revisión de la literatura, donde se muestra hipótesis gráfica. La coinfección de A. lumbricoides y el virus dengue DENV , publicado por Camacho ML, et al

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Cartas al editor

Disminución de la capacidad funcional cardiorrespiratoria: Un reto emergente para la salud pública por el COVID-Largo

(Decline in cardiorespiratory functional capacity: An emerging public health challenge due to Long-COVID)

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Estimado editor

Recientemente se han documentado las alteraciones hematológicas en sangre periférica de pacientes con COVID-19 en donde, los pacientes que se encontraban en cuidados intensivos han tenido valores bajos en plaquetas y por ende disminución en sus leucocitos, llevándolos a poseer un sistema inmune disminuido y frágil. No obstante, se evidencia en estos pacientes niveles bajos de macroplaquetas, vacuolas citoplasmáticas y granulaciones tóxicas, influyendo estos valores de forma negativa en la enfermedad (1).

Esto sin lugar a dudas pone en evidencia la existencia de cambios importantes hematológicos y morfológicos en la sangre periférica de pacientes con COVID-19 los cuales fueron ingresados a cuidados intensivos; sin embargo, poco se ha abordado respecto a las repercusiones o secuelas posteriores en la capacidad funcional cardiorrespiratoria de los sobrevivientes del COVID-19. Por ende, el propósito de este escrito es describir los cambios morfofuncionales cardiorrespiratorios provocados por el COVID-Largo y los retos para los profesionales de la salud pública, como aporte al documento en mención.

Sin lugar a dudas, las secuelas a largo plazo del SARS-CoV-2 son importantes e inciertas, debido a que estas se van conociendo día tras día y su comportamiento es incierto en el cuerpo humano (2), Estas se presentan en el 50% de los sujetos y aparecen en algunos casos hasta 12 meses luego de la infección SARS-CoV-2 (3,4), repercutiendo a nivel clínico en complicaciones con los pacientes post COVID y afectando a nivel cardiopulmonar, trastornos neurocognitivos, así como fatiga pronunciada y persistente (5).

Recientemente, se han conocido biomarcadores por la infección por COVID-19, los cuales repercuten en diferentes síntomas en el organismo (6), también, han aumentado la aparición de la neumonía generada por el COVID-19, asociada por los diferentes cambios a nivel ambiental (7).

A partir de ello, algunos estudios han valorado las repercusiones funcionales cardiorrespiratorias, por ejemplo, en la prueba de caminata de 6 minutos se encontraron niveles de saturación del oxígeno en sangre disminuidos, esto en los pacientes con COVID-19, lo que representa una dificultad para realizar con facilidad el intercambio de gases a nivel pulmonar, asumiendo que esta

enfermedad influye de forma negativa en daños pulmonares(8), estos daños repercuten en fenómenos vasculares, los cuales no permiten tener un flujo sanguíneo apropiado para todos los tejidos y a su vez generan lesiones epiteliales graves (9).

Por otro lado, dentro de las secuelas que se generan tras la infección por COVID-19 en estos pacientes se encuentra la limitación a nivel ventilatorio, esta repercute en el buen desarrollo de la actividad física, generando disnea, además, es preocupante que en algún momento puedan desarrollar una hiperventilación, debido a que estos pacientes no tienden a alcanzar una alcalosis hipocapnia (10).

Teniendo en cuenta lo encontrado en la literatura, estas manifestaciones inapropiadas con los pacientes con COVID prolongado, para realizar actividad física es importante desarrollar programas que conduzcan no solo a mejorar la función del organismo ante la infección, sino su estado de salud mental, llevando a cabo ejercicios y terapias que mejoren la condición de los pacientes (11).

De esta manera, para conocer y controlar la capacidad pulmonar con estos pacientes por medio de la saturación del oxígeno en sangre, es importante descartar y predecir de una forma eficiente la disminución de la funcionalidad pulmonar en los sujetos que hayan tenido la infección por COVID-19 y a su vez que hayan sobrevivido (12), por lo que, puede resultar en un indicador clave en las valoraciones de control y seguimiento para el tratamiento post-COVID.

No obstante, es importante valorar la rehabilitación con los pacientes que tengan síntomas persistentes generados por la infección del COVID-19, teniendo en cuenta las directrices dadas por la Organización Mundial de la Salud (13).

Por tal motivo y como respuesta ante la problemática existente, los profesionales de la salud desde un enfoque multidisciplinar deben estructurar programas de tratamiento, seguimiento y control de las secuelas postagudas de la infección por SARS-CoV-2 en las poblaciones más vulnerables y quienes persistan en la sintomatología.

Referencias

1. Roque-García W, Simón-Pita A, Hernández-Rego Y, Rodríguez-García K, Lam-Díaz R. Alteraciones hematológicas en sangre periférica de pacientes con COVID-19. Revista Cubana de Hematología, Inmunología y Hemoterapia. 2023 [acceso 06/08/2023]; 39 (1) [Google Scholar]
2. Moghimi N, Di Napoli M, Biller J, Siegler JE, Shekhar R, McCullough LD, Harkins MS, Hong E, Alaouieh DA, Mansueto G, Divani AA. The Neurological Manifestations of Post-Acute Sequelae of SARS-CoV-2 infection. Curr Neurol Neurosci Rep. 2021; 21: 44. [PubMed] [Google Scholar]
3. Takao M, Ohira M. Neurological post-acute sequelae of SARS-CoV-2 infection. Psychiatry Clin Neurosci. 2023;77: 72-83. [PubMed] [Google Scholar]
4. Sherif ZA, Gomez CR, Connors TJ, Henrich TJ, Reeves WB; RECOVER Mechanistic Pathway Task Force. Pathogenic mechanisms of post-acute sequelae of SARS-CoV-2 infection (PASC). Elife. 2023; 12: e86002. [PubMed] [Google Scholar]
5. Opsteen S, Files JK, Fram T, Erdmann N. The role of immune activation and antigen persistence in acute and long COVID. J Investig Med. 2023;71: 545-62. [PubMed] [Google Scholar]

6. Turton N, Millichap L, Hargreaves IP. Potential Biomarkers of Mitochondrial Dysfunction Associated with COVID-19 Infection. Adv Exp Med Biol. 2023; 1412: 211-24. [PubMed] [Google Scholar]
7. Shrestha DB, Sedhai YR, Budhathoki P, Adhikari A, Pokharel N, Dhakal R, Kafle S, Yadullahi Mir WA, Acharya R, Kashiouris MG, Parker MS. Pulmonary barotrauma in COVID-19: A systematic review and meta-analysis. Ann Med Surg (Lond). 2022; 73: 103221. [PubMed] [Google Scholar]
8. Vrabie D, Abalașei BA. Study of Exercise Capacity and Quality of Life after SARS-CoV-2 Infection among the Elderly. Behav Sci (Basel). 2023; 13: 381. [PubMed] [Google Scholar]
9. Duarte-Neto AN, Monteiro RAA, da Silva LFF, Malheiros DMAC, de Oliveira EP, Theodoro-Filho J, Pinho JRR, Gomes-Gouvêa MS, Salles APM, de Oliveira IRS, Mauad T, Saldiva PHN, Dolhnikoff M. Pulmonary and systemic involvement in COVID-19 patients assessed with ultrasound-guided minimally invasive autopsy. Histopathology. 2020; 77: 186–97. [PubMed] [Google Scholar]
10. Wirth KJ, Scheibenbogen C. Dyspnea in Post-COVID Syndrome following Mild Acute COVID-19 Infections: Potential Causes and Consequences for a Therapeutic Approach. Medicina (Kaunas). 2022; 58: 419. [PubMed] [Google Scholar]
11. Weldon EJ 4th, Hong B, Hayashi J, Goo C, Carrazana E, Viereck J, Liow K. Mechanisms and Severity of Exercise Intolerance Following COVID-19 and Similar Viral Infections: A Comparative Review. Cureus. 2023; 15: e39722. [PubMed] [Google Scholar]
12. Duran M, Uygun T, Kurtipek E. Assessment of Long-Term Sequelae of Pulmonary Dysfunction Associated with COVID-19 Using Pulmonary Pulse Transit Time. J Cardiovasc Echogr. 2022; 32: 200-4 [PubMed] [Google Scholar]
13. Gloeckl R, Leitl D, Schneeberger T, Jarosch I, Koczulla AR. Rehabilitative interventions in patients with persistent post COVID-19 symptoms-a review of recent advances and future perspectives [published online ahead of print, 2023 Jun 16]. Eur Arch Psychiatry Clin Neurosci. 2023;10.1007/s00406-023-01631-9. [PubMed] [Google Scholar].

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Cartas al editor

Factores asociados a la autopercepción genital y procedimientos estéticos genitales en mujeres

(Factors associated with genital self-perception and genital aesthetic procedures in women)

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Estimado editor

Teniendo en cuenta cuanto influye la autoimagen genital en el bienestar sexual de las mujeres, es necesario que los proveedores de atención médica prioricen en la generación de conciencia en la percepción positiva de las mujeres sobre sus genitales (1), debido a que, la insatisfacción en lo que respecta a la apariencia y el tamaño de los genitales se ha convertido en una problemática común, lo que ha llevado al aumento de las cirugías genitales cosméticas (2), por lo que, identificar los factores asociados a la autopercepción genital y procedimientos estéticos genitales en mujeres, corresponde a un tema de interés creciente para los profesionales en áreas de la psicología, psiquiatría, medicina y cirugía estética.

Ahora bien, los procesos de autoimagen genital positiva, se asocian con sentimientos positivos sobre su propio cuerpo, lo que lleva a reducir las preocupaciones al momento del encuentro sexual, generando mayor desempeño y satisfacción sexual (3).

Por otro lado, últimamente, se ha demostrado que los procesos de autoimagen genital es uno de los factores predictivo que ha generado estrés y, por ende, ha perjudicado los momentos de satisfacción sexual (4). No obstante, es importante resaltar que la autoimagen genital femenina no es elocuentemente diferente durante el embarazo y durante el proceso del posparto, ni tampoco en el modo de parto (5). De esta manera, en lo concierne a las mujeres con pareja cuando la autoimagen genital es negativa se asocia con menor satisfacción sexual propia, y, se percibe por los individuos de la pareja de forma simultánea (6).

De la misma manera, se ha demostrado científicamente que las mujeres que tienen antecedentes de procedimientos genitales, tienen una edad media mayor, poseen menor nivel educativo, tienen ingresos familiares altos, poseen mayor número de embarazos, partos, parto vaginal, episiotomía y neonatos con un peso de ≥ 3,5 kg (7) de esa forma, las mujeres que tienen el deseo de someterse a una vaginoplastia poseen disminución en su salud sexual y bajo imagen de sus genitales (8).

Palabras de cierre

La directa relación entre los factores que se asocian con la autopercepción genital y los procedimientos estéticos genitales en mujeres, demuestran la importancia del abordaje de estos temas desde un enfoque multidisciplinar, el cual integre los componentes sociales, médicos y psicológicos. Por lo que, es necesario que los profesionales del área de la salud construyan y promuevan estrategias enfocadas en la mejora constante de la percepción positiva de la autoimagen genital femenina, reconociendo de esa manera el impacto directo que esta genera en el bienestar emocional y sexual de las mujeres.

Además, la promoción en la sensibilización con respecto a los factores de riesgo y las expectativas realistas sobre los procedimientos estéticos debe convertirse en una prioridad de la práctica clínica que garantice decisiones informadas y responsables. De esta forma, se podría tener un enfoque integral sobre el cuidado de la salud sexual y psicológica de las mujeres, reduciendo así cualquier estigma y causando un bienestar general.

Referencias

1. Malary M, Hamzehgardeshi Z, Keramat A, Yunesian M, Farjamfar M. Predictors of genital self-image in Iranian women: a cross-sectional study. BMC Psychol. 2024; 12:541. [PubMed] [Google Scholar]
2. Hustad IB, Malmqvist K, Ivanova E, Rück C, Enander J. Does Size Matter? Genital Self-Image, Genital Size, Pornography Use and Openness Toward Cosmetic Genital Surgery in 3503 Swedish Men and Women. J Sex Med. 2022; 19: 1378-86. [PubMed] [Google Scholar]
3. Komarnicky T, Skakoon-Sparling S, Milhausen RR, Breuer R. Genital Self-Image: Associations with Other Domains of Body Image and Sexual Response. J Sex Marital Ther. 2019; 45: 524-37. [PubMed] [Google Scholar]
4. Sönmez T, Koç Ö, Alver E. The effect of genital self-image on sexual satisfaction and stress in women after vaginal delivery. Rev Assoc Med Bras (1992). 2024; 70: e20240692. [PubMed] [Google Scholar]
5. Samiei G, Mehrbakhsh Z, Khosravi H, Moghasemi S. Genital self-image and sexual function in Iranian women from pregnancy to postpartum: a cohort study. J Sex Med. 2024; 21: 605-13. [PubMed] [Google Scholar]
6. Goldberg SY, O'Kane KMK, Fitzpatrick ET, Jang GE, Bouchard KN, Dawson SJ. Associations between Genital Self-Image and Individuals' Own and Perceived Partner Sexual Satisfaction. J Sex Marital Ther. 2024; 50: 171-81. [PubMed] [Google Scholar]
7. Sasanfar T, Maasoumi R, Ataei M, Haghani S, Nekoolaltak M. Comparative Investigation of Genital Self-image and Sexual Function in Women with and Without a History of Female Genital Cosmetic Procedures: A Cross-sectional Study. Int J Community Based Nurs Midwifery. 2024; 12: 121-34. [PubMed] [Google Scholar]
8. Kloer C, Blasdel G, Shakir N, Parker A, Itzel Gómez A, Zhao LC, Bluebond-Langner R. Does Genital Self-image Correspond with Sexual Health before and after Vaginoplasty? Plast Reconstr Surg Glob Open. 2023; 11: e4806. [PubMed] [Google Scholar]

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Cuestionario clínico ortopédico Kerlan-Jobe: Revisión narrativa de adaptación transcultural, validez y confiabilidad

(Kerlan-Jobe Orthopedic Clinical Questionnaire: Narrative review of cross-cultural adaptation, validity and reliability)

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Resumen(español)

La evaluación, control, medición y regreso a los entrenamientos luego de una lesión, es una de las actividades que tienen los fisioterapeutas y médicos del deporte en el día a día, lo cual amerita una responsabilidad importante debido al riesgo en la toma de decisiones en el que se identifica el regreso después de un proceso de rehabilitación por lesión en hombro o codo. Científicamente se han establecido varios parámetros para realizar dicha valoración en deportistas entre los que se encuentran el Cuestionario Clínico Ortopédico Kerlan-Jobe (KJOC) para hombro y codo, por lo que este estudio tiene como objetivo consolidar algunos procesos de adaptación transcultural, validez y confiabilidad del cuestionario, con el fin que, los profesionales puedan contar con los resultados de los procesos de validación y sus niveles de confiabilidad para que al momento de aplicarlo en procesos de investigación, en la evaluación de las intervenciones quirúrgicas y en la toma de decisiones diagnósticas y terapéuticas lo puedan hacer de forma confiable y segura. Se concluye que, el cuestionario KJOC cuenta respectivamente con estudios de validación y fiabilidad para sus versiones en finlandés, turco, italiano, alemana, coreana, persa, holandesa, noruega y española, presentando de igual forma, la posibilidad de evidenciar que posee buena consistencia interna, validez de constructo al correlacionar con otros instrumentos similares y una buena interpretabilidad, por lo que, se cuenta con un instrumento fiable, válido y aplicable en contextos médico-deportivos.

Palabras clave(español)

Medicina Deportiva, Volver al Deporte, Traumatismos en Atletas, Ortopedia (Fuente: DECS).

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Abstract (english)

The evaluation, control, measurement, and return to training after an injury is one of the activities that physiotherapists and sports doctors have on a day-to-day basis, which merits an important responsibility due to the risk in decision-making in which the return after a rehabilitation process for a shoulder or elbow injury is identified. Scientifically, several parameters have been established to carry out this assessment in athletes, among which are the Kerlan-Jobe Orthopedic Clinical Questionnaire (KJOC) for shoulder and elbow, so this study aims to consolidate some processes of cross-cultural adaptation, validity, and reliability of the questionnaire so that professionals can count on the results of the validation processes and their levels of reliability so that at the time of applying it in research processes, in the evaluation of surgical interventions and in the making of diagnostic and therapeutic decisions, they can do so reliably and safely. It is concluded that the KJOC questionnaire has validation and reliability studies, respectively, for its versions in Finnish, Turkish, Italian, German, Korean, Persian, Dutch, Norwegian, and Spanish, presenting in the same way the possibility of evidencing that it has good internal consistency, construct validity when correlating with other similar instruments, and good interpretability; therefore, it is a reliable, valid, and applicable instrument in medical-sports contexts.

Keywords(english)

Sports Medicine, Return to Sport, Athletic Injuries, Orthopedics (Source: DECS).

Introducción

La evaluación de la participación y la medición de las respuesta al tratamiento en entornos de rehabilitación amerita como condición ineludible en el proceso la evaluación de las lesiones, donde se emplean las medidas que proporcionan los atletas relacionadas con las tareas específicas, según lo presentan Monti y otros, (1) así mismo Dowling y otros(2) plantean la necesidad del desarrollo de una investigación de prevención primaria de posibles lesiones en poblaciones de alto riesgo, la cual contribuye a disminuir los altos costos, la disminución del nivel de calidad de vida y el riesgo de volver a lesionarse, específicamente en el área del hombro.

Con el fin de determinar cuándo debe darse el regreso después de un proceso de rehabilitación por lesión en hombro o codo, se han establecido varios parámetros de la función de lanzamiento mediante la puntuación de la Clínica Ortopédica Kerlan-Jobe (KJOC). También se toma en cuenta, la relación entre un historial de lesiones en las extremidades superiores de tipo músculo esqueléticas y la puntuación KJOC, y en dicha relación es debido tomar en cuenta tanto la atención central en el dolor, (3) como los acontecimientos que se generan después de la reconstrucción del ligamento colateral cubital.(4)

Los aspectos antes mencionados, así como todo lo referido a el establecimiento de parámetros y de los niveles necesarios de las situaciones que pueden llegar a presentarse ante una evaluación a los atletas, revisten de importancia el hecho de contar con instrumentos que ofrezcan los requerimientos de validación que a nivel de investigación ameritan.

Todo instrumento de medición en investigaciones tiene un objetivo particular, como por ejemplo las escalas que determinan el retorno de sus actividades después de un proceso de rehabilitación, la cual es diseñada con el fin de ofrecer evidencias sobre su objeto de estudio; es por ello, que una vez diseñadas y validadas, estas pueden ser aplicados por otros investigadores en contextos semejantes, lo que genera la necesidad de tener sus traducciones en varios idiomas y que su validación sea específica para los diversos escenarios donde puedan ser aplicados.(5)

Plantearse el objetivo que persigue consolidar algunos procesos de adaptación transcultural, validez y confiabilidad del cuestionario KJOC, se traduce de forma directa en el beneficio de que los profesionales puedan contar con los resultados de los procesos de validación y sus niveles de confiabilidad para que al momento de aplicarlo en procesos de investigación, en la evaluación de las intervenciones quirúrgicas y en la toma de decisiones diagnósticas y terapéuticas lo puedan hacer de forma confiable y segura.

Métodos

Una vez concluida una primera fase de búsqueda, en la que no se aplicó restricción desde la fecha de inicio hasta el 16 de octubre de 2023, con la aplicación de la siguiente estrategia de búsqueda: "Validation" AND "Reliability" AND "Kerlan-Jobe Orthopaedic Clinic" se logró la obtención de documentos para las bases de datos como Pubmed (n = 8), Scopus, Springerlink (n = 9), Taylor & Francis (n = 3), Science Direct (n = 27), Sage Journals (n = 13), EBSCOShost (n = 8), Scielo (n = 0), Nature (n = 0), Google Académico (n = 187) y del mismo modo, se consideraron las investigaciones relacionadas con los criterios de inclusión y las cuales presentan los procesos mediante los que legitiman las

diversas versiones del Cuestionario KJOC, ofreciendo el documento completo y en diferentes idiomas.

El siguiente paso del proceso consistió en la revisión de diversas bases de datos para obtener la identificación de las publicaciones, el procedimiento de selección se efectuó tomando en cuenta los títulos y los resúmenes, haciendo un proceso de exclusión de aquellas cuyos procesos de validación o evaluación de la fiabilidad no se relacionaran con el cuestionario KJOC en algún idioma o que de algún modo sus instrumentos obedecieran a diferentes cuestionarios.

Como fase de finalización del proceso de selección se efectuó una búsqueda cruzada empleando las referencias de los estudios incluidos inicialmente, escogiendo al azar algunos de ellos, obteniéndose como resultado diez validaciones para diversos idiomas del cuestionario KJOC, presentándose un caso específico de la versión griega del cuestionario KJOC,(6) el cual después de haber sido seleccionado, se evidenció que no cuenta con revisión por pares, característica que llevó a ser descartado en esta revisión, reduciéndose a 9 trabajos en la totalidad incluidos.

Desarrollo

La compilación de los 9 trabajos analizados se presenta en la Tabla 1, en la cual se describen aspectos clave como los participantes valoraciones y disciplinas deportivas incluidas en el estudio, así como las pruebas estadísticas aplicadas y sus respectivos hallazgos obtenidos con respecto al instrumento KJOC.

Validez de contenido y Validez de Constructo. Partiendo de la definición empírica de la validez como el grado en el que un instrumento en verdad mide la variable que se busca calcular, es posible determinar que según, Sukanen y otros(7) en Finlandia realizaron modificaciones menores durante el proceso de traducción y adaptación transcultural, que se relacionaron con la terminología cultural específica en los deportes y fueron acordadas por un comité de expertos, lo que le otorga un alto nivel de Validez de Contenido, de igual manera, el parámetro Validez de Constructo de la puntuación KJOC fue de moderada a alta.

Según las correlaciones con DASH (r = - 0,757); módulo deportivo DASH (r = - 0,667); ASES (r = 0,559); y cuestionarios RAND-36 (r = 0,397), sin embargo, Turgut & Tunay,(8) presenta que la validez de constructo en Turquía, fue buena para todos los participantes, ya que se obtuvo la validez discriminante al someterla a un proceso de comparación, donde los tres subgrupos de atletas se encontraban en tres situaciones diferentes, tales como: jugar sin problemas en el brazo; jugar, pero con problemas en el brazo; y no jugar debido a problemas en el brazo.

En las revisiones a los postulados del idioma alemán se encontró que Schulz y otros, (9) sugiere una Validez de Constructo moderada, mientras que Fredriksen & Myklebust,(10) muestran en la versión noruega, que la Validez Concurrente versus DASH fue moderada de −0,642, y entre KJOC-N y DASH-sport fue de −0,790. Sin embargo, KJOC tuvo un rango más amplio de puntuaciones que DASH, quien distinguió mejor entre sujetos que jugaban con y sin dolor y fue más sensible para capturar a los que participaban con dolor.

Confiabilidad e interpretabilidad. Sukanen y otros(7) en su trabajo muestra la puntuación KJOC finlandesa con una excelente consistencia interna (α = 0,92) y una buena confiabilidad test-retest (modelo de efectos mixtos bidireccional ICC = 0,77) con un nivel de error de medición aceptable, así como en Turquía, Turgut & Tunay,(8) α de Cronbach de 0,94, la confiabilidad test-retest del KJOC-SES-Tr fue excelente con un coeficiente interclase de 0,93. Hubo una fuerte correlación entre el KJOC-SES-Tr, el DASH (r = -0,645), Módulo deportivo DASH (r = -0,843) y el ASES (r = 0,831).

En Italia, Merolla y otros,(11) logran describir los parámetros de confiabilidad e interpretabilidad mediante la presentación italiana del cuestionario KJOC, donde el alfa de Cronbach fue de 0,910, es confiable en términos de los ítems individuales y la puntuación general (ICC 0,95-0,99); alta correlación con la escala DASH (r = -0,697) y módulo deportivo DASH (r = -0,704) ; y que responde a las diferencias clínicas en la función del hombro (p <0,0001), comparable con la versión alemana presentada por Schulz y otros, (9) et al., (2022) donde la consistencia interna (alfa de Cronbach = 0,93) y la confiabilidad test-retest (ICC 2,1 = 0,94) del cuestionario general fueron excelentes. Correlaciones moderadas con la versión alemana del cuestionario Discapacidades del brazo, hombro y mano (DASH) (r = −0,51, p < 0,05).

En términos de confiabilidad, la versión coreana, cuyos autores son Oh y otros,(12) presentan un cuestionario con la puntuación K-KJOC correlacionada con el Quick DASH - discapacidad/síntoma (-0,309, ~-0,268, p < 0,05), Quick DASH - trabajo (r = -0,721 a -0,671, p = 0,000) y QuickDASH - deportes (r = -0,721 a -0,714, p = 0,000), describen además una consistencia interna de la puntuación K-KJOC excelente (α de Cronbach: 0,917-0,966), y los coeficientes de correlación intraclase de confiabilidad test-retest para los 10 ítems de la puntuación K-KJOC fueron de regular a excelente (ICC 0,505- 0,937, p < 0,05), sin embargo el tiempo que se describe en la versión holandesa, por parte de Leenen y otros,(13) donde el alfa de Cronbach estuvo

Tabla. 1. Fiabilidad y validez del instrumento KJOC .

Instrumentos	Población y tamaño de muestra	Análisis estadístico	Resultados
KJOC versión finlandés, DASH, ASES y RAND-36 (Sukanen y otros, 2022)	114 atletas (52 hombres, 62 mujeres, edad media 18,1 ± 2,8 años) de cinco deportes diferentes (voleibol, natación, tenis, gimnasia, béisbol finlandés) que competían a nivel nacional o internacional	a) Consistencia interna b) Confiabilidad test-retest c) Validez de constructo d) Error de medición	a) Alfa de Cronbach de 0,92 b) ICC de 0,77 c) r= − 0,757 para DASH, r = − 0,667 en DASH-sport, r = 0,559 para ASES, y r = 0,397 en RAND-36 d) Error de medición aceptable (EEM 5,5; CMD 15,1)
KJOC versión turco, ASES y DASH (Turgut y Tunay, 2018)	123 atletas que realizan ejercicios por encima de la cabeza (voleibol, balonmano, baloncesto, natación, tenis y wáter polo) con una edad media de 23,1 ± 5,06 años.	a) La confiabilidad test-retest b) Validez de constructo	a) CIC de 0,93. b) r = −0.64 para DASH, r = −0.84 para DASH-sport, y, r = 0.83 para ASES
KJOC versión italiana, DASH (Merolla et al., 2017)	90 atletas profesionales de voleibol, softbol, tenis, beisbol y natación con dolor en el hombro y se les asignó al "grupo de lesión" (n = 32) o al "grupo de uso excesivo" (n = 58)	a) Consistencia interna b) Validez de constructo c) Confiabilidad test-retest d) Interpretabilidad	a) alfa de Cronbach fue de 0,910 b) r = −0,697 para DASH y r= −0,704 en DASH-sport c) CIC de 0,99 d) No hubo efectos suelo o techo antes o después del tratamiento para la puntuación total del KJOC.
KJOC versión alemana, DASH (Schulz et al., 2022)	152 atletas (edad 25,0 ± 6,6 años; 87 hombres/65 mujeres) de balonmano, voleibol, béisbol, softbol,baloncesto, waterpolo, tenis o bádminton a nivel de competición	a) Consistencia interna b) Validez de constructo c) Confiabilidad test-retest	a) alfa de Cronbach = 0,93. b) r = -0,51 para DASH, y, r = -0,54 en DASH-sport c) CIC de 0,94
KJOC versión coreana, Quick DASH (Oh et al., 2017)	52 jugadores de béisbol profesionales de la Liga Coreana de Béisbol	a) Consistencia interna b) Validez de constructo c) Confiabilidad test-retest	a) Alfa de Cronbach de 0,917-0,966. b) r = -0,268 a -0,309 en Quick DASH, r = -0,671 a -0,721 en Quick DASH – trabajo, r = -0,714 a -0,721 en Quick DASH-sport. c) CIC de 0,505- 0,937.
KJOC versión persa, DASH y SF-12 (Moarref et al., 2020)	341 atletas (45 hombres y 296 mujeres; edad: 18.93±5.30 años) de voleibol, balonmano y wáter polo	a) Consistencia interna b) Validez de constructo c) Confiabilidad test-retest	a) Alfa de Cronbach de 0,92 b) r =−0.559 en DASH y r=−0.505 para SF-12. c) CIC de 0,82
KJOC versión holandesa, DASH y WOSI (Leenen y otros, 2022)	107 lanzadores juveniles de beisbol entre 12 y 18 años.	a) Consistencia interna b) Validez de constructo c) Interpretabilidad	a) Alfa de Cronbach de 0,8 para todo el grupo y 0,62-0,86 para el subgrupo sintomático. b) r = -0,47 y -0,67 para todo el grupo con DASH; r = -0,32 a -0,87 en WOSI y -0,58 a -0,99 en DASH para el grupo sintomático. c) No se observó ningún efecto suelo para el cuestionario KJOC
KJOC versión noruega, DASH (Fredriksen & Myklebust, 2019)	33 deportistas de balonmano (edad 18,6 ± 4,2 años, 10 hombres/23 mujeres)	a) Consistencia interna b) Validez de constructo c) Confiabilidad test-retest	a) Alfa de Cronbach de 0,952. b) r = −0,642 para DASH, y r = -0,790 para DASH-sport. c) CIC de 0,967 (IC del 95%: 0,935 a 0,984).
KJOC versión española, DASH y SPADI (Bailón-Cerezo y otros, 2023).	100 participantes (41 mujeres y 59 hombres) con una edad media de 22,4 ± 5,9 años	a) Consistencia interna b) Validez de constructo c) Confiabilidad test-retest d) Interpretabilidad	a) Alfa de Cronbach de 0,98. b) r = -0,60 para SPADI, y, r = 0,66 para DASH. c) CIC de 0,96. d) No se observaron efectos suelo o techo entre los atletas sintomáticos.

EEM: error estándar de medición; CMD: Cambio mínimo detectable; CIC: Coeficiente interclase; Formulario de Evaluación de Cirujanos Estadounidenses de Hombro y Codo/American Shoulder and Elbow Surgeons Evaluation Form (ASES) y Discapacidades del Brazo, Hombro y Mano/ Disabilities of the Arm, Shoulder, and Hand (DASH); Cuestionario WOSI de inestabilidad de hombro/Western Ontario Shoulder Instability Index (WOSI); Cuestionarimo corto de 12-ítems para curación/12-Item Short Form Health Survey (SF-12); Índice de discapacidad del dolor y el hombro: Shoulder Pain and Disability Index (SPADI).

períodos de tiempo para todo el grupo y osciló entre 0,62 y 0,86 para el subgrupo sintomático es más representativa, del mismo modo, los coeficientes de correlación de rangos de Spearman oscilaron entre -0,47 y -0,67 para todo el grupo con DASH y entre -0,32 a -0,87 en WOSI y -0,58 a -0,99 en DASH para el subgrupo sintomático.

Siguiendo en las descripciones de los parámetros de confiablidad e interpretabilidad la versión noruega, presentada por Fredriksen & Myklebust,(10) mostró una excelente consistencia interna (α de Cronbach = 0,952) y confiabilidad relativa test-retest (coeficiente de correlación intraclase, ICC = 0,967). SEM, cambio mínimo detectable (MDC) y límites de concordancia fueron 3,1 a 8,5 y -9,2 a 7,7, respectivamente, en el habla persa, Moarref y otros,(14) sugieren que los coeficientes de correlación intraclase de confiabilidad test-retest para los 10 ítems de KJOC-SES fueron excelentes (ICC = 0,82, p < 0,001) y la nueva puntuación estratificó correctamente a los atletas por encima de la cabeza según la categoría de lesión (P <0,001).

Finalmente, en el habla hispana, Bailón-Cerezo y otros,(15) presentan las correlaciones, describiendo que fueron de -0,60 (p < 0,05) con el cuestionario del Índice de discapacidad del dolor y el hombro y de -0,66 (p < 0,05) con el cuestionario del Módulo deportivo de discapacidad del brazo, el hombro y la mano. El alfa de Cronbach fue de 0,98 (intervalo de confianza del 95%, 0,97-0,98) y el ICC fue de 0,96 (intervalo de confianza del 95% 0,93-0,98). No se observaron efectos suelo o techo entre los atletas sintomáticos.

Otras aplicaciones

Entre otras consideraciones de valor fundamental para la sustentación de las descripciones de los parámetros analizados, el trabajo de Erickson y otros,(16) donde se seleccionó una muestra de cincuenta pacientes, los cuales fueron asignados al azar para completar el cuestionario KJOC, de dos formas diferentes: por teléfono (25 pacientes) y en persona (25 pacientes), según un análisis de poder a priori, ofrece como resultados que no hubo diferencias significativas en la puntuación general del KJOC entre los grupos de teléfono y los presenciales siendo (p = 0,139). El coeficiente de correlación intraclase que comparó las puntuaciones presenciales y por teléfono fue de 0,802 (IC del 95 %, 0,767-0,883; p < 0,001), con un alfa de Cronbach de 0,89. Al comparar las preguntas individuales, hubo diferencias significativas para las preguntas 1, 3 y 8 (p = 0,013, 0,023 y 0,042, respectivamente).

Esta consideración antes descrita, permite determinar que el cuestionario KJOC se puede administrar por teléfono sin diferencias significativas en la puntuación general en comparación con la administración en persona.

Del mismo modo, Monti y otros,(1) considera que esta evaluación cuantifica la respuesta mediante la puntuación de ítems, y también ofrece una cifra final determinante en la toma de decisiones clínicas, ante la presencia de síntomas en el atleta. Se complementa esta consideración con el aporte de Chasse y otros,(17) cuando describe que los lanzadores sin antecedentes quirúrgicos obtuvieron mejores puntajes KJOC en tiempo de calentamiento, resistencia competitiva e impacto en las relaciones del equipo; destacando que una carga elevada (> 5,5 h/día) provocó un riesgo 2,6 veces mayor de lesiones y una aparición de lesiones 3,3 veces más temprana que una carga baja (< 5,5 h/día).(18)

Con el propósito de identificar las patologías potenciales y así poder ofrecer a los atletas signos de alertas y confirmar ante los profesionales médicos la importancia y la necesidad prioritaria de la evaluación Rich y otros,(19) ofrece el postulado que presenta la combinación de pruebas grupales de deterioro específico aunadas a una herramienta de autoevaluación, que logre centrarse en la actividad del atleta como una importante opción que permitirá determinar en las pretemporadas el grupo de factores de riesgo referidos a este tipo específico de lesiones, los cuales son altamente conocidos y fáciles de determinar, a diferencia de los que se presentan en las temporadas.(20)

Conclusión

A partir de revisión bibliográfica y los análisis efectuados, es posible concluir que de acuerdo a estas evidencias científicas el cuestionario KJOC cuenta respectivamente con estudios de validación y fiabilidad para sus versiones en finlandés, turco, italiano, alemana, coreana, persa, holandesa, noruega y española, presentando de igual forma, la posibilidad de evidenciar que posee buena consistencia interna, validez de constructo al correlacionar con otros instrumentos similares y una buena interpretabilidad, por lo que, se cuenta con un instrumento fiable, válido y aplicable en contextos médico-deportivos.

Conflictos de interés

Ninguno que declarar.

Referencias

1. Monti R, Fernandez-Fernandez A. The Kerlan-Jobe Orthopaedic Clinic Shoulder & Elbow Score used as a Patient-Reported Outcome Measure for the Youth and High School Aged Baseball Athlete. Int J Sports Phys Ther. 2022; 17: 879-86. [PubMed] [Google scholar]
2. Dowling B, McNally MP, Chaudhari AMW, Oñate JA. A Review of Workload-Monitoring Considerations for Baseball Pitchers. J Athl Train. 2020; 55: 911-7. [PubMed] [Google scholar]
3. Faherty MS, Plata A, Chasse P, Zarzour R, Sell TC. Upper Extremity Musculoskeletal Characteristics and the Kerlan-Jobe Orthopaedic Clinic Questionnaire Score in Collegiate Baseball Athletes. J Athl Train. 2019; 54: 945-52. [PubMed] [Google scholar]
4. Tsuruike M, Ellenbecker TS, Hirose N. Kerlan-Jobe Orthopaedic Clinic (KJOC) score and scapular dyskinesis test in collegiate baseball players. J Shoulder Elbow Surg. 2018;27: 1830-6. [PubMed] [Google scholar]
5. Castejón Oliva FJ, Santos Pastor ML, Palacios Picos A. Cuestionario sobre metodología y evaluación en formación inicial en educación física / Questionnaire On Methodology And Assessment In Physical Education Initial Training. pp. 245-267. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte. 2015; 58: 245–67 [Google scholar]
6. Paraskevopoulos E, Plakoutsis G, Papandreou M. Cross-cultural adaptation and validation of the Greek version of the Kerlan-Jobe orthopaedic clinic shoulder and elbow score in Greek overhead athletes. F1000Res. 2023; 12: 498. [PubMed]
7. Sukanen M, Pajari J, Äyrämö S, Paloneva J, Waller B, Häkkinen A, Multanen J. Cross-cultural adaptation and validation of the Kerlan-Jobe Orthopaedic Clinic shoulder and elbow score in Finnish-speaking overhead athletes. BMC Sports Sci Med Rehabil.. 2022;14. [PubMed] [Google scholar]
8. Turgut E, Tunay VB. Cross-cultural adaptation of Kerlan-Jobe Orthopaedic Clinic shoulder and elbow score: Reliability and validity in Turkish-speaking overhead athletes. Acta Orthop Traumatol Turc. 2018; 52: 206-10. [PubMed] [Google scholar]
9. Schulz C, Eibl AD, Radovanović G, Agres A, Nobis T, Legerlotz K. Cross-cultural adaptation and validation of the Kerlan-Jobe orthopedic clinic shoulder and elbow score for German-speaking overhead athletes. Physiother Theory Pract. 2022; 38:1059–70. [PubMed] [Google scholar]
10. Fredriksen H, Myklebust G. Norwegian translation, cross-cultural adaptation and validation of the Kerlan-Jobe Orthopaedic Clinic shoulder and elbow questionnaire. BMJ Open Sport Exerc Med. 2019;5: e000611. [PubMed] [Google scholar]
11. Merolla G, Corona K, Zanoli G, Cerciello S, Giannotti S, Porcellini G. Cross-cultural adaptation and validation of the Italian version of the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow score. J Orthop Traumatol. 2017;18: 415-21. [PubMed] [Google scholar]
12. Oh JH, Kim JY, Limpisvasti O, Lee TQ, Song SH, Kwon KB. Cross-cultural adaptation, validity and reliability of the Korean version of the Kerlan-Jobe Orthopedic Clinic shoulder and elbow score. JSES Open Access. 2017;1: 39-44. [PubMed] [Google scholar]
13. Leenen AJR, Hurry A, van Dis F, van der Graaff E, Veeger HEJ, Hoozemans MJM. Cross-Cultural Adaption and Validation of the Dutch Version of the Kerlan-Jobe Orthopaedic Clinic Questionnaire in Juvenile Baseball Pitchers. Sports (Basel). 2022; 10: 163. [PubMed] [Google scholar]
14. Moarref S, Noorizadeh Dehkordi S, Akbari M, Sedighimehr N. Persian translation and cross-cultural adaptation of the Kerlan-Jobe orthopaedic clinic shoulder and Elbow Score in overhead athletes. Func Disabil J [Internet]. 2020 [citado el 16 de octubre de 2023]; 3: 35–44. [PubMed] [Google scholar]
15. Bailón-Cerezo J, La Touche R, Sánchez-Sánchez B, de la Rosa-Díaz I, Torres-Lacomba M, Hernández-Sánchez S. Spanish Cross-Cultural Adaptation and Validation of the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score. J Sport Rehabil. 2023 Sep 27; 33: 12-9. [PubMed] [Google scholar]
16. Erickson BJ, Chalmers PN, Newgren J, Malaret M, O'Brien M, Nicholson GP, Romeo AA. Can the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score Be Reliably Administered Over the Phone?: A Randomized Study. Orthop J Sports Med. 2018; 6: 2325967118791510. [PubMed] [Google scholar]
17. Chasse P, Bullock GS, Schmitt AC, Little BA, Diehl LH, Butler RJ. The relationship between trunk rotation, upper quarter dynamic stability, and the kerlan-jobe orthopaedic clinic overhead athlete shoulder and elbow score in division i collegiate pitchers. Int J Sports Phys Ther. 2018; 13: 819-27 [PubMed] [Google scholar]
18. Shitara H, Tajika T, Kuboi T, Ichinose T, Sasaki T, Hamano N, Endo T, Kamiyama M, Yamamoto A, Kobayashi T, Takagishi K, Chikuda H. A small number of daily pitches induces shoulder and elbow injuries among high school baseball pitchers: a prospective study. Sci Rep. 2020; 10: 21955. [PubMed] [Google scholar]
19. Rich A, Stickley L. Correlation between the kerlan-jobe orthopedic clinic screen and subacromial impingement test-item cluster in collegiate baseball pitchers: a pilot study. Int J Sports Phys Ther. 2020; 15: 1080-9. [PubMed] [Google scholar]
20. Shitara H, Tajika T, Kuboi T, Ichinose T, Sasaki T, Hamano N, et al. High baseball loads induce shoulder and elbow injuries among high school baseball pitchers: a prospective study. Sci Rep. 2021; 11. [PubMed] [Google scholar]

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Infectious nexus between oral and maxillofacial pathology and periodontology- a narrative review

(Nexo infeccioso entre la patología oral y maxilofacial y la periodontología: una revisión narrativa)

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Abstract(english)

The periodontium is the anatomical structure in which forces applied impinge upon the teeth which in turn is associated with the bacterial infection and plaque. The periodontium is associated with the gingivae and also the ligaments connected with the periodontal region and thus both the dentists and the periodontists can communicate with each other and together find the effects of the lesions and can detect and diagnose in the early stages. On various disease conditions, the classification and illustration is done as well some investigation is to be done whenever any abnormality is seen.

Keywords(english)

oral, periodontium, pathology, gingiva, lesion.

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Resumen(español)

El periodonto es la estructura anatómica donde las fuerzas aplicadas impactan los dientes, lo que a su vez se asocia con la infección bacteriana y la placa. El periodonto está conectado con la encía y los ligamentos que conectan con la región periodontal, por lo que tanto dentistas como periodoncistas pueden comunicarse entre sí y, juntos, identificar los efectos de las lesiones, así como detectarlas y diagnosticarlas en sus etapas iniciales. Se realiza la clasificación e ilustración de diversas enfermedades, y se debe realizar una investigación ante cualquier anomalía.

Palabras clave(español)

oral, periodonto, patología, encía, lesión.

Introduction

The gingival lesions are formed due to changes in the genetic origin, infectious origin, immunologic origin, traumatic origin, sometimes auto-immunity and auto-inflammatory disorders and also when drugs are induced in larger quantities and when proper care is not taken. Hence the dentist should do the early diagnosis to prevent the gingival lesions in the patients. Various gingival lesions are treated in different ways according to the severity and their origin. Based on the age, gender, pain, clinical representation the involvement of the tissue, the gingival lesions are classified into many disorders. The gingival lesions, if persists may be malignant and causes cancers like squamous cell carcinoma. So, both periodontists and the dentists must correlate, communicate and then follow the protocols so as to eradicate this type of above disorders by early detection and early diagnosis.

Periodontal lesions

The classification of the gingival lesions is named depending upon the genetic origin like hereditary gingival fibromatosis which is normal to slightly pale colour and very firm in their texture as well enlargement of the gingivae is seen in this condition. It is an autosomal dominant mutation which is mostly seen with son-of-sevenless gene that plays an important role in activation of Ras in which guanine-nucleotide exchange takes place and therefore proliferation of the cell takes place and thus causes fibrosis in the gingivae. In this syndrome, hypertrichosis is seen along with epileptic disorders and mental retardation is seen occasionally. Oral hygienic care is the ultimate treatment along with the surgery (1,2). The second gingival lesions named Ligneous gingivitis is a rarely seen disorder in which enlargement of the gingivae is seen because of no usage of the medicines and treatments. Some nodes are seen along with the ulcers on the gingival surface (3). Also in fewer patients with ligneous gingivitis, hypoplasminogenemia is seen in higher quantities as it is also associated with the inherited type 1 plasminogen deficiency (4). The third lesion called odontogenic gingival epithelial hamartoma is a benign hamartomatous lesion which is rarely seen in the epithelial remnants of dental lamina otherwise called as rests of Serres in most of the female adults. It is an asymptomatic gingival innocuous lesion diagnosed for the peripheral odontogenic neoplasms. The gingival lesions which are of traumatic origin are very common and can be easily detected by the dentists. These purplish or bluish peripheral giant cell lesions also called as giant cell epulis which are obtained from the periodontal ligament otherwise called periosteum in respond to the local trauma. There are several multinucleated giant cells which are of osteoclastic origin connected to vascular cellular tissue (5,6). Sometimes, brown tumours are seen which are related to hyperparathyroidism and they look alike the giant cell lesions which are to be excluded in the treatment process. Based on the infectious origin, gingival lesions are classified in various lesions such as herpes simplex virus infection, which is seen in young children with the painful reddened, swollen gums and intra-oral vesicles. The primary herpetic gingivostomatitis is an acute viral illness that is different from other viral infections which involves oral mucosa, herpangina, hand, foot and mouth disease. Treatment involves, antiviral agent such as acyclovir which is recommended in immunocompromised hosts as well it is also observed thoroughly that the patient is hydrated (7,8). Other herpes viruses like gingival herpes zoster virus and varicella zoster virus may rarely affect the peridontium. Based on the HIV infection, the linear gingival erythema and necrotizing periodontitis is seen but they are very rarely seen as highly active antiretroviral therapy is used to minimise the symptoms. Human papillomaviruses may cause gingival papillomas in the patients with HIV including focal epithelial hyperplasia and warts (9,10). Based on the immunologic origin, the

gingival lesions are classified as Lichen planus which is associated with lesions seen on the buccal mucosa, lateral margins of tongue and gingivae. These are asymptomatic, atrophic ulcers that affect the gingiva causing edema and desquamation. Biopsy is used in the diagnosis process. But there is a difficulty in perfect diagnosis as the cause of lichen planus is not totally known but it is immunologic process in which basal epithelial keratinocytes are destroyed by the cytotoxic T-cells which is triggered by the usage of the medications (11,12). Sometimes, the symptomatic gingival lichen planus may disturb the normal oral-hygiene routine of the patient leading to gingivitis which results in the oral lichen planus. In this condition, the dentist, and the periodontist should co-ordinate, communicate and diagnose in regular intervals so as there will be no occurrence of the oral squamous cell carcinoma which is pertaining to atrophic or ulcerative oral lichen planus (13,14). The mucous membrane pemphigoid is also a rare, chronic, auto immune gingival lesion seen in middle-aged and elderly females in which autoantibody like BP180 is formed in the basement membrane with the bulla formation or oral mucosal vesicle formation. Usually, desquamation is seen along with the painful erythema in the gingiva or minor trauma is also seen. Treatment involves biopsy followed by routine microscopic evaluation and immunofluorescence (15,16). Pemphigus vulgaris is another type of gingival lesions which is rare, auto immune disease which occurs in intraoral region. Antibody such as desmoglein-3 is formed when cell gets adhered to form molecules which lead to bulla formation, desquamation and ulceration in the oral mucosa. Biopsy is the ultimate treatment before doing therapies like topical and systemic immunosuppressive therapy. The tissue is very delicate, so, care has to be taken while taking the specimen and that too not directly from the gingival site but perilesional site is taken into consideration for the diagnosis. Therefore, the early diagnosis helps in minimising the severity of the oral lesions as well there is no requirement to induce desmoglein-1 antibody (17,18). Orofacial granulomatosis is also another type of gingival lesion in which the swelling in the lower part of the face is seen that includes lips, and the cheek mucosa. Diffused gingival erythema is also seen. The treatment includes biopsy that shows non-caseating granulomata. The oral lesions in the patient having this order may antedate gastrointestinal Crohn's disease otherwise called as sarcoidosis. Benzoates and cinnamonaldehyde are highly recommended to overcome this disorder (19,20). The lesions which are so common and that cause esthetic problems and interferes with mastication and which are associated with the enlargement of the gingiva when drugs such as phenytoin, calcineurin inhibitors like cyclosporine and tacrolimus, and calcium channel blockers like nifedipine, oxidipine, diltiazen, and amlodipine are called drug-induced gingival lesions (21,22). These drugs inhibits the cation flux, which ultimately leads to decreased uptake of folate by gingival fibroblasts and also lack of collagenase activation along with the changes in the matrix metalloproteinase metabolism are seen. The treatment involves care towards the oral hygiene. Xerostomia increases susceptibility towards the tooth-root dental caries and gingivitis and this in turn results in plaque formation at tooth-gingiva interface. So medications such as antidepressants and diuretics can be given to the patients. If the medication is not taken, symptomatic relief may occur with salivary substitutes or salivary stimulants or Sjogren's syndrome has to be taken into consideration. When the gingival involvement is peculiar with the cysts and neoplasms formation in the odontogenic tissues, then there is enlargement in the intra bony site and also expansion in the cortical plate is seen, this type of lesions are seen in the soft tissues of the gingiva like gingival cyst and are called as odontogenic cysts and neoplasms (23-25. When there is no bone involvement, there is predilection of lingual gingiva in the premolar area of the mandible and this condition is called as extra-osseous ameloblastoma otherwise called as peripheral ameloblastoma which has the histological features alike as the intra-osseous one which retains invasive growth (26,27). The benign neoplasms that produce cementum like ossifying fibroma and benign cementoblastoma and non-neoplastic bone lesions like osseous dysplasia and fibrous dysplasia may be present in the swelling of the alveolar bone (28). Another condition called as leukoplakia which may be homogenous or non-homogenous may develop in the gingiva and may give rise to malignant transformation due to more in-take of tobacco, alcohol and smoking. Biopsy is the best necessity to check the occurrence of the epithelial dysplasia (29). Squamous cell carcinoma is also the most prevailing oral malignancy in which the edentulous alveolar mucosa and the gingivae are mostly involved. The treatment involves biopsy which is to be done within 3 weeks as well local surgery can be done to eradicate gingival squamous cell carcinoma. If any lesions are not treated then they may cause more difficulty in the surgical process and as well it may be fatal (30). The heterogeneous group of malignant disorder which is derived from the lymphatic cells is

called lymphoma. It is the second most common intra-oral malignant disorder after squamous cell carcinoma. B-cell non-Hodgkin's lymphoma is the most common oral lymphoma. The extra-nodal Hodgkin's lymphoma is rarely seen. Immunodeficiency also causes gingival lesions in the people. Biopsy is the ultimate task for the diagnosis that shows atopical invasive growth. Immunohistochemical markers are also used for various classifications (31).

There are various disorders classified depending upon the prevalence, age group, gender, clinical representation, pain and other oral tissue involvement.

Erythroplakia is a disorder seen around 0.02%-0.83% of older adults. The clinical presentations are isolated fiery red patches which have a papillary or velvety surface observed on all mucosal surfaces which are painless.

Lymphoma is also one of the disorders which is seen in predominantly in males than in females in their 6th and 7th decades. Lymphadenopathy, bony expansion and oral mucosal swelling is seen on any oral mucosal surface, tonsils, bone and the palate which has variable pain.

Proliferative verrucous leukoplakia is seen mostly in 5th-7th decades of people predominantly in females than in males. Multifocal verrucous and papillary white plaque is seen with squamoproliferative lesions on all oral mucosal surfaces and are painless. Sometimes predilection of the gingiva is seen.

Acute myeloid leukemia is a disorder seen in males than in females of age group 85-89 years. Purpuric enlargement along with redness and bleeding is seen in the buccal mucosa with less or no pain.

Oral squamous cell carcinoma is disorder seen 3.1% in worldwide population. Seen predominantly in males than in females of age 70-74 years. Mobility of teeth, red and white exophytic or endophytic mass which is papillary, ulcerated and granular is seen on the lateral and ventral surface of tongue, buccal mucosa and the floor of the mouth with variable pain.

Scurvy is also one of the disorders seen equally in both males and females. Reddening, gingival enlargement, edema, spontaneous bleeding, shiny surface and necrosis with pseudomembrane formation are seen with variable pain.

Kaposi's sarcoma is seen in any age group but mostly seen in males when compared to females. The purpuric swelling of the oral mucosa including palate and the alveolar mucosa with no pain is observed in this disorder.

Oral tuberculosis varies accordingly with the region and the population. It is seen in any age group in both males and females equally. Mucous patches, ulceration, fiery redness and edema are seen on the floor of the mouth, tongue, trachea, larynx, trachea and the bone with variable pain.

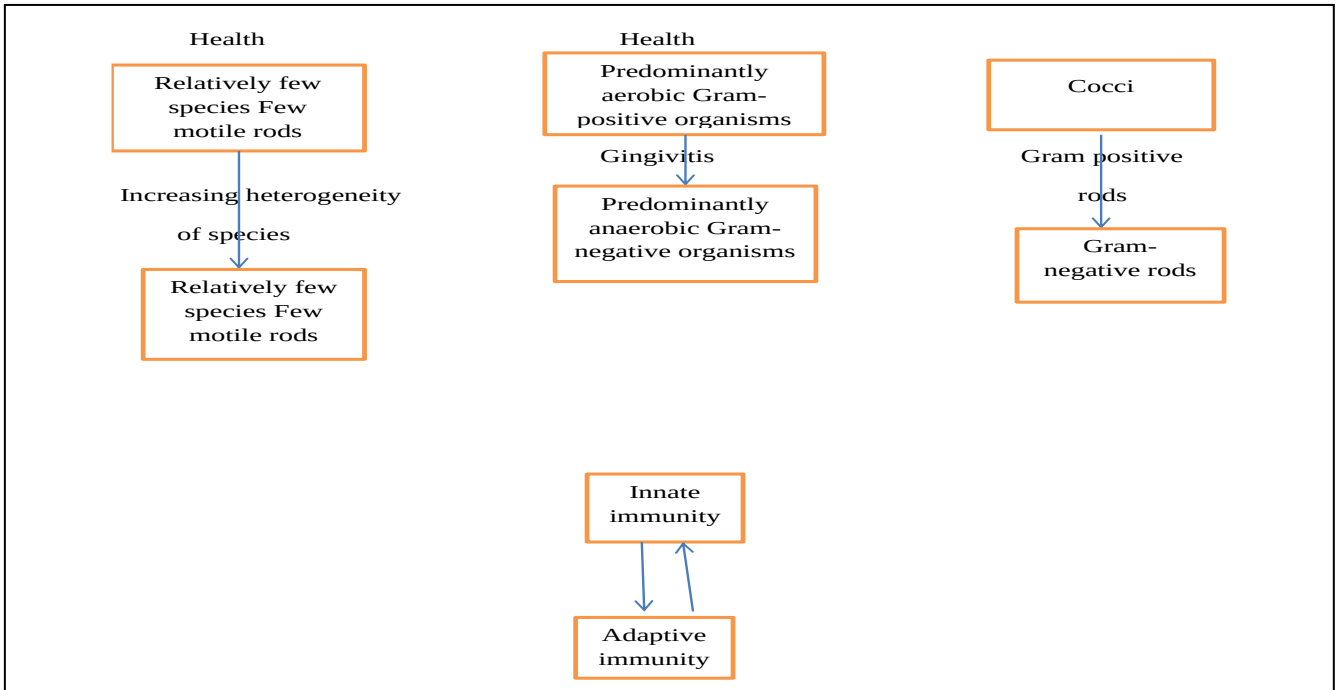


Figura 1. Flow chart

Erythematous candidiasis is disorder seen in any age group. Red lines are seen on tongue, lips, buccal mucosa, soft palate and hard palate with milder pain.

Drug induced gingival enlargement is seen in any age group who are exposed to the drugs. Gingival enlargement is seen with no pain.

Mouth breathing is one of the disorders in which reddening, shiny surface which are diffused and edema is also observed with no pain.

Gingival injuries may occur equally in both males and females. The coagulated surfaces, ulceration, erosion, vesicles, desquamation, petechiae and dilacerations are associated with this disorder and mild to severe pain is observed (32-34).

Discussion

The destruction of the tissue takes place by direct use of bacteria such as damage to cervical epithelium is activated by bacteria like Triponema denticola, Porphyromonas gingivalis. Impairment of leukotoxin is done by Aggregatibacter actinomycetemcomitans. Degradation of immunoglobulins, the cytokine networks and the fibrin are done by bacteria Capnocytophaga spp, and Porphyromonas gingivalis (35)**.** Degradation of collagen is done by fibroblastic collagenase by sulphur compounds from gram negative anaerobes like Tannerella forsythia, Prevotella intermedia. Bone resorption and complement activation by endotoxins. The bone resorption is stimulated by lipoteichoic acid which is obtained from cell walls of gram positive bacteria. Break down of periodontal tissues takes place by proteolytic enzymes to amino acids and peptides by providing nutrients to gram negative bacteria. Apart from the damage by the bacteria, indirect damage is also seen which is via the host response like polyclonal activation of B cells which prevents production of a specific antibody. Triggering immunity leads to activation of complement and more inflammation (Figure 1). Cellular immunity activated T-cells activate antigen-presenting cells that release so many cytokines such as IL-1β whose effects are bone-resorption, fever and are pro-inflammatory36. Another cytokine named TNF-α effects are bone-resorption, fever and are pro-inflammatory and these cytokines are synergistic with IL-1β cytokine. IL-6 is also one type of cytokine which effects B cells differentiation and production of the antibodies as well as differentiation in osteoclast are seen. Polymorphonuclear neutrophils (PMNs) release enzymes like collagenases, elastases, matrix metalloproteinases and stromelysins which destroy the effected tissues (37). In initial 24-48 hours, the lesions are localised to gingival sulcus and the periodontal tissue and the local vasodilation brings immunoglobulins, fibrin, complement and more PMNs into the tissues which in turn increases gingival crevicular fluid (38). The PMNs then migrate into gingival crevice through the junctional epithelium where few lymphocytes and macrophages are seen followed by the formation of the immune complexes, in turn increasing the permeability of PMNs. In the early 4-7 days, localised proliferation of junctional and sulcular epithelium is detected as well increment of gingival crevicular fluid is also seen (39). PMNs are still seen in the crevices and within the periodontal tissues, the accumulation of lymphocyte T-cells is seen. The lymphoid cells may give rise to gingival inflammation and the cytokines are released which proliferates invasion growth. In the period of 2-3 weeks, proliferation of sulcular and junctional epithelium and loss of collagen is seen. Plasma cells are found near to the gingival lesions and there is rapid increase in the gingival crevicular fluid. T-cells dominate the lesions where the PMNs are still present (40). Non-specific polyclonal B-cell mitogens are also present giving rise to gingival inflammation from which immunoglobulins and the plasma cells are produced. In the advanced weeks, the gingivitis may cause damage to the other parts by spreading to the soft tissues and the bones causing inflammation in peridontium which is called periodontitis. Loss of attachment, loss of collagen and bone loss is seen (41)**.** Destructive pathological reaction and imbalance in the host-microbial interaction is seen. The established lesion is with more immunoglobulins, and more gingival crevicular fluid is also seen where the PMNs are still present in large numbers. Due to invasion of the macrophages, plasma cells and lymphocytes, the epithelial wall will break and this is the gateway to direct access of the plaque antigens which activates immune cells further giving rise to tissue damage (42). The immunoglobulins, complement and the lymphocytes in turn give rise to formation of antibody-antigen reactions leading to the tissue wear and tear and the destruction (43).

Conclusion

The patients with the lesions on the periodontium should consult the periodontists as soon as possible so that they get a plan so as to follow the signs and the symptoms so as to access whether the lesions are simple to severe or to confirm whether they are local or systemic disorders**.**

Conflict of interest

None to declare.

References

1. Brown RS, Arany PR. Mechanism of drug-induced gingival overgrowth revisited: a unifying hypothesis. Oral Dis 2015: 21: e51–e61. [PubMed] [Google Scholar]
2. Endo H, Rees TD, Hallmon WW, Kuyama K, Nakadai M, Kato T, Kono Y, Yamamoto H. Disease progression from mucosal to mucocutaneous involvement in a patient with desquamative gingivitis associated with pemphigus vulgaris. J Periodontol 2008: 79: 369–75. [PubMed] [Google Scholar]
3. Endo H, Rees TD, Allen EP, Kuyama K, Aoki S, Yamamoto H, Ito T. A stab-and-roll biopsy technique to maintain gingival epithelium for desquamative gingivitis. J Periodontol 2014: 85: 802–9. [PubMed] [Google Scholar]
4. Epstein JB, Epstein JD, Le ND, Gorsky M. Characteristics of oral and paraoral malignant lymphoma: a populationbased review of 361 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2001: 92: 519–25. [PubMed] [Google Scholar]
5. Hart TC, Zhang Y, Gorry MC, Hart PS, Cooper M, Marazita ML, Marks JM, Cortelli JR, Pallos D. A mutation in the SOS1 gene causes hereditary gingival fibromatosis type 1. Am J Human Genet 2002: 70: 943–54. [PubMed] [Google Scholar]
6. Buduneli N, Kinane D F. Host-derived diagnostic markers related to soft tissue destruction and bone degradation in periodontitis. J Clin Periodontol 2011; 38: 85–105. [PubMed] [Google Scholar]
7. Karimbux NY, Saraiya VM, Elangovan S, Allareddy V, Kinnunen T, Kornman KS, Duff GW. Interleukin-1 gene polymorphisms and chronic periodontitis in adult whites: a systematic review and meta-analysis. J Periodontol.. J Periodontol 2012; 83: 1407-19. [PubMed] [Google Scholar]
8. Marsh P D, Devine D A. How is the development of dental biofilms influenced by the host? J Clin Periodontol 2011; 38: 28-35. [PubMed] [Google Scholar]
9. Nussbaum G, Shapira L. How has neutrophil research improved our understanding of periodontal pathogenesis? J Clin Periodontol 2011; 38: 49-59. [PubMed] [Google Scholar]
10. Palmer R M, Wilson R F, Hasan A S, Scott D A. Mechanisms of action of environmental factors – tobacco smoking. J Clin Periodontol 2005; 32: 180-95. [PubMed] [Google Scholar]
11. Colyer, F.: Bacteriological Infection in Pulps of Pyorrhetie Teeth, Br. Dent. J. 45: 553, 1924.
12. Neville BW, Damm DD and Allen CW, eds. Oral and maxillofacial pathology. WB Saunders/Elsevier, St. Louis; 2009. p. 968.
13. Ricucci D, Siqueira JF Jr. Apical actinomycosis as a continuum of intraradicular and extraradicular infection: case report and critical review on its involvement with treatment failure. J Endod 2008; 34: 1124-9. [PubMed] [Google Scholar]
14. Mitchell RG. Actinomycosis and the dental abscess. Br Dent J 1966; 120: 423-9. [PubMed]
15. Borssen E, Sundqvist G. Actinomyces of infected dental root canals. Oral Surg Oral Med Oral Pathol 1981; 51: 643-8. [PubMed] [Google Scholar]
16. Rautemaa R, Ramage G. Oral candidosis—clinical challenges of a biofilm disease. Crit Rev Microbiol 2011; 37: 328-36. [PubMed] [Google Scholar]
17. Cahn, L. R.: The Pathology of Pulps Found in Pyorrhetic Teeth, Dent. Items Int. 1927; 49: 598-617.
18. Fischer, G.: L'Histologie Pathologique de la Pulpa dans la Parodontose, VIII Congres Dentaire Internationale. Paris. 1931. D. 171.
19. Hill, T. J.: Pathology 'of the' Den&i Pulp, J. Am. Dent. Assoc. 1934; 21: 820-44.
20. Canby, C. P.: Incidence of Pulpal Infection in Periodontoclasia, J. Am. Dent. Assoc. . 1936; 23: 1871-1580. [Google Scholar]
21. Hirschfeld J, Higham J, Blair F, Richards A, Chapple ILC. Systemic disease or periodontal disease? Distinguishing causes of gingival inflammation: a guide for dental practitioners. Part 2: cancer related, infective, and other causes of gingival pathology. Br Dent J. 2019; 227: 1029-34. [PubMed] [Google Scholar]
22. Yardimci G, Kutlubay Z, Engin B, Tuzun Y. Precancerous lesions of oral mucosa. World J Clin Cases 2014; 2: 866-72. [PubMed] [Google Scholar]
23. Rosenquist K. Risk factors in oral and oropharyngeal squamous cell carcinoma: a population-based case-control study in southern Sweden. Swed Dent J Suppl 2005; 179: 1-66. [PubMed] [Google Scholar]
24. Gupta B, Bray F, Kumar N, Johnson N W. Associations between oral hygiene habits, diet, tobacco and alcohol and risk of oral cancer: A case-control study from India. Cancer Epidemiol 2017; 51: 7-14. [PubMed] [Google Scholar]
25. Lerman M A, Almazrooa S, Lindeman N, Hall D, Villa A, Woo S B. HPV16 in a distinct subset of oral epithelial dysplasia. Mod Pathol 2017; 30: 1646-54. [PubMed] [Google Scholar]
26. Hirschfeld J, Higham J, Chatzistavrianou D, Blair F, Richards A, Chapple I. Josefine Hirschfeld. Systemic disease or periodontal disease? Distinguishing causes of gingival inflammation: a guide for dental practitioners. Part 1: immune-mediated, autoinflammatory, and hereditary lesions. Br Dent J 2019; 227: 961–6. [PubMed] [Google Scholar]
27. Persson L, Bergström J, Gustafsson A. Effect of tobacco smoking on neutrophil activity following periodontal surgery. J Periodontol. 2003; 74: 1475-82. [PubMed] [Google Scholar]
28. Paraskevas S, onetti MS, Preshaw PM, Hughes FJ. Tobacco smoking and periodontal hemorrhagic responsiveness. J Clin Periodontology. 2009; 25: 650–5.
29. Eaton KA, Soames JV, Allen CM, Greenberg MS. A systematic review of definitions of periodontitis and methods

that have been used to identify this disease. J Clin Periodontology. 2017; 38: 452–67.
30. James O, Gary C, Worthington, Deery, C. Blastomycosis of the Gingiva and Jaw. Canadian Medical Association Journal. 2016; 26: 662–5.
31. Scott A, Singhrao, Jack G, Nickerson J. Endogenous Aspergillus endophthalmitis associated with periodontitis. Ophthalmologica. Journal International d'Ophtalmologie. International Journal of Ophthalmology. Zeitschrift für Augenheilkunde. 2014; 209: 109–11.
32. Denisse L. Efects and the Prospects of Periodontal Disease. J Dent Pathol Med. 20215; 108.
33. Rich AM, Seo B, Parachuru V, Hussaini HM. The nexus between periodontics and oral pathology. Periodontol 2000. 2017; 74: 176-81. [PubMed] [Google Scholar]
34. Meiller TF, Garber K, Scheper M. A review of common oral pathology lesions,
35. with a focus on periodontology and implantology. J Evid Based Dent Pract. 2012; 12(3 Suppl): 254-62. . [PubMed] [Google Scholar]
36. Langeland K, Rodrigues H, Dowden W. Periodontal disease, bacteria, and pulpal histopathology. Oral Surg Oral Med Oral Pathol. 1974; 37: 257-70. [PubMed] [Google Scholar]
37. Kitano M, Landini G, Urago A, Okubo A, Mukai H, Yamashita S. Odontogenic epithelial hamartoma of the gingiva: a case report. J Periodontol 1991: 62: 452–7. [PubMed] [Google Scholar]
38. Lester SR, Cordell KG, Rosebush MS, Palaiologou AA, Maney P. Peripheral giant cell granulomas: a series of 279 cases. Oral Surg Oral Med Oral Pathol Oral Radiol 2014: 118: 475–82. [PubMed] [Google Scholar]
39. Philipsen HP, Reichart PA, Nikai H, Takata T, Kudo Y. Peripheral ameloblastoma: biological profile based on 160 cases from the literature. Oral Oncol. 2001; 37: 17-27. [PubMed] [Google Scholar]
40. Poulopoulos A, Kittas D, Sarigelou A. Current concepts on gingival
41. fibromatosis-related syndromes. J Invest Clin Dent 2011: 2: 156–61. [PubMed] [Google Scholar]
42. Schuster V, Mingers AM, Seidenspinner S, Nüssgens Z, Pukrop T, Kreth HW. Homozygous mutations in the plasminogen gene of two unrelated girls with ligneous conjunctivitis. Blood. 1997: 90: 958–66. [PubMed] [Google Scholar]
43. Sciubba JJ. Autoimmune oral mucosal diseases: clinical, etiological, diagnostic, and treatment considerations. Dent Clin N Am 2011: 55: 89–103. [PubMed] [Google Scholar]
44. Scully C, Gokbuget A, Kurtulus I. Hypoplasminogenaemia, gingival swelling and ulceration. Oral Dis 2007: 13: 515–8. [PubMed] [Google Scholar]
45. Sivolella S, De Biagi M, Sartori MT, Berengo M, Bressan E. Destructive membranous periodontal disease (ligneous gingivitis): a literature review. J Periodontol 2012: 83: 465–76. [PubMed] [Google Scholar]

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Intraoral scanners: enhancing efficiency and patient comfort in prosthodontics – a systematic review

(Escáneres intraorales: mejora de la eficiencia y la comodidad del paciente en prostodoncia: una revisión sistemática)

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Abstract (english)

This review evaluates the effectiveness of intraoral scanners in prosthodontics, focusing on their ability to reduce working time and enhance patient comfort compared to conventional impression techniques. A systematic review was conducted following PRISMA guidelines. Studies from 2016 to 2023 were selected based on predefined inclusion criteria, including clinical trials involving adult participants using various intraoral scanners. The review included comparisons with traditional impression techniques to assess time efficiency, accuracy, and patient experience. Five studies were selected from an initial pool of 1,544 articles. The findings indicate that intraoral scanners significantly reduce working time, particularly in full-arch rehabilitations, and improve patient comfort. Digital impressions were associated with shorter chair times and fewer complications during follow-up, highlighting their efficiency and acceptability. In conclusion, intraoral scanners offer a promising alternative to conventional methods in prosthodontics, with significant benefits in terms of time efficiency and patient comfort. Further advancements in scanner technology and digital workflows are expected to enhance their accuracy and reliability in clinical practice.

Keywords(english)

Intraoral Scanners, Prosthodontics, Digital Impressions, Conventional Impressions , CAD/CAM

Resumen (español)

Esta revisión evalúa la eficacia de los escáneres intraorales en prostodoncia, centrándose en su capacidad para reducir el tiempo de trabajo y mejorar la comodidad del paciente en comparación con las técnicas de impresión convencionales. Se realizó una revisión sistemática siguiendo las directrices PRISMA. Se seleccionaron estudios publicados entre 2016 y 2023 según criterios de inclusión predefinidos, incluyendo ensayos clínicos con participantes adultos que utilizaron diversos escáneres intraorales. La revisión incluyó comparaciones con las técnicas de impresión tradicionales para evaluar la eficiencia temporal, la precisión y la experiencia del paciente. Se seleccionaron cinco estudios de un total inicial de 1544 artículos. Los resultados indican que los escáneres intraorales reducen significativamente el tiempo de trabajo, especialmente en rehabilitaciones de arcada completa, y mejoran la comodidad del paciente. Las impresiones digitales se asociaron con

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tiempos de consulta más cortos y menos complicaciones durante el seguimiento, lo que destaca su eficiencia y aceptabilidad. En conclusión, los escáneres intraorales ofrecen una alternativa prometedora a los métodos convencionales en prostodoncia, con importantes beneficios en términos de eficiencia temporal y comodidad del paciente. Se espera que los avances en la tecnología de escáneres y los flujos de trabajo digitales mejoren su precisión y fiabilidad en la práctica clínica.

Palabras clave(español)

Escáneres intraorales, prótesis dentales, impresiones digitales, impresiones convencionales, CAD/CAM.

Introduction

Intraoral scanners have revolutionized prosthodontic practices by providing a digital alternative to conventional impression techniques. These advanced devices capture detailed digital impressions of the oral cavity, improving accuracy, efficiency, and patient comfort. This systematic review examines the efficacy of intraoral scanners compared to traditional methods, focusing on their impact on working time, patient experience, and clinical outcomes.

The shift from conventional impression materials like polyether and polyvinyl siloxane to digital workflows represents a significant advancement in dental technology. Recent studies have shown that intraoral scanners not only reduce the time required for impression-taking but also enhance patient satisfaction by minimizing discomfort associated with traditional methods [2]. Additionally, digital impressions facilitate streamlined workflows, from data acquisition to computer-aided design (CAD) and manufacturing (CAM), enhancing the precision and efficiency of prosthodontic treatments.

Methods

Study Design. This systematic review and meta-analysis followed the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and was registered in PROSPERO (table 1).

Research Question. The research question was framed using the PICO (Population, Intervention, Comparison, Outcome) framework: *"Do intraoral scanners reduce working time and enhance patient comfort compared to conventional methods in prosthodontics?"*

PICO Analysis. Population: Studies involving adult participants aged 3–55 years with one or two non-adjustable tissue-level implants in the posterior region, dentition in the opposing jaw, implant diameters of at least 4.1 mm, implant heights of at least 8 mm, and patients requiring full-arch rehabilitation in the maxilla.

• *Intervention:* Various intraoral scanners, such as 3M, Carestream CS 3600, Lava, iTero, and Dentsply Sirona, used for full-mouth scans.

Table. 1. Articles and Study Designs.

	Article	Year	Study Design
1.	Randomized controlled clinical trial of digital and conventional workflows for the fabrication of zirconia-ceramic fixed partial dentures. Part I: Time efficiency of complete-arch digital scans versus conventional impressions (Sailer I et al)[1]	2019	Randomised control trial
2.	Conventional versus Digital Impressions for Full Arch Screw-Retained Maxillary Rehabilitations: A Randomized Clinical Trial (Cappare P et al)[2]	2019	Randomised clinical trial
3.	Digital versus Analog Procedures for the Prosthetic Restoration of Single Implants: A Randomized Controlled Trial with 1 Year of Follow-Up (Mangano F et al)[3]	2018	Randomised controlled trial
4.	Digital vs. conventional workflow for one-abutment one-time immediate restoration in the esthetic zone: a randomized controlled trial (Hanozin B et al)[4]	2022	Randomised controlled trial
5.	Randomized Clinical Trial comparing clinical adjustment times of CAD/CAM screw-retained posterior crowns on ti-base abutments created with digital or conventional impressions. One-year follow-up (Derksen W et al)[5]	2021	Randomised clinical trial

Tabla. 2. Table extraction.

Treatment	Article Title	No. Of Patients/Population	Intervention	Comparison
Fixed Partial Denture	Randomized controlled clinical trial of digital and conventional workflows for the fabrication of zirconia-ceramic fixed partial dentures. Part I: Time efficiency of complete-arch digital scans versus conventional impressions (Sailer I et al)	10 patients >18 years eligible for 3-unit FPD in the posterior region not supported by third molar	Digital scanning using Lava C.O.S, iTero, Cerec Bluecam scanners	Conventional impressions using polyether
Implant	Conventional versus Digital Impressions for Full Arch Screw-Retained Maxillary Rehabilitations: A Randomized Clinical Trial (Cappare P et al)	50 patients (48–72 years) with edentulous upper arch and sufficient bone for 6 implants	6 immediate-loading implants scanned using intraoral scanners	Conventional pick-up impressions
Implant	Digital versus Analog Procedures for the Prosthetic Restoration of Single Implants: A Randomized Controlled Trial with 1 Year of Follow-Up (Mangano F et al)	50 patients (22 males, 28 females, mean age: 52.6 years) with 15 implants in maxilla and 35 in mandible	Implant placement with digital workflow for 12 males and 13 females	Conventional workflow for 10 males and 15 females
Implant	Digital vs. conventional workflow for one-abutment one-time immediate restoration in the esthetic zone: A randomized controlled trial (Hanozin B et al)	Patients >18 years with single or two non-adjacent missing teeth in the aesthetic area	Digital workflow using CARES software and scanning with TRIOS, 3Shape, and Denmark scanners	Conventional one-abutment, one-time technique
Implant	Randomized Clinical Trial comparing clinical adjustment times of CAD/CAM screw-retained posterior crowns on ti-base abutments created with digital or conventional impressions. One-year follow-up (Derksen W et al)	32 patients with 45 posterior tissue-level implants replacing solitary teeth	Intraoral scanner impressions (3MTM TDS)	Conventional polyether pick-up impressions

• *Comparison:* Conventional impression techniques employing polyether or polyvinyl siloxane materials, used to evaluate time requirements and quality.

• *Outcome:* Intraoral scanners significantly reduce working time, time required for crown adjustments, and follow-up complications while improving patient comfort and acceptability.

Eligibility Criteria. *Inclusion Criteria*: Published clinical trial articles in English from 2016 to 2023. *Exclusion Criteria*: Non-English articles, animal studies, in-vitro studies, review papers, case reports, participants undergoing orthodontic treatment, and those with systemic illnesses.

Study Selection. The search process involved independent screening of article titles by two reviewers (LN and [Reviewer Name]). Duplicates and irrelevant studies were excluded. Abstracts meeting eligibility criteria were assessed, and full-text articles were retrieved for insufficiently detailed abstracts. Discrepancies were resolved through discussion or by involving a third party. Of 1,544 initially identified articles from PubMed, EMBASE, Google Scholar, and Web of Science, 107 were retained after duplicate removal. Abstracts of 87 articles were reviewed, with 35 excluded. A total of 52 full-text articles were evaluated, and 5 studies met the eligibility criteria for the systematic review.

Data Sources and Search Strategy. A detailed search strategy was tailored for each database, including Google Scholar, Web of Science, Scopus, PubMed, ResearchGate, EMBASE, and the Cochrane Central Register of Controlled Trials, covering publications from 2017 to 2023. MeSH (Medical Subject Headings) terms included: “intraoral scanners,” “workflow,” “digital workflow,” “digitization,” and “image.” Boolean operators (AND/OR) refined the search. Grey literature from Google Scholar was also included. Filters applied were full free text and randomized controlled trials. The PICO framework structured the search, adhering to PRISMA guidelines.

Data Extraction. Study details were organized into a “Characteristics of Included Studies” table 2. Data were extracted using a pre-defined standard sheet and cross-verified for accuracy by two independent reviewers (table 2).

Assessment of Methodological Quality. The Cochrane Collaboration’s tool was used to assess the risk of bias, following the Cochrane Handbook for Systematic Reviews of Interventions (Higgins, 2008). Two reviewers (LN

Tabla. 3. Quality Assessment.

Study	Randomization	Allocation Concealment	Assessor Blinded	Dropouts Described	Risk of Bias
Randomized controlled clinical trial of digital and conventional workflows for the fabrication of zirconia-ceramic fixed partial dentures. Part I: Time efficiency of complete-arch digital scans versus conventional impressions (Sailer I et al)	Yes	Yes	Yes	Yes	Low
Conventional versus Digital Impressions for Full Arch Screw-Retained Maxillary Rehabilitations: A Randomized Clinical Trial (Cappare P et al)	Yes	No	Yes	Yes	Low
Digital versus Analog Procedures for the Prosthetic Restoration of Single Implants: A Randomized Controlled Trial with 1 Year of Follow-Up (Mangano F et al)	Yes	Yes	No	Yes	Low
Digital vs. conventional workflow for one-abutment one-time immediate restoration in the esthetic zone: a randomized controlled trial (Hanozin B et al)	Yes	No	No	No	High
Randomized Clinical Trial comparing clinical adjustment times of CAD/CAM screw-retained posterior crowns on ti-base abutments created with digital or conventional impressions. One-year follow-up (Derksen W et al)	Yes	yes	No	No	Moderate

and IK) independently graded the bias as "Yes," "Unclear," or "No" based on major and minor criteria. *Major Criteria*: Randomization method, allocation concealment, blinding, dropouts, and overall risk of bias. *Minor Criteria*: Sample justification, baseline comparisons, eligibility criteria, and error methods. Results were summarized in [Table 2]. *Inclusion Criteria:* 1. Partially edentulous adults. 2. Presence of at least one osseointegrated Straumann tissue-level implant with an RN prosthetic connection to replace a single missing tooth in the posterior region. 3. The location of the missing tooth (future restoration site) must have at least one opposing antagonist tooth. 4. Stable medical condition at the time of the study. 5. The implant must meet specific size requirements: a minimum diameter of 4.1 mm and a minimum height of 8 mm. *Exclusion Criteria:* 1. Presence of signs of inflammation or peri-implant diseases during the time of implant impressions. 2. Implants that do not allow for straight occlusal screw access within the contours of the planned implant crown. 3. Patients with known allergies to any of the prosthetic components used in the intervention.

This table 3, simplifies the decision-making process for choosing between digital and conventional impressions by summarizing key performance indicators and referencing relevant studies. It highlights the advantages, challenges, and appropriate applications of each method in modern dental practice.

The table 4, provides a comparative overview of several studies analyzing the accuracy and effectiveness of digital and conventional dental impression techniques. It categorizes these studies based on their type, focus, scanner types used, and main findings. The study types range from pilot in vitro experiments to systematic reviews, with each approach addressing specific aspects of dental impressions. Some studies, like those focused on intraoral versus laboratory scanners, emphasize the impact of the scanning environment on accuracy. Others, such as umbrella reviews, synthesize existing research to provide broader insights.

The focus of these studies varies but commonly includes comparing the precision of digital scanners to traditional methods, assessing factors influencing scanning accuracy, and evaluating the role of operator expertise and scanning strategies. For example, studies have shown that intraoral scanners are highly effective, particularly when used by experienced operators and with optimal scan body designs, but their performance can be influenced by variables like implant angulation or scanner model. In contrast, conventional methods are reliable but may lack the speed and convenience of digital alternatives.

Key findings from these studies highlight that the choice of scanner type, the design and position of scan bodies, and the selected scanning strategy all significantly influence the accuracy of impressions.

Table. 4. Digital and conventional impressions.

Parameter	Digital Impressions	Conventional Impressions	References
Accuracy	High accuracy for single-unit and short-span cases; affected by implant angulation and scanning strategy.	Reliable in various cases but prone to dimensional changes (e.g., due to material shrinkage).	Shely et al. (2023), Çakmak et al. (2020), Afrashtehfar et al. (2022)
Efficiency	Faster scanning process and no need for physical storage of models.	Time-consuming, requiring physical impressions and model pouring.	Ahlholm et al. (2018), Mandelli et al. (2018)
Operator Dependency	Dependent on experience with digital tools and proper scan body alignment.	Requires expertise in material handling and precise impression techniques.	Ben-Izhack et al. (2024), Amin et al. (2017)
Material Costs	Initial cost for scanner equipment is high; lower recurring costs.	Lower initial costs but higher recurring expenses (materials, shipping, and model storage).	Alikhasi et al. (2018), Turkyilmaz et al. (2020)
Patient Comfort	Less invasive and more comfortable for patients due to no impression materials being used.	Can cause discomfort, especially in cases of gag reflex or extended procedures.	Mandelli et al. (2018), Giménez et al. (2014)
Versatility	Ideal for digital workflows, CAD/CAM, and full-arch cases with specific adjustments.	Compatible with traditional prosthetic workflows; limited for complex digital designs.	Arcuri et al. (2020), Fluegge et al. (2017)
Environmental Impact	Eco-friendly, as it reduces the use of disposable impression materials and physical storage requirements.	Higher environmental footprint due to waste from impression materials and physical model storage.	Nimavat et al. (2021), Afrashtehfar et al. (2022)
Applications	Widely used for prosthetics, implants, orthodontics, and full-arch restorations.	Primarily used in traditional prosthetic restorations and in cases without access to digital technology.	Natsubori et al. (2022), Pachiou et al. (2023)
Learning Curve	Requires initial training but becomes efficient with experience.	Familiar to most clinicians; does not require advanced technology training.	Alikhasi et al. (2018), Çakmak et al. (2020)

While digital methods are increasingly favored for their efficiency and accuracy, especially in complex implant scenarios, traditional techniques still offer dependable results in simpler cases. Table 5, offers a succinct yet comprehensive reference for understanding these trends and can guide decision-making in clinical practice and further research.

Results

Study Selection. The initial search identified 1544 studies, of which 5 studies were selected for systematic review based on independent reviews meeting the inclusion criteria.

Characteristics of the Trial Setting. Netherlands: 1 study (Derksen W et al) (5), Italy: 2 studies (Cappare P et al) (2), (Mangano F et al), Switzerland: 2 studies (Sailer I et al) (1), (Hanozin B et al)

Characteristics of the Participants. *Age Group*: Out of the 5 studies, 4 studies included participants aged 18 and above. 2 studies (Cappare P et al) (2), (Mangano F et al) (3) recruited participants aged 45–60 years. 1 study (Derksen W et al) (5) did not specify the age of participants.

Blinding. 3 studies (Sailer I et al) (1), (Cappare P et al) (2), (Derksen W et al) (5) were double-blinded.

Exclusions. All studies excluded participants with the following conditions: Signs of inflammation or peri-implant diseases, Allergies or diseases in the oral cavity, Smoking habits, use of antibiotics, pregnancy, hypertension. Evidence of parafunctional habits, TMJ disorders, or severe medical complications.

Characteristics of the outcome. Hanozin B et al (2019): Accuracy of implant positioning was evaluated by deviation in entry point, apex position, and angulation. Statistically significant improvements were found using s-CAIS compared to free-handed surgery.

Sailer I et al (2017): Time for complete-arch impressions, including powdering and occlusal registration, was shorter with conventional impressions compared to digital scans. Patients and clinicians rated digital scans as less comfortable than conventional impressions.

Cappare P et al (2020): Digital impressions took significantly less time compared to conventional methods ($p<0.05$).

Mangano F et al (2019): Impression-taking time was nearly halved in the digital group compared to the analogue group (20 minutes vs. 50 minutes). Digital workflow was more efficient than the conventional workflow when considering active working time.

Derksen W et al (2021): Adjustment time for crowns was significantly shorter in the digital group using intraoral scanners (3.35 minutes) compared to the conventional group (6.09 minutes).

Discussion

The digital era has revolutionized dentistry, providing advanced technologies for scanning both implants and teeth. Scanners, both intraoral and extraoral, offer numerous benefits, including enhanced patient comfort, reduced material distortion, shortened chair time, passive impressions, and the generation of digital files for CAD workflows.

Digital vs. Conventional Workflows. 1. Advantages of Digital Workflows: o Accuracy and Precision: Digital impressions yield a stereolithography (STL) file, enabling high-precision CAD designs. Accuracy refers to the consistency of scans, while trueness reflects how well the scan matches the actual dimensions of the object. o Patient Comfort: Digital workflows reduce the discomfort associated with conventional impressions, such as gagging, pain, and unpleasant taste. o Efficiency: Studies show that digital impressions, particularly with modern scanners, significantly reduce active working time compared to conventional methods. o Material Independence: Unlike traditional methods, digital workflows are less affected by environmental factors such as moisture or deformation of materials.

2. Challenges in Digital Scanning. o Scanner Variability: The outcomes depend on the type of intraoral scanner (IOS) used and the associated scanning strategy. For instance, the "stitching technique" often yields better precision than non-stitching methods. o Limitations: Factors such as limited intraoral space, patient compliance, saliva, and

Table. 5. Comparison of digital conventional Impression.

Reference	Study Type	Focus	Scanner Types	Main Findings
Shely et al.	Pilot In Vitro Study	Influence of lab vs. intraoral scanners on implant axes and distances.	Laboratory, Intraoral	Intraoral scanners show varied accuracy depending on scan body usage.
Afrashtehfar et al.	Rapid Umbrella Review	Comparison of accuracy between intraoral scanners and traditional impressions.	Multiple Intraoral Scanners	Intraoral scanners are generally accurate, but limitations exist for complex cases.
Çakmak et al.	Clinical Study	Effect of scanner type and scan body position on full-arch scans.	Multiple Scanner Types	Scanner type and scan body position significantly affect accuracy.
Ben-Izhack et al.	In Vitro Study	Conventional vs. digital impressions for implant axes and distances.	Conventional, Digital	Digital impressions provided comparable results to conventional ones.
Alikhasi et al.	Experimental Study	3D accuracy of digital impressions vs. conventional methods under various conditions.	Digital, Conventional	Digital methods are highly accurate but influenced by implant angulation.
Mandelli & Gherlone	Comparative Study	Strategies for full-arch intraoral scanning and outcomes.	Multiple Digital Scanners	Scanning strategy impacts precision significantly.
Giménez et al.	Comparative Study	Operator experience and implant angulation impact on digital impression accuracy.	Parallel Confocal Laser Scanners	Operator experience and implant angulation are key factors in accuracy.
Amin et al.	Comparative Study	Full-arch digital vs. conventional implant impressions.	Digital, Conventional	Digital scans are comparable to traditional methods for full-arch impressions.
Pachiou et al.	Systematic Review	Characteristics of scan bodies influencing impression accuracy.	Intraoral Scan Bodies	Material and design of scan bodies significantly affect results.
Natsubori et al.	Experimental Study	Comparison of scanning accuracy for multiple implants.	Intraoral, Laboratory Scanners	Laboratory scanners slightly outperform intraoral scanners for complex geometries.

software handling can introduce errors during digital scanning. o Complex Cases: For full-arch rehabilitations, conventional workflows sometimes fail to reproduce excessive disparallelisms accurately, necessitating reimpressions or adjustments.

3. Conventional Methods. o Advantages: In specific scenarios, such as cases with poor moisture control, polyether impressions outperform other materials like polyvinylsiloxane (PVS). o Disadvantages: Conventional methods are prone to distortions, contamination from saliva or blood, and inaccuracies stemming from material elasticity and handling.

Clinical Outcomes and Time Efficiency. • *Patient and Clinician Feedback*: Studies (e.g., Sailer et al.) report no clear preference for digital or conventional methods among patients. Clinicians, however, faced greater challenges with digital workflows due to software and scanner handling issues. • *Time Savings*: Digital workflows consistently demonstrated shorter impression times and more efficient working protocols compared to conventional methods. For instance, Mangano et al. reported a near 50% reduction in time using digital impressions. • *Error Rates*: While digital scans excel in trueness and precision, conventional methods occasionally outperform in cases involving posterior teeth or challenging intraoral environments due to cumulative errors in digital workflows.

Future Directions. 1. *Technology Development:* o Focus on scanners that eliminate the need for powdering, gingival displacement cords, and moisture control, streamlining the digital workflow. o Improve software handling and scanning strategies to minimize errors and enhance ease of use. 2. *Clinical Integration:* o Establish guidelines for selecting appropriate workflows based on case complexity, patient needs, and clinical settings. o Develop hybrid workflows that combine the strengths of both digital and conventional methods for optimal outcomes.

In conclusion, the choice between digital and conventional workflows depends on specific clinical scenarios, patient preferences, and the available technology. On equal terms, digital workflows represent a promising, less invasive, and time-efficient option, especially for full-arch rehabilitations. However, advancements in scanner technology and scanning strategies are essential to further enhance the reliability and accuracy of digital impressions.

Conflict of interest

None to declare.

References

1. Shely A, Lugassy D, Rosner O, Zanziper E, Nissan J, Rachmiel S, Khoury Y, Ben-Izhack G. The Influence of Laboratory Scanner versus Intra-Oral Scanner on Determining Axes and Distances between Three Implants in a Straight Line by Using Two Different Intraoral Scan Bodies: A Pilot In Vitro Study. J Clin Med. 2023; 12: 6644. [PubMed] [Google Scholar]
2. Afrashtehfar KI, Alnakeb NA, Assery MKM. Accuracy of Intraoral Scanners Versus Traditional Impressions: A Rapid Umbrella Review. J Evid Based Dent Pract. 2022; 22: 101719. [PubMed] [Google Scholar]
3. Çakmak G, Yilmaz H, Treviño A, Kökat AM, Yilmaz B. The Effect of Scanner Type and Scan Body Position on the Accuracy of Complete-Arch Digital Implant Scans. Clin Implant Dent Relat Res. 2020; 22: 533-41. [PubMed] [Google Scholar]
4. Ben-Izhack G, Rosner O, Zanziper E, Nissan J, Hosary R, Lugassy D, Shely A. Comparison Between Conventional and Digital Impressions for Determining Axes and Distances of Three Implants in Straight and Curved Lines: An In Vitro Study. J Clin Med. 2024; 13: 2352. [PubMed] [Google Scholar]
5. Nimavat N, Singh S, Fichadiya N, Sharma P, Patel N, Kumar M, Chauhan G, Pandit N. Online Medical Education in India - Different Challenges and Probable Solutions in the Age of COVID-19. Adv Med Educ Pract. 2021; 12: 237-43. [PubMed] [Google Scholar]
6. Alikhasi M, Siadat H, Nasirpour A, Hasanzade M. Three-Dimensional Accuracy of Digital Impression Versus Conventional Method: Effect of Implant Angulation and Connection Type. Int J Dent. 2018; 2018: 3761750. [PubMed] [Google Scholar]
7. Mandelli F, Gherlone EF. Full-Arch Intraoral Scanning: Comparison of the Two Different Strategies and Their Accuracy Outcomes. J Osseointegr. 2018; 10: 65–74. [Google Scholar]
8. Ahlholm P, Sipilä K, Vallittu P, Jakonen M, Kotiranta U. Digital Versus Conventional Impressions in Fixed Prosthodontics: A Review. J Prosthodont. 2018; 27: 35-41. [PubMed] [Google Scholar]
9. Giménez B, Özcan M, Martínez-Rus F, Pradíes G. Accuracy of a Digital Impression System Based on Parallel Confocal Laser Technology for Implants With Consideration of Operator Experience and Implant Angulation and Depth. Int J Oral Maxillofac Implants. 2014; 29: 853-62. [PubMed] [Google Scholar]

10. Amin S, Weber HP, Finkelman M, El Rafie K, Kudara Y, Papaspyridakos P. Digital vs. Conventional Full-Arch Implant Impressions: A Comparative Study. Clin Oral Implants Res. 2017; 28: 1360-7. [PubMed] [Google Scholar]
11. Turkyilmaz I, Lakhia S, Tarrida LG, Varvara G. Guest Commentary: The Battle of File Formats From Intraoral Optical Scanners. Int J Prosthodont. 2020; 33: 369–371. [PubMed] [Google Scholar]
12. Arcuri L, Pozzi A, Lio F, Rompen E, Zechner W, Nardi A. Influence of Implant Scanbody Material, Position, and Operator on the Accuracy of Digital Impression for Complete-Arch: A Randomized In Vitro Trial. J Prosthodont Res. 2020; 64: 128–36. [PubMed] [Google Scholar]
13. Fluegge T, Att W, Metzger M, Nelson K. A Novel Method to Evaluate Precision of Optical Implant Impressions With Commercial Scan Bodies: An
14. Experimental Approach. J Prosthodont. 2017;26:34–41. [PubMed] [Google Scholar]
15. Pachiou A, Zervou E, Tsirogiannis P, Sykaras N, Tortopidis D, Kourtis S. Characteristics of Intraoral Scan Bodies and Their Influence on Impression Accuracy: A Systematic Review. J Esthet Restor Dent. 2023. [PubMed] [Google Scholar]
16. Natsubori R, Fukazawa S, Chiba T, Tanabe N, Kihara H, Kondo H. In Vitro Comparative Analysis of Scanning Accuracy of Intraoral and Laboratory Scanners in Measuring the Distance Between Multiple Implants. Int J I
17. mplant Dent. 2022; 8: 18. [PubMed] [Google Scholar]

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Coinfección de *Ascaris lumbricoides* y virus dengue. Casos clínicos y revisión de la literatura

(Coinfections with Ascaris lumbricoides and dengue virus. Case reports and literature review)

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Resumen(español)

Con el propósito de describir un caso de coinfección humana de un varón de 24 años con *Ascaris lumbricoides* y virus dengue, se realizó una búsqueda documental en tres bases de datos: Google Scholar, PubMed y Medscape, para lo cual empleamos una combinación de palabras claves en inglés y español con el uso de los operadores booleanos AND, OR y NOT. Se obtuvo un total de 22.937 documentos que incluyeron casos clínicos, revisiones de los diferentes mecanismos inmunes, aspectos clínicos, entre otros. Un interesante interjuego entre respuesta inmune Th2 para patógenos extracelulares y una respuesta de células Th1 para el patógeno intracelular, señalan a la IL-10, el TGF-β1 y de los linfocitos T reguladores (Treg) del lado de *A. lumbricoides* y un estado de inmunosupresión inducido por este verme que favorece la replicación viral del virus dengue, con mecanismos inmunes como la activación del sistema de complemento, linfoblastólisis en médula ósea, inmunoeliminación por células NK, entre otros. Todo lo anterior aunado a una malnutrición jugó en contra de este hospedero susceptible generando un desenlace fatal. Es necesario activar medidas básicas de saneamiento ambiental como fumigaciones, mejorar el acceso al agua potable, red de alcantarillado, adecuada disposición de excretas, y asumir la corresponsabilidad que como integrantes del equipo de salud, junto a las autoridades sanitarias estadales y municipales, y una adecuada educación para la salud en nuestra población, para que no se pierdan vidas humanas por enfermedades que en conjunto podemos controlar.

Palabras clave(español)

Ascaris lumbricoides, virus dengue, coinfecciones, inmunopatogenia, Barinas.

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Abstract(english)

In order to describe a case of human coinfection of a 24-year-old male with *Ascaris lumbricoides* and dengue virus, a documentary search was conducted in three databases: Google Scholar, PubMed and Medscape, for which we used a combination of keywords in English and Spanish with the use of the Boolean operators: AND, OR and NOT. A total of 22,937 documents were obtained, including clinical cases, reviews of the different immune mechanisms, clinical aspects and others. An interesting interplay between Th2 immune responses to extracellular pathogens and a Th1 cell response for intracellular virus, indicate the involvement of IL-10, TGF-β1 and regulatory T lymphocytes (Tregs) on the side of *A. lumbricoides* and a state of "immunosuppression" induced by this worm that favors viral replication of the dengue virus, with immune mechanisms such as activation of the complement system, lymphoblastolysis in bone marrow, immunoelimination by NK cells. All of the above, combined with malnutrition, played against this susceptible host, leading to a fatal outcome. It is necessary to implement basic environmental sanitation measures such as fumigation, access to drinking water, a sewage system, and adequate waste disposal. We must also assume joint responsibility as members of the health team, and state and municipal health authorities, and provide adequate health education to our population, so that lives are not lost to diseases that we can jointly control.

Keywords(english)

Ascaris lumbricoides, dengue virus, coinfections, immunopathogenesis, Barinas.

Introducción

El estudio de las enfermedades infectocontagiosas es de gran interés en todo el mundo, las tasas de prevalencia e incidencia, la comorbilidad asociada a las infecciones, las horas de trabajo que se pierden por estas causas, aunado al alto costo generado por la atención de un gran número de personas en centros de atención tanto públicos como privados, constituyen en muchos casos graves problemas de salud pública mundial y Venezuela no escapa a esta realidad (1-6).

Si un solo agente etiológico no es suficiente, cuando existen dos o más patógenos infectando al paciente, este panorama se complica aún más. El trabajo de Mubaraki et al., 2024 (7) se centró en las coinfecciones microbianas en pacientes de malaria en Pakistán. Al respecto señalaron que conocer las coinfecciones demuestra claramente su potencial para exacerbar la malaria y provocar el fracaso tanto del tratamiento como de las medidas de control. Investigar las coinfecciones de la malaria con diferentes virus (entre ellos el dengue) y diferentes helmintos comunes (incluye *A. lumbricoides*), en diferentes hospitales del sur de la provincia de Khyber Pakhtunkhwa demostró que *A. lumbricoides* representó el 42,7% de infección siendo el geohelminto más importante, seguido de *Enterobius vermicularis* 31,6% y las uncinarias (*Necator americanus y Ancylostoma duodenale*) con el 18,6% en pacientes con malaria. De igual manera se demostró la incidencia de coinfección por malaria con dengue fue la segunda más alta (27,4%), después de la del virus de la hepatitis A (7).

El presente reporte se inspiró en un caso clínico de coinfección de *A. lumbricoides* y virus dengue. A la dirección regional de salud de la ciudad de Barinas, estado Barinas en Venezuela llegó un paciente masculino de diecisiete años de edad, procedente de la población de Calderas, Sector La Laguna, municipio Bolívar del estado Barinas, quien ingresó el 10 de diciembre de 2024 con sintomatología sugestiva de dengue y recuento de glóbulos blancos disminuida. El recuento plaquetario fue realizado en dos centros de atención a la salud independientes con valores de 25.000 y 61.000 plaquetas / mm3 respectivamente (trombocitopenia). La toma de muestras fue realizada el 17 de diciembre de 2024 para el procesamiento posterior en el laboratorio de Salud Pública "Dr. Avilio Acosta" mediante el UMELISA-Dengue para la detección de IgM anti-virus dengue. La figura 1 muestra los niveles de la IgM del paciente frente al virus dengue. No tuvimos acceso a la historia clínica, ni a la necropsia de ley.

Hipótesis. La infección por *A. lumbricoides* genera una respuesta inmunomoduladora de células T ayudadoras 2 (Th2) con altos niveles de interleucina 10 (IL-10), factor transformante de crecimiento beta 1 (TGF-ß1); con participación de las células T reguladoras (Treg), la interleucina 27 (IL-27) con la finalidad de evitar la inflamación intestinal (particularmente del intestino delgado) y esto favorece el desarrollo adecuado del geohelminto; es decir, una "tolerancia" inducida por el verme para su beneficio. Entones, la respuesta Th1 frente a cualquier patógeno intracelular, como por ejemplo el virus dengue, estaría disminuida favoreciendo concomitantemente la replicación viral de cualquiera de los cuatro tipos de virus dengue (8 - 11).

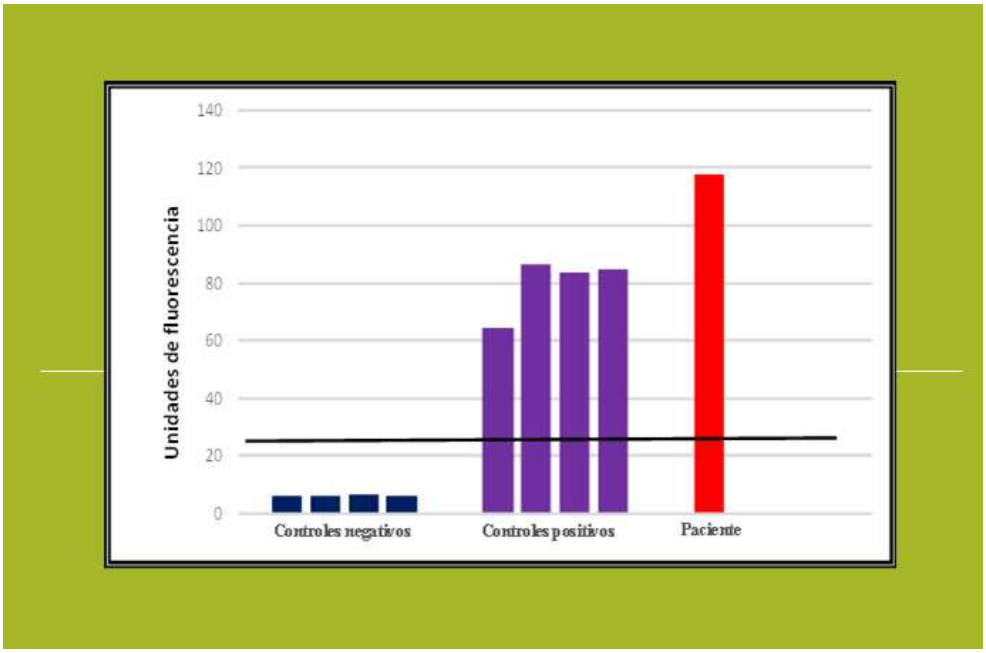


Figura 1. Detección de IgM anti-virus dengue mediante el sistema ultra-micro ELISA (UMELISA Dengue, La Habana, Cuba). El nivel de corte es representado con una línea negra continua = 0,225 (P-NN) + NN = 23,77. El cutoff para unidades de fluorescencia = (P-NN) + NN = 0,191. La relación entre valores absolutos y unidades de fluorescencia fue: NN (P-NN) (Fi-NN) (P-NN). P = control positivo con un valor promedio de fluorescencia más error estándar = 84,89 + 6.855. NN = control negativo, valor promedio obtenido más error estándar = 6.02 + 0.327. El valor de fluorescencia obtenido para el paciente fue de 117,79 y el valor calculado mediante la relación = 1417, que indica exposición reciente al virus dengue.

Además de los factores de los agentes infecciosos antes mencionados, un factor importante como el estado nutricional (si el paciente está desnutrido o malnutrido), un estado de inmunosupresión anterior a la infección con *A. lumbricoides* y virus dengue, factores del acervo genético del hospedero, por ejemplo, ciertos haplotipos del sistema mayor de histocompatibilidad (MHC-I y MHC-II), pudiesen explicar buena parte de las complicaciones del caso clínico presentado y que dichas complicaciones condujeron a un desenlace fatal por asfixia, inducida por los vermes de *A. lumbricoides*.

El objetivo de la presente revisión sistemática cualitativa fue describir los casos de coinfección entre *A. lumbricoides* y virus dengue; de igual manera, señalar los mecanismos fisiopatológicos que pueden explicar un desenlace fatal en estos casos, de dos enfermedades infecciosas endémicas en Venezuela.

Materiales y métodos

En la figura 2 se muestra el flujograma PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) de la revisión documental realizada. Para la búsqueda de la información se utilizaron combinaciones de palabras claves en español e inglés, con el uso de los operadores booleanos: AND, OR y NOT: *"Dengue immunopathology", "Ascaris immunopathology", "Ascaris dengue coinfections",* para lo cual se emplearon los siguientes motores de búsqueda, metabuscadores, bases de datos: PubMed, Google scholar y MedScape. Se obtuvo un total de 22.937 documentos, discriminados de mayor a menor cantidad, como sigue: Google Scholar (n = 22.670), PubMed (n = 134) y MedScape (n = 133).

Criterios de inclusión. Se seleccionaron estudios in vivo o in vitro que cumplieran con las siguientes pautas: a) estudios de casos clínicos humanos, b) estudios en animales de experimentación y líneas celulares, c) artículos de revisión, e) artículos realizados por los autores del presente manuscrito. Utilizamos la lectura rápida de títulos y resúmenes para eliminar los artículos no relacionados con el esquema expositivo propuesto (12-16). De los 45 trabajos que fueron seleccionados, solo 37 fueron empleados finalmente para la redacción del manuscrito.

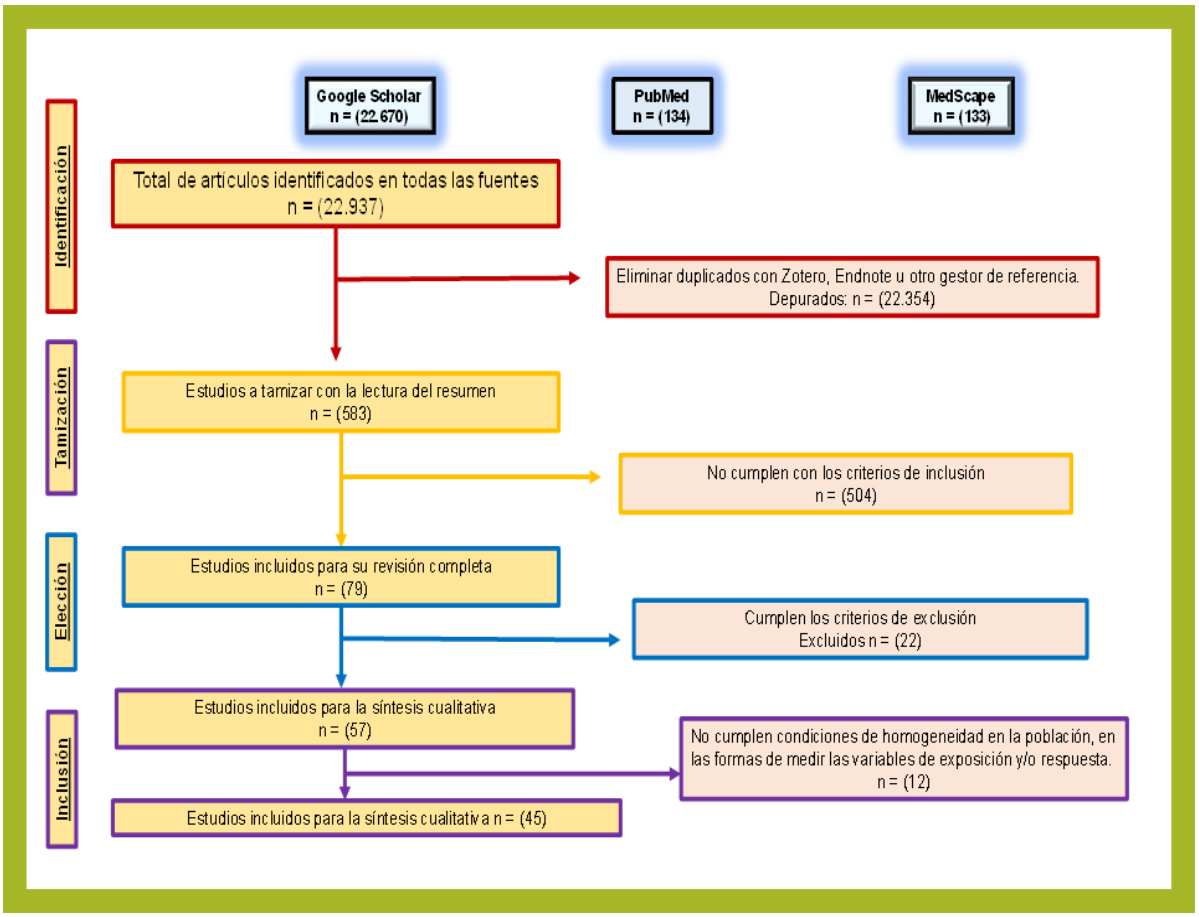


Figura 2. Flujograma PRISMA donde se muestra la búsqueda, tamización y selección final de los documentos de la presente revisión.

Dengue: un alfaviridae de gran importancia clínica en el mundo.

El dengue constituye una infección viral sistémica que se transmite de humano a humano por vectores del género Aedes. En Venezuela las especies de interés epidemiológico son: *Aedes aegypti y Aedes albopictus*. Para algunos pacientes, el dengue constituye una enfermedad que compromete sus actividades diarias (educativas, de trabajo, entre otras) y en algunos casos surgen complicaciones de importancia como el síndrome de shock por dengue y el dengue hemorrágico. Hasta la presente fecha no existen vacunas autorizadas, ni tampoco un tratamiento específico, quedando el control de la infección en los esfuerzos por evitar la vía de transmisión que ocurre por la piel del hospedero susceptible (hombre) en el momento de la picadura de la hembra del género *Aedes* que contiene las partículas virales (17).

El agente etiológico es un virus de la familia flaviviridae de ARN polaridad positiva, simetría icosaédrica, y posee envoltura. Se conocen cuatro virus dengue: DENV1, DENV2, DENV3 y DENV4. Los reservorios están representados por el hombre infectado (virémico) y por el mosquito infectado. El vector es un artrópodo con las dos especies de interés epidemiológico en Venezuela señaladas anteriormente. El único hospedero susceptible conocido es el ser humano. La vía de transmisión es por la picadura, siendo la piel tanto puerta de entrada como de salida de las progenies virales. La principal medida de control y prevención es cortar la vía de transmisión humano infectado – mosquito – hospedero susceptible (figura 3), mediante programas de fumigación intensivos, especialmente en épocas de lluvias. El periodo de incubación de la infección es de 3 a 15 días, con un promedio de 5 a 6 días. Se ha señalado al periodo de transmisibilidad desde el día anterior al comienzo de los síntomas hasta el quinto día de la enfermedad (18-19).

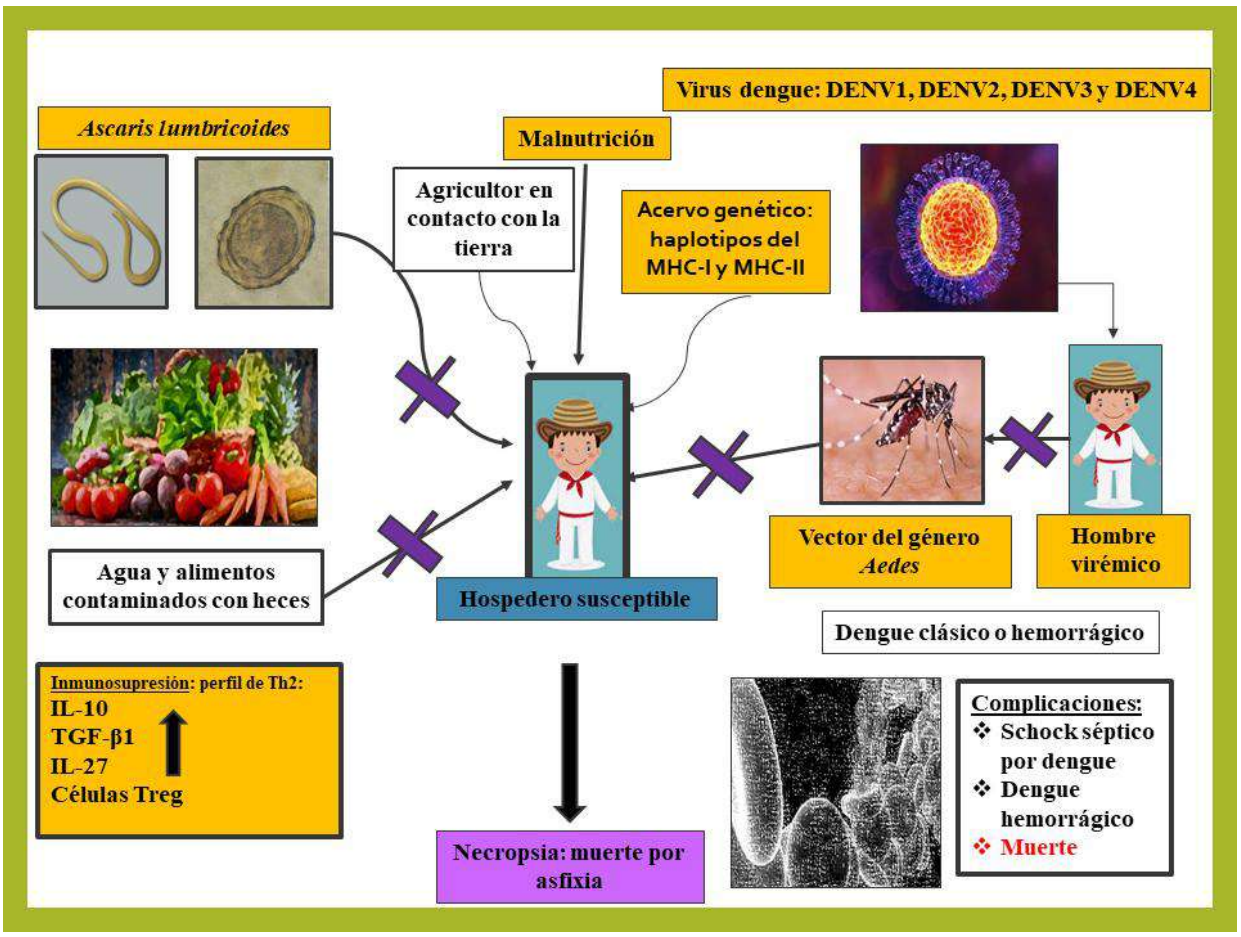


Figura 3. Hipótesis gráfica. La coinfección de *A. lumbricoides* y el virus dengue DENV presenta interesantes mecanismos inmunes involucrados. Del lado del geohelminto induce un estado de inmunosupresión en el hospedero, esto está relacionado con el perfil de citocinas de las células Th2 con producción de IL-10, TGF-β1, IL-27, y la participación de las células Treg (linfocitos T reguladores), lo que induce una "tolerancia inmune". Del lado del virus dengue y sus cuatro serotipos existe linfoblastólisis en médula ósea, inmunoeliminación mediada por células NK (asesinas naturales), ADCC (citotoxicidad celular dependiente de anticuerpos), activación del sistema de complemento, entre otros. Es decir, en este caso hay un patógeno extracelular que genera altos niveles de IL-10 y con ello disminuye la capacidad de respuesta Th1 indispensable para eliminar a un patógeno intracelular como el DENV. Las cruces de color morado evidencian que en ambas patologías la mejor manera de controlar y prevenir a los patógenos es en la vía de transmisión.

Fisiopatología de la infección por virus dengue

Luego que el virus penetra a la sangre del hospedero susceptible es fagocitado por las células del sistema retículo endotelial, multiplicándose en ellas para generar una nueva progenie viral, generando una **viremia primaria**, lo cual da inicio a la fase sistémica de la enfermedad. Invade sistema nervioso central (SNC), piel, músculos, vasos sanguíneos, hígado, bazo y ganglios linfáticos (20).

Ante el primer contacto virus - hospedero se induce una respuesta inmune innata y otra adaptativa. En este sentido la inmunidad adaptativa humoral contra los cuatro serotipos del virus produce una **respuesta homotípica**, caracterizada por la producción de anticuerpos protectores neutralizantes del hospedero frente al serotipo infectante (por ejemplo DENV4), que es de larga data. De igual manera, se produce una **respuesta heterotípica** protectora contra los otros serotipos por dos meses (inmunidad cruzada). Desde un punto de vista bioquímico la diferencia sería la presencia de anticuerpos homotípicas de **alta afinidad** y baja constante de disociación (Kd) y anticuerpos heterotípicos de **baja afinidad** y alto Kd (20-22).

De transcurrir un periodo mayor de 2 años y producirse en este mismo paciente otra infección por otro serotipo del virus dengue (por ejemplo DENV1), éste sufrirá dengue clásico con su respuesta inmune ya señalada y así para cada serotipo. Pero, en caso contrario, si la nueva infección tiene lugar en un lapso menor de dos años, este paciente posee anticuerpos heterólogos subneutralizantes que formarán complejos antígenos - anticuerpos, haciendo más eficaz la unión de los virus a los macrófagos y linfocitos por medio de los receptores para la fracción cristalizable gamma (Fc-γ) de la superficie celular (20-22).

Las células invadidas serán destruidas por efecto directo de la replicación viral para generar nuevas progenies y de igual forma participan mecanismos inmunológicos como la inmunoeliminación por células asesinas naturales (NK), lo que genera la liberación de mediadores químicos vasoactivos. Estos mediadores y los complejos antígeno - anticuerpo activan al complemento, lo que determina cambios en la permeabilidad vascular, salida de plasma al espacio extravascular, hemoconcentración, y aparición de signos de shock, si el proceso se torna crítico (23).

La activación del sistema de complemento lleva a la linfoblastólisis en médula ósea por activación de los componentes C3a y C3b del complemento. La **trombocitopenia** observada en estos pacientes, puede ser generada por mecanismos de inmunoeliminación. La liberación de los factores de permeabilidad vascular conduce también a la liberación de tromboplastina, que lleva a activación del fibrinógeno (con una concomitante disminución de sus valores normales). También ocurren disminuciones de: protrombina, el factor VIII, XII, la antitrombina III, la α-antiplasmina. En casos graves de disfunción hepática, se ven afectados los factores de la coagulación dependientes de la vitamina K: los factores V, VII, IX y X. Esto genera trastornos de la hemostasis por alteraciones vasculares, la trombocitopenia antes mencionada, coagulopatías y se puede llegar a producir la coagulación intravascular diseminada y las hemorragias. En resumen, los mecanismos antes descritos son los responsables de la **fiebre hemorrágica por dengue y del shock séptico por dengue**, que son las complicaciones más severas de la infección, pudiendo en algunos casos tener un desenlace fatal (24-25).

Manifestaciones clínicas

Dengue clásico. Generalmente de curso benigno, fiebre de inicio brusco, intermitente, bifásica 39 - 40 oC durante dos a tres días, remite por horas a días y reaparece 2 - 3 días. Puede presentarse malestar general, cefalea intensa, artralgias, mialgias, dorsalgias, dolor retroocular, postración, erupción maculopapular o escarlatiniforme primero en el tórax y luego se disemina a extremidades. Las adenomegalias, esplenomegalia y hepatomegalia no son constantes. Los vómitos, náuseas, sabor amargo en la boca y diarrea o estreñimiento pueden aparecer. La convalecencia se inicia al sexto día generalmente con fatiga y depresión prolongada. El diagnóstico diferencial debe incluir: malaria, sepsis bacterianas, fiebre amarilla, fiebre hemorrágica de Guanarito, influenza, leptospirosis, rubeola, sarampión y otras exantemáticas virales (26).

Generalidades de *A. lumbricoides* y la ascariosis

Ascaris lumbricoides es el nematodo intestinal más grande que parasita al ser humano, pertenece al phylum Nematoda. De acuerdo con la OMS y la OPS: "Se estima que una de cada tres personas está infectada por geohelmintos y cerca de 46 millones de niños entre 1 y 14 años están en riesgo de infectarse por estos parásitos [aproximadamente 13 millones de niños en edad pre-escolar (1 a 4 años) y 33,3 millones en edad escolar (de 5 a 14 años)], por falta de saneamiento básico y acceso al agua potable. La infección es más frecuente en mujeres y niños. La falta de acceso al agua y saneamiento es la causa de la persistencia de estas infecciones. La desparasitación masiva una o dos veces al año en comunidades y países con altas prevalencias, junto con medidas de higiene personal, e incremento al acceso al agua y saneamiento son las intervenciones para reducir la carga de enfermedad" (11).

El parásito posee forma cilíndrica de unos 5 mm de diámetro, machos y hembras se diferencian por el tamaño, siendo la hembra de mayor envergadura 20 - 35 cm, en tanto el macho puede llegar a medir de 15 - 30 cm de largo. La parte posterior del macho es curvada, con espículas y papilas, mientras que en la parte posterior de la hembra la forma es recta y terminada en punta. Ambos sexos poseen una boca provista de tres labios. Los huevos fértiles (infectantes para el ser humano) poseen forma oval o redondeada, de 45 - 75 micras de largo por 35 - 50 micras de ancho, con una cubierta protectora formada por tres capas y en el interior existe una masa granular de donde se originarán las larvas en diferentes estadios de maduración en el medio ambiente (L1-L3). El ciclo de vida del nematodo es directo y **la larva infectante es la L2** para el humano. Esta es la causa más frecuente de helmintiosis humana, la cual afecta intestino delgado,

colon y conducto biliar común. El curso clínico es asintomático o clínicamente inespecífico. Las complicaciones más frecuentes ocasionada por este nematodo incluyen: malnutrición, obstrucción intestinal mecánica, vólvulo o invaginaciones, colecistitis, apendicitis aguda (3, 9).

Ascaris lumbricoides al ser un geohelminto, debe tener un periodo de maduración en la tierra en condiciones climatológicas y de humedad adecuadas para garantizar la maduración de las larvas. Las medidas de prevención y control de la parasitosis consisten en reconocer en primer término los principales mecanismos de infección y uno de los más importantes es la ingesta de agua contaminada con huevos embrionados maduros por una mala higiene doméstica (9). La ascariosis se considera una enfermedad de la pobreza y en general de malas condiciones higiénicas (3, 9).

Fisiopatología del parasitismo por *Ascaris lumbricoides* y manifestaciones clínicas.

Los dos únicos estadios del parásito *A. lumbricoides* capaces de originar manifestaciones clínicas son las larvas y los vermes adultos. Cada uno afecta órganos específicos con manifestaciones clínicas propias y diversas, sobre todo los adultos por su capacidad migratoria dentro del intestino y conductos que depositan líquidos digestivos provenientes del hígado, vías biliares y páncreas. Las larvas en su segundo estadio evolutivo rompen los capilares pulmonares y se alojan dentro de los alvéolos pulmonares; ahí esperan hasta madurar al quinto estadio (L5) para luego migrar por la vía respiratoria hasta ser deglutidas y llegar al intestino. Entonces, durante todo este trayecto los síntomas varían, sin embargo, serán siempre respiratorios. Su intensidad y gravedad van en relación con la **carga parasitaria**. Lo que genera los signos y síntomas en este punto es la ruptura capilar y de los alvéolos. Aquí puede haber como consecuencias: hemorragias e inflamación, que clínicamente pueden expresarse como: tos, expectoración, disnea, ocasionalmente hemoptisis y dolor torácico asociados y, se pueden observar infiltrados alveolares en la radiografía simple de tórax, eosinofilia en sangre periférica; este contexto clínico se conoce como **síndrome de Loeffler** que corresponde a la migración transpulmonar del helminto (26, 27).

Los mecanismos patógenos por parte del estadio adulto son variados, principalmente en los niños. Estos pueden llegar a agravar el estado nutricional deficitario en las poblaciones aún más susceptibles. Uno de estos mecanismos es la respuesta inflamatoria que se genera por la presencia de los parásitos. La respuesta inmune produce citocinas, que generan pérdida del apetito y tiene además un efecto deletéreo sobre el metabolismo de las proteínas haciendo que su aprovechamiento por parte del cuerpo sea ineficiente (28).

Otro mecanismo es la escasa absorción de nutrientes en el intestino delgado, debido principalmente a dos situaciones: la primera es el aprovechamiento por parte de los vermes. Se han realizado cálculos que indican que un solo gusano puede llegar a consumir hasta 100 mg de proteínas; mientras que el segundo mecanismo se da por inflamación de la pared interna intestinal, que hace que este aumente su velocidad de tránsito y que sea escaso el tiempo en que las proteínas puedan ser aprovechadas debidamente por el hospedero, llevando a retardo en el crecimiento e incluso en el desarrollo cognitivo. Estos son los llamados “niños barrigones” (26-28).

Respuesta inmune frente a *A. lumbricoides*

Los helmintos intestinales aumentan la producción de citocinas Th2 (inmunomoduladoras) ya que se necesita este tipo de respuesta para evitar la inflamación intestinal exacerbada, especialmente participan las células T reguladoras (Treg) y las citocinas IL-10 e IL-27 (9). Uno de los grupos de investigación en Venezuela que más ha aportado al conocimiento de la respuesta inmune de los seres humanos frente a *A. lumbricoides* es el liderado por la doctora Isabel Hagel. En un trabajo publicado en el año 2005 (29) se logró demostrar los aspectos protectores del sistema inmune frente a la infección por *A. lumbricoides* en niños indígenas y criollos. Mediante Kato-Katz se logró cuantificar la carga parasitaria y la prevalencia de la infección. El uso de ELISA permitió la detección de los niveles de IgE específica para el verme y finalmente el número de linfocitos T (CD3+, CD3 + CD4+) y B (CD20+, CD20 + CD23+) en circulación sanguínea fueron determinados mediante citometría de flujo. De acuerdo a los resultados de la IgE, los niños fueron divididos en dos subgrupos: **respondedores** (mayor a 0,7 UI/mL) y **no respondedores** (menor a 0,7 UI/mL). Las subpoblaciones de linfocitos T y B circulantes fueron más elevadas en los grupos respondedores. De igual manera se observó una correlación negativa entre la carga parasitaria con los niveles de IgE específica anti - *A. lumbricoides* y el número de linfocitos TCD4+ en circulación sanguínea. Estos valiosos datos subrayan la

importancia del mecanismo efector del hospedero denominado citotoxicidad celular dependiente de anticuerpos (ADCC, por su acrónimo en inglés), potente mecanismo donde la IgE marca al parásito, que luego es reconocida por las células efectoras para aniquilar al parásito. Entonces, existe un papel protector frente a la infección por *A. lumbricoides* tanto de la IgE específica como de la respuesta de linfocitos T cooperadores (29).

Las citocinas IL-10 y el TGF-ß1 estimuladas por el fluido corporal de *A. lumbricoides* están asociadas con los niveles de IgA secretora frente a otros patógenos intestinales, que actúan atenuando los síntomas de la diarrea (9, 30).

La selección de las más exitosas respuestas inmunes contra la malaria ha ocurrido en poblaciones coinfectadas con parásitos intestinales y *Plasmodium*, los modelos animales indican que tales infecciones mixtas con helmintos y protozoos generan en el hospedero un rango de interacciones sinérgicas y antagónicas; hallazgos recientes indican que interacciones similares tienen lugar entre helmintos, *Plasmodium falciparum* y humanos. El grupo de Nacher et al., 2000 (10) señalaron que la infección por Ascaris lumbricoides está asociada con la protección frente a la malaria cerebral por *P. falciparum*. En general, las infecciones por *A. lumbricoides* aumentan el riesgo de desarrollar infección malárica, pero también reducen el riesgo de hacer malaria cerebral. De igual manera, la infección por *Necator americanus* y la desnutrición protegen de la malaria cerebral (31-32).

Ascaris lumbricoides puede presentar los mismos epitopos o determinantes antigénicos del sistema ABO que sus hospederos. Estudios previos demuestran que los epitopos ABO contra los extractos de este geohelminto coinciden con los epitopos ABO de los humanos de los que se obtienen los vermes, así como también, se comprobó la ausencia de epitopos pertenecientes a los grupos A y B en homogenatos derivados del parásito de pacientes pertenecientes al grupo O. Una posible conclusión indica que la heterogeneidad en la expresión de epitopos ABO de *A. lumbricoides* podría estar involucrada en la evasión de la respuesta inmune del hospedero (33).

Clínica de las infecciones

Perturbaciones producidas por las larvas. Las larvas provenientes del intestino delgado, a su paso por el parénquima hepático y las paredes de los alveolos pulmonares, pueden generar una respuesta inmune más o menos intensa, en función del número de larvas, que incluyen a la inmunidad celular, y es posible reacciones de hipersensibilidad del hospedero y **síndrome de Loeffler** (neumonía alérgica eosinofílica o eosinofilia tropical, son sinonimias). Este último síndrome se define como un trastorno idiopático benigno eosinofílico pulmonar, opacidad transitoria pulmonar, anemia, fiebre, disnea y pérdida de peso en los pacientes infectados. El **síndrome de Loeffler** puede ser causado por el estadio larval de varios otros helmintos, siendo la descripción relacionada a *A. lumbricoides,* un ejemplo de su posible etiología (26).

La hepatitis ascaridiana en general es silenciosa, siendo su diagnóstico generalmente un hallazgo histopatológico. En los pulmones se puede producir un cuadro bronquítico caracterizado por tos, fiebre, a veces con esputo hemoptoico y disnea, pudiendo simular un cuadro de asma bronquial. La migración de las larvas a otros órganos como: ganglios linfáticos, bazo, riñón y cerebro son acontecimientos excepcionales (26).

Perturbaciones producidas por los vermes adultos. En pacientes bien nutridos y con pequeñas cargas de parásitos, la ascaridiosis intestinal puede ser asintomática. Cuando los síntomas están presentes, puede encontrarse: anorexia, náuseas y vómitos (a veces con eliminación de los geohelmintos), distensión abdominal, diarrea y principalmente dolor abdominal vago epigástrico o periumbilical. En niños pequeños, estos dolores pueden a veces ser muy intensos y hasta simular cuadros de abdomen agudo. Libres en la luz del intestino delgado, los vermes no lesionan mucho la mucosa, a no ser por pequeños traumas durante sus movimientos. Sin embargo, pueden llevar a un estado serio de expoliación principalmente en infecciones masivas en pacientes con desnutrición (34-35).

Esta expoliación es debida a: aprovechamiento de los alimentos y sus nutrientes directamente por *A. lumbricoides*, también puede existir alteraciones enzimáticas y de la fisiología intestinal del hospedero. Existe disminución de: Albúmina, vitamina C, disminución del aprovechamiento de la riboflavina y pérdida de peso corporal del paciente. En general podemos resumir sucintamente, que los parásitos generan: una acción mecánica que lleva a la obstrucción, migración, de igual forma, puede presentarse una acción traumática expoliadora, una reacción inflamatoria, acción tóxica y alergizante La complicación más temida está representada por la semioclusión y oclusión intestinal causada por un bolo de *A. lumbricoides* (34-35).

Manifestaciones de hipersensibilidad. Las alteraciones relacionadas con el Sistema Nervioso Central (componente psíquico): alteraciones del comportamiento, alucinaciones y otros síntomas

psicóticos. Las manifestaciones neurológicas varían desde agitación y el crujir de los dientes durante el sueño hasta cuadros convulsivos. Pueden presentarse erupción urticariforme, prurito nasal y asma (26).

Discusión

En la figura 3 se presenta la hipótesis gráfica sugerida, donde destacamos los mecanismos bioquímicos que explican que la coinfección del hospedero de 24 años procedente de la población de Calderas, ubicada al noreste del estado Barinas en Venezuela con dos patógenos como *A. lumbricoides* y el virus dengue (no pudimos acceder al reconocimiento del serotipo involucrado por el sistema de detección empleado: UMELISA - Dengue), aunado a las actividades laborales, un agricultor en contacto con la tierra y una posible malnutrición jugaron en contra, ocurriendo la peor consecuencia posible, su defunción en diciembre del año 2024. Lamentablemente las defunciones por *A. lumbricoides* han sido reportadas en nuestro continente. El grupo de Defagot et al., en el año 2013 describieron un caso clínico de una niña de 3 años oriunda de Cosquín (50 km de la ciudad de Córdoba) en la Argentina, la cual estaba desnutrida. Su fallecimiento ocurrió como consecuencia de las complicaciones de una ascariosis masiva. La consulta médica se realizó de manera tardía cuando aparecieron las complicaciones, siendo que hacía tiempo la niña eliminaba parásitos por la materia fecal. El día de la muerte presentó disnea que fue atribuida a broncoaspiración por "fideos", pero se trataba de parásitos en la vía área que originaron asfixia y muerte. El caso fue denunciado como muerte de etiología dudosa, la autopsia reveló parásitos en pulmón y en todo el intestino (36).

Natividad en el año 2014 (8) presentó un caso clínico similar al nuestro referido a un varón de 24 años con fiebre e infiltrados pulmonares, que había realizado un viaje a Senegal durante 18 días, tiempo en el cual visitó áreas rurales y urbanas. Los dos últimos días del viaje presentó rinorrea, tos seca, ambas leves y fue mejorando de forma progresiva, al regresar a su país de origen, se le realizaron varias pruebas como la determinación de IgM e IgG para virus dengue (ambas con resultados positivos que indicaban tanto la exposición reciente como la pasada al flavivirus), un examen de heces permitió identificar huevos de *A. lumbricoides* y también hubo positividad para un tercer agente infeccioso distinto, la bacteria *Rickettsia coronii*. A diferencia del caso relatado al inicio de este manuscrito, este otro caso clínico no tuvo un desenlace mortal.

Al inicio de nuestra introducción se presentó el trabajo de Mubaraki et al., 2024 (7) que destacó las coinfecciones microbianas en pacientes con malaria en Pakistán. Si bien es cierto, no se observó una asociación significativa entre los diferentes grupos etarios, la tasa de incidencia de DENV fue del 25,1% (34/135). La mayor parte de este país asiático experimenta brotes tanto de dengue como de malaria durante la temporada posmonzónica, como resultado de períodos prolongados de estancamiento de aguas residuales, agravados por una infraestructura sanitaria y de alcantarillado inadecuada. Estas condiciones son similares a las que se presentan en muchos centros urbanos y rurales en Venezuela, donde existen brotes frecuentes del virus dengue durante los periodos de fuertes lluvias y la precariedad de medidas sanitarias permite y potencian aún más su diseminación. Este trabajo no muestra la incidencia por separado de coinfecciones Ascaris - DENV.

En reportes previos de nuestro grupo observamos 60 casos donde se logró identificar A. lumbricoides en pacientes atendidos en el laboratorio de emergencia y hospitalización del hospital Dr. Adolfo Pons de la ciudad de Maracaibo, estado Zulia en Venezuela. En este sentido la prevalencia del geohelminto fue de 1,20% (50/4982), destacando las coinfecciones de *A. lumbricoides + Trichiuris trichiura* con un 2,34 % (11/427), seguido de *Blastocystis spp. + Entamoeba coli + A. lumbricoides* 1,87 % (8/427) y por último *Blastocystis spp. + A. lumbricoides + E. coli + T. trichiura* con un 0,51% (2/427). No se determinó la prevalencia del virus dengue, el trabajo se limitó al uso solo de muestras de heces (37).

La necesidad de una adecuada educación para la salud, el esfuerzo concertado de todos los actores del equipo de salud: médicos, enfermeras, bioanalistas, personal de las direcciones de epidemiología, autoridades sanitarias regionales y nacionales y de toda la comunidad podría generar un cambio en las conductas de higiene personal y saneamiento ambiental básico, tendientes a prevenir la pérdida de vidas de jóvenes útiles para nuestra sociedad venezolana.

Conflicto de interés

Ninguno que declarar.

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References

1. Vielma JR, Pérez I, Villarreal J, Vegas M, Reimi Y, Belisario M, Prieto M, Uzcátegui D, Hernández H, Pineda C, González E, Gutiérrez L. Blastocystis spp. y enteroparásitos en pacientes que asisten a dos instituciones públicas de atención a la salud, occidente venezolano. Acta Bioclín 2017; 7: 80-99. [Google Scholar]
2. Vielma JR, Chirinos R, León A, Pérez I, Díaz S, Gutiérrez L. Blastocystis spp. y enteroparásitos en un instituto de educación especial venezolano. Acta Bioclín 2021; 11: 29-48. [Google Scholar]
3. Vielma JR. Contribución al estudio de los parásitos intestinales en hospitales públicos, ambulatorios urbanos e Instituto de educación especial en el occidente venezolano. [Trabajo de Ascenso]. Universidad Nacional Experimental Sur del Lago "Jesús María Semprum" (UNESUR). 2012. 90 pp. [Google Scholar]
4. Vielma JR. Blastocystosis: Epidemiological, clinical, pathogenic, diagnostic, and therapeutic aspects. Invest Clin 2019; 60: 53-78. [Google Scholar]
5. Vielma J R, Villarreal Andrade JC, Gutiérrez-Pena LV. El SARS-CoV-2 y la COVID-19 en Venezuela. Plan de capacitación comunitaria en materia de bioseguridad. Generis Publishing. 155 pp. ISBN: 979-8-88676-217-4. (2022). [Google Scholar]
6. Vielma-Guevara J R, Villarreal JC, Gutiérrez-Peña LV. Pandemia por el SARS-CoV-2. Aspectos diagnósticos, desarrollo de vacunas, tratamiento e Impacto en el sector educativo venezolano. Observador del Conocimiento 2021; 6: 13-34. [Google Scholar]
7. Mubaraki MA, Hussain M, Fozia F, Ahmad I, Niaz Khan S, Qadir Khan A, Ziaullah Z. Incidence of Helminthic and Viral Coinfections in Malaria Patients in the Tertiary Care Hospital Setup. J Trop Med 2024; 8529788. [PubMed] [Google Scholar]
8. Natividad B. Varón de 24 años con fiebre e infiltrados pulmonares. Medicina Clínica 2014; 142: 259-64. [PubMed] [Google Scholar]
9. Grijalva Zuluaga D.S. Epidemiología, ciclo de vida, y patogénesis del Ascaris lumbricoides en pediatría. Gastrohnup 2016; 19: 17-23. [Google Scholar]
10. Nacher M, Gay F, Singhasivanon P, Krudsood S, Treeprasertsuk S, Mazier D, Vouldoukis I, Looareesuwan S. Ascaris lumbricoides infection is associated with protection from cerebral malaria. Parasite Immunol 2000; 22: 107-13. [PubMed] [Google Scholar]
11. Organización Panamericana de la Salud (OPS) y Organización Mundial de la Salud (OMS). 2025. Geohelmintiasis. [Google Scholar]
12. García Perdomo, H. Conceptos fundamentales de las revisiones sistemáticas/metaanálisis. Urología Colombiana 2015; 24: 28-34. [Google Scholar]
13. Vielma JR, Picón-Borregales DE, Gutiérrez-Peña LV, Lara ND. Pathophysiology of osteoporosis: genes, oxidative stress and immunopathogeny. A systematic review. Avan Biomed. 2018; 7: 100-11. [Google Scholar]
14. Vielma Guevara JR. Vacunas basadas en sistemas colinérgicos en infecciones por helmintos. Revisión sistemática y metaanálisis. Revista Científica UNET 2023; 35: 132-42. [Google Scholar]
15. Vielma Guevara J.R. Tratamiento de la osteoporosis. Revisión Sistemática. Avan Biomed. 2023; 12: 6-20.[Google Scholar]
16. Vielma-Guevara JR, Villarreal-Andrade, JC. Sistemas colinérgicos neuronales y no-neuronales en infecciones por parásitos. Revisión sistemática y metaanálisis. Avan Biomed. 2022; 11: 6-23. [Google Scholar]
17. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, Drake JM, Brownstein JS, Hoen AG, Sankoh O, Myers MF, George DB, Jaenisch T, Wint GR, Simmons CP, Scott TW, Farrar JJ, Hay SI. The global distribution and burden of dengue. Nature 2013; 496: 504-7. [PubMed] [Google Scholar]
18. Witte P, Venturini S, Meyer H, Zeller A, Christ M. Dengue Fever-Diagnosis, Risk Stratification, and Treatment. Dtsch Arztebl Int 2024; 121: 773-8. [PubMed] [Google Scholar]
19. Raafat N, Blacksell SD, Maude RJ. A review of dengue diagnostics and implications for surveillance and control. Trans R Soc Trop Med Hyg 2019; 113: 653-60. [PubMed] [Google Scholar]
20. Guzman MG, Gubler DJ, Izquierdo A, Martinez E, Halstead SB. Dengue infection. Nat Rev Dis Primers 2016; 2: 16055. [PubMed] [Google Scholar]
21. Kularatne SA. Dengue fever. BMJ 2015; 351: h4661. [PubMed] [Google Scholar]
22. Losada PX, DeLaura I, Narváez CF. Dengue Virus and Platelets: From the Biology to the Clinic. Viral Immunol 2022; 35: 349-58. [PubMed] [Google Scholar]
23. Petitdemange C, Wauquier N, Rey J, Hervier B, Leroy E, Vieillard V. Control of acute dengue virus infection by natural killer cells. Front Immunol 2014; 5: 209. [PubMed] [Google Scholar]
24. Carlos CC, Oishi K, Cinco MT, Mapua CA, Inoue S, Cruz DJ, Pancho MA, Tanig CZ,

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Matias RR, Morita K, Natividad FF, Igarashi A, Nagatake T. Comparison of clinical features and hematologic abnormalities between dengue fever and dengue hemorrhagic fever among children in the Philippines. Am J Trop Med Hyg 2005; 73: 435-40. [PubMed] [Google Scholar]

25. Sosothikul D, Thisyakorn U, Thisyakorn C. Hemostatic Studies in Dengue Patients. Southeast Asian J Trop Med Public Health. 2015; 46 Suppl 1: 43-5. [PubMed] [Google Scholar]
26. Loscalzo J, Fauci A, Kasper D, Hauser S, Longo D, Jameson JR. Harrison Principios de Medicina Interna. Parte 5: Enfermedades infecciosas. 2022. Mc. Graw Hill. ISBN: 9781264540259. 21 Edición. [Google Scholar]
27. Pérez Arellano JL, Andrade MA, López Abánbj, Carranzac C, Murob A. Helmintos y aparato respiratorio. Arch. Bronconeumonol 2016; 42: 47-57. [Google Scholar]
28. Botero D, Restrepo M. Parasitosis humana. 5ta ed. 2012: 93-41. [Google Scholar]
29. Hagel I, Rodríguez O, Sánchez P, Rodríguez P, Palenque M. Aspectos inmunológicos protectores frente a la infección por Ascaris lumbricoides en niños indígenas y criollos de comunidades rurales de Venezuela. Boletín de Malariología y Salud Ambiental 2005; 155: 37-45. [Google Scholar]
30. Cabrera Barroso J. L., Jiménez Artigas J.
31. C., Nuñez L, Pocaterra L, Rojas E, Hernán A. Evaluación inmunológica de extractos de Ascaris Lumbricoides para las inmunoglobulinas IgA en el suero de individuos infectados. Gen 2014; 68: 48-52. [Google Scholar]
32. Carmona Fonseca, J. Malaria, desnutrición y parasitosis intestinal en los niños colombianos: interrelaciones. Iatreia 2004; 17: 354-69. [Google Scholar]
33. Zakzuk J. Inmunorregulación inducida por helmintos: una actualización. Iatreia 2016; 29: 182-93. [Google Scholar]
34. Ponce-León P. Respuesta inmune frente a Ascaris lumbricoides. Invest Clin 2006; 47: 385-93. [Google Scholar]
35. Portús Vinyeta M, Garate Ormaechea T. Infecciones causadas por cestodos y nematodos intestinales. En: Ferreas Rozma. Medicina interna. 17 ed. 2012; 2199-2207. Elsevier, España.
36. Coello Kuon Yeng L, Rey Guevara R. Ascariasis: actualización sobre una parasitosis endémica. Revista científica Hallazgos 2019; 4: 87-99.
37. [Google Scholar]
38. Defagot LM, Pizzi HL, Pizzi RD, Dib MD. Ascariasis: Un caso de muerte por asfixia. Rev. Salud Pública (Córdoba) 2014; 17: 31-9. [Google Scholar]
39. Vielma-Guevara JR, Díaz Y, Pérez Z, Villarreal-Andrade JC, Gutiérrez-Peña LV. Blastocystis spp. y otros enteroparásitos en pacientes atendidos en el Hospital Doctor Adolfo Pons, Maracaibo, Venezuela. Avan Biomed 2019; 8: 102-112. [Google Scholar]

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Comparative evaluation of fracture strength of CAD/CAM anterior FPD framework made with zirconia and peek–an in-vitro study

(Evaluación comparativa de la resistencia a la fractura de una estructura de FPD frontal flexible anterior CAD/CAM fabricada con zirconia y peek: un estudio in vitro)

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Abstract(english)

This study aimed to comparatively evaluate the fracture strength of Computer Aided Designing, Computer Aided Manufacturing, 3-unit anterior Zirconia, and PEEK framework. A prefabricated prepared teeth model for 3-unit anterior FPD in relation to 21,22 & 23 was obtained and scanned using 3 Shape, Trios intraoral scanner, and a metallic die was milled using base metal alloy. The metallic die was scanned using the same Intraoral scanner (3 shape, Trios), and five 3-unit CAD/CAM Zirconia (Group A) and five 3-unit PEEK (Group B) frameworks were fabricated and cemented to the metallic die using resin cement. A universal testing machine was used for the fracture strength evaluation. The load was applied to the specimen at a crosshead speed of 0.5mm/min until catastrophic failure occurred. This was repeated for all the FPD frameworks, and the fracture strength mean value was recorded and statistically analyzed through an Unpaired Student t-test. The mean fracture strength of CAD/CAM Zirconia is 1862 N +18.8149 N, and the mean fracture strength of CAD/CAM PEEK is 2563 N +19.7231 N. The Fracture strength of CAD/CAM PEEK framework was higher than that of CAD/CAM Zirconia framework. The values were statistically significant by 1% (p value < 0.01). Since PEEK showed a significantly higher fracture strength value compared to Zirconia, it could be an alternative metal-free, esthetic material for replacing missing anterior teeth.

Keywords(english)

Fixed partial denture, Fracture strength, Polyetheretherketone, Zirconia.

Resumen(español)

Este estudio tuvo como objetivo evaluar comparativamente la resistencia a la fractura del diseño asistido por computadora, la fabricación asistida por computadora, la zirconia anterior de 3 unidades y el marco de PEEK. Se obtuvo un modelo de diente

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preparado prefabricado para FPD anterior de 3 unidades en relación con 21, 22 y 23 y se escaneó utilizando 3 Shape, escáner intraoral Trios, y se fresó un troquel metálico utilizando una aleación de metal base. El troquel metálico se escaneó utilizando el mismo escáner intraoral (3 shape, Trios), y se fabricaron cinco estructuras de zirconia CAD/CAM de 3 unidades (Grupo A) y cinco estructuras de PEEK de 3 unidades (Grupo B) y se cementaron al troquel metálico utilizando cemento de resina. Se utilizó una máquina de prueba universal para la evaluación de la resistencia a la fractura. La carga se aplicó a la muestra a una velocidad de cruceta de 0,5 mm/min hasta que se produjo una falla catastrófica. Esto se repitió para todas las estructuras de FPD, y el valor medio de la resistencia a la fractura se registró y se analizó estadísticamente mediante una prueba t de Student no pareada. La resistencia media a la fractura del zirconio CAD/CAM es de 1862 N + 18,8149 N, y la del PEEK CAD/CAM es de 2563 N + 19,7231 N. La resistencia a la fractura de la estructura de PEEK CAD/CAM fue superior a la de la estructura de zirconio CAD/CAM. Los valores fueron estadísticamente significativos al 1 % ($p < 0,01$). Dado que el PEEK mostró una resistencia a la fractura significativamente superior a la del zirconio, podría ser un material alternativo, sin metal y estético, para la sustitución de dientes anteriores faltantes.

Palabras clave(español)

Prótesis parcial fija, Resistencia a la fractura, Polieteretercetona, Zirconia.

Clinical significance

Introduction of Zirconia in dentistry has expanded the possible application of metal-free ceramic restoration with great success and reliability. Among the clinical complications of Zirconia FPD's, crown/connector fractures are reported most commonly. As PEEK (Polyetheretherketone) is high performance polymer, with low modulus of elasticity, resulting in shock shock-absorbing effect, which makes it less prone to fracture. Fracture strength of Zirconia is well known; hence this study aimed to evaluate the fracture strength of PEEK and compare it with Zirconia

Introduction

A missing tooth is a common condition in clinical dentistry. The replacement of missing tooth in the anterior region is challenging because of the soft and hard tissue, esthetic, phonetic, functional, and occlusal requirements. The prosthetic options for replacement of missing anterior teeth are Resin-bonded Fixed Partial Dentures, Conventional Fixed Partial Dentures (FPDs), Removable Partial Dentures, and Implant-supported Fixed Prosthesis. The demand for esthetics in fixed prosthodontics has led to development of new materials. The permanent materials most commonly used for restoration of anterior teeth are Metal ceramic and All ceramic. Metal-ceramics cause "graying" of the gingival margin because of metal show through and have the potential to cause allergic or toxic reactions within the soft or hard tissues (1). Use of these materials, have resulted in the development of metal free alternatives that is All ceramic restoration and more recently PEEK to restore the missing anterior teeth.

All ceramic crown like IPS Empress & e-max provide good esthetics but lack strength when used for FPD's. Zirconia crowns has been used since 1960's. Yttria-stabilized Tetragonal Zirconia Polycrystal (3Y-TZP) has been used for its high strength and good reliability. All ceramic crowns can be Monolithic or Bilayered. Bilayered restorations are used to replace teeth in esthetic region where the core is fabricated using Alumina, Zirconia, Zirconia toughened Alumina, Magnesium Aluminate Spinel and Lithium silicate. Once the core is fabricated, veneering porcelain are applied to the core to create the final esthetic restoration. The most common failure of these bilayered crowns and bridges are fracture of the veneering ceramic from its core (2). Before the advent of silanation, all-ceramic FPD failures were also attributed to a lack of adhesion to the underlying tooth substance. Silanation provided a means by which a chemical bond between etched porcelain and the tooth could be achieved. Monolithic crowns are made up of alternative ceramics like monolithic lithium disilicate which showed lower fracture strength than those made of monolithic Zirconia. Fabricating mono-block restorations from pure Zirconia (full contour Zirconia crowns) could increase the mechanical stability, expand the range of indications and also provide a higher reliability and sustain loading (3). But from the esthetic point of view, they are still inferior to their lithium disilicate in spite of adequate staining. Therefore, their indication range is limited to posterior single crowns and short span FDP's.

PEEK is a viable alternative to Zirconia full contour crowns, which could not only be able to resist occlusal loading but also provide good esthetics when used for an anterior esthetics. Polyetheretherketone (PEEK) is a sulfonated aromatic high-temperature thermoplastic material with very high mechanical strength. It is highly inert, resistant to chemical erosion, exhibits bone like flexibility and withstands high temperature. It is also non-allergic and has low plaque affinity. PEEK is widely accepted as a biomaterial and is an excellent substitute of bone (4). Apart from physiological properties, its esthetic properties such as

proximity to natural teeth color, radiolucency, rigidness and light weight makes it the perfect choice for dental restorations.

PEEK is used widely in CAD/CAM manufacturing for dental implants, provisional abutments, implant-supported bars, framework for removable prostheses, and fixed dental prosthesis (5). When used in Fixed partial denture the PEEK framework is layered with microfilled veneering composite resin. At first the opaque paste of selected shade is applied on the framework and then light cured for 10 minutes, followed by layering with deep dentin shade and subsequently with dentin body and incisal shades with periodic curing after each application (6).

Studies evaluating the mechanical properties of PEEK are limited in literature. Till date there only few studies regarding the fracture strength of PEEK. An in-vitro study on "Fracture strength of three-unit implant supported fixed partial denture with excessive crown height fabricated from different materials" where they compared Zirconia and PEEK material in posterior tooth region (7). There is no scientific information available regarding the fracture strength of anterior FPD framework made with Zirconia and PEEK.

This study aimed to comparatively evaluate the fracture strength of three-unit anterior CAD/CAM FPD framework made with Zirconia and PEEK cemented to metal die with resin cement. The Null hypothesis of the present in-vitro study is that there would be no significant difference in fracture strength of CAD/CAM anterior FPD framework made with Zirconia and PEEK.

Materials and methods

Fabrication of metallic die. A prepared three unit anterior FPD gypsum model was obtained (Figure 1a). The model was scanned using Trios 3 Shape, intraoral scanner and the STL file was exported to graft 3D Healthcare solution, for metallic die fabrication. To simulate the oral condition, the metallic die was digitally designed such that the teeth are in 30-degree angulation to that of the floor, so that the given load is subjected to cingulum (Figure 1b and c). If not the force given will be subjected to the incisal edges of crown. Metallic die was 3D printed with cobalt chromium base metal alloy. The outer surface of the metallic die was sandblasted with Al2O3 for better bonding and to avoid the adhesive failure.



Figure 1. 1a. Prepared tooth model. **1b and 1c.** Mettalic die.

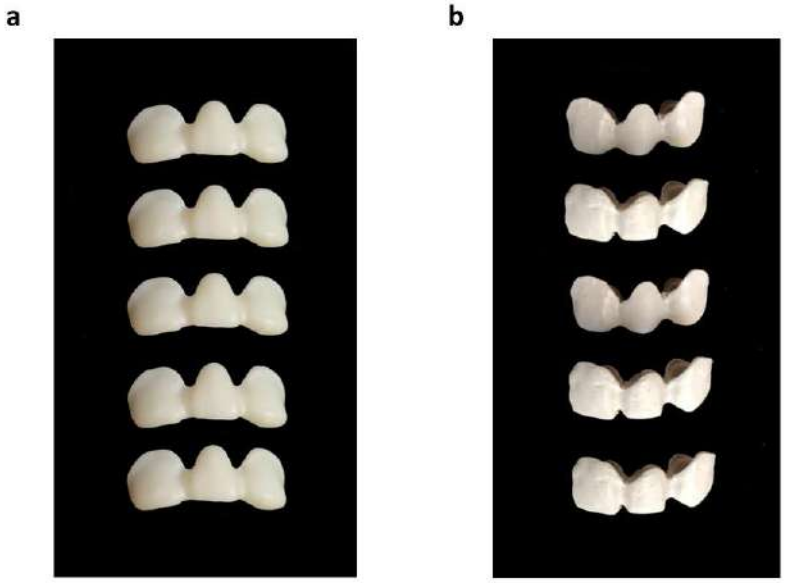


Figure 2. 2a. CAD/CAM three-unit zirconia framework. **2b** CAD/CAM three-unit peek framework.

Fabrication of cad/cam zirconia and peek framework. The metallic die was scanned using Intra oral scanner (3 Shape, TRIOS). Total of 5 CAD CAM 3-unit and Zirconia (Figure 2a) and PEEK (Figure 2b) framework was fabricated. The framework was digitally designed using Exocad Dental DB 2.2 Valletta software. The connector between the central incisor and lateral incisor had a height of 4.96 mm, width of 3.12, and an area of 11.09mm and the connector between the lateral incisor and canine had a height of 4.93mm, width of 3.18 mm and an area of 11.52 mm. The framework was cemented to the metallic die using dual cure resin cement. The metallic die along with the framework was subjected to load to evaluate the fracture strength.

Fracture strength evaluation. Universal testing machine (Servo Controlled, Model - F 100) was used for the fracture strength evaluation. All samples were subjected . compressive axial loading with a 5mm diameter spherical head mounted in a computer-controlled universal testing machine at a crosshead speed of 0.5 mm/min. The load was applied to the lingual fossa of the framework until catastrophic failure occurred (Figure 3). Catastrophic failure was defined as the exhibition of visible cracks, load drops, and acoustic events of chipping or fracture. This was repeated for all samples and the values were recorded and statistically analyzed (Figure 4a and b).

Results

The present in-vitro study was conducted to comparatively evaluate the fracture strength of three-unit CAD/CAM anterior FPD framework made with Zirconia and PEEK. All the samples in Group A (Zirconia) and Group B (PEEK) were subjected to compressive axial loading with a 5mm diameter spherical head mounted

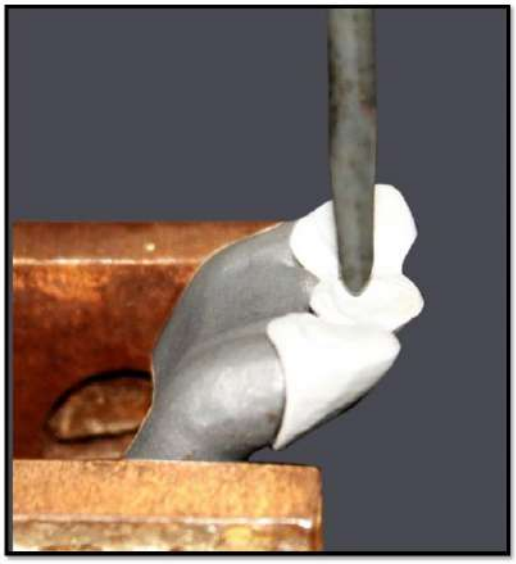


Figure 3. Fracture strength evaluation.

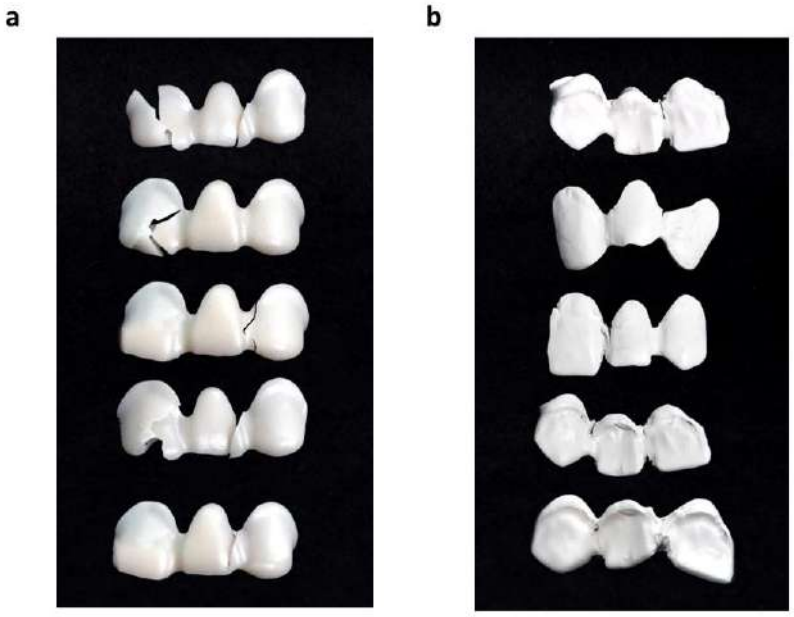


Figure 4. 4a. Fractured CAD/CAM three unit zirconia framework. **4b.** Fractured CAD/AM three unit peek framework**.**

in a computer-controlled universal testing machine at a crosshead speed of 0.5 mm/min and the force at which the material fracture were noted with the load displacement curve. The values were tabulated as following.(Table 1)

Inference. Statistical analysis was done with Non parametric Unpaired Student t-test to compare the mean value of fracture strength between the CAD/CAM Zirconia framework (Group A) & CAD/CAM PEEK framework (Group B). The values obtained for PEEK (Group B) was higher than the values obtained for Zirconia (Group A). It is statistically significant by 1%. (p value <0.01).

• The highest fracture strength value for Zirconia was 1890 N.

• The highest fracture strength value for PEEK was 2610 N.

• The mean fracture strength value for Zirconia was 1862 N +18.8149 N.

• The mean fracture strength value for PEEK was 2563 N +19.7231 N.

Discusion

Fixed Prosthodontics is a branch of Prosthodontics concerned with the replacement or restoration of teeth with artificial substitutes that are not removed from the mouth. A Fixed Partial Denture (FPD) is a restoration that is luted or otherwise securely retained to natural teeth/tooth roots/dental implant abutments that furnish the primary support for the prosthesis.

Rehabilitation of teeth with crowns has increased greatly over the last three decades. The final crown or FPD is fabricated from All-ceramic, Porcelain Fused Metal, or All-Metal. All restorations are liable to failure during function. Failure of the fixed partial denture could be biologic, aesthetic, mechanical or a combination. Restoration failures are often a multi-factorial phenomenon. A number of different factors may be responsible for the mechanical failure of

Table. 1. Fracture strength of zirconia and peek framework.

S.no	Zirconia (group a)	Peek (group b)
1	1890 N	2500 N
2	1790 N	2600 N
3	1880 N	2550 N
4	1890 N	2610 N
5	1860 N	2555 N

restorations (8,9) and factors may also vary depending on the type of fracture that has occurred.

Despite rapid advancements in the development of newer and stronger ceramic systems metal-ceramic restorations still remain the 'gold standard' in prosthodontics since their introduction in the 1960s. Metal-ceramics crowns are prone to mechanical fracture, especially fracture of veneering porcelain. Eliasson et al (10) reported a survival rate of 97% for metal-ceramic restorations after a period of ten years in clinical service. A systematic review by Goodacre et al (11) revealed that the fracture of veneering porcelain is the most common complication associated with metal-ceramic prostheses. Metal-ceramic crowns had advantages of strength and disadvantage of esthetics which was over comed with the evolution of materials and techniques. Evolution of all ceramic crowns was initially not well accepted due to failure rates. With technological and material advances in Zirconia core, all ceramic crowns were demonstrated comparable mechanical properties to that of metal ceramic crowns in 2012 (12) and 2009 (13).

Fracture strength of restorative materials is important to predict both the clinical service and failure rates. Fracture strength is defined as the ability of a material to resist failure and is designated specifically according to the mode of applied load, such as tensile, compressive, or bending. Fracture strength is also known as the breaking strength. It is the stress at which a specimen fails via fracture. The final recorded point is the fracture strength.

The aim of the present study was to comparatively evaluate the fracture strength of CAD/CAM framework made of Zirconia & PEEK of same thickness. The null hypothesis of the present study was that there would be no significant difference in fracture strength of CAD/CAM three unit FPD framework made of Zirconia (Group A) and PEEK (Group B).

To avoid operator-based errors, all the procedure mentioned in methodology was performed by single operator.

Kelly recommended few guidelines for a clinically relevant in vitro load to-failure test protocol for all-ceramic restorations which was followed in this study (14). This includes designing the prepared teeth and cementing the crowns with reliable and most commonly used luting cement. The teeth preparation was digitally designed according to clinical guidelines for all ceramic anterior teeth with 6°taper. If tooth preparation was done in a typodont model manually exact taper and accurate dimension reduction cannot be achieved. Following this, the metallic die and the Zirconia and PEEK framework was also digitally designed for standardization. The crowns were cemented using dual cure resin cement which is the most common luting cement used for the cementation of the all ceramic crowns.

The mean fracture strength of CAD/CAM Zirconia is 1862 N +18.8149 N and the

mean fracture strength of CAD/CAM PEEK is2563 N +19.7231 N. Fracture strength of

CAD/CAM PEEK framework was significantly higher than that of CAD/CAM Zirconia

framework. Hence the results support the rejection of the null hypothesis because significant differences were observed.

Maximum bite force is usually highest in the molar region. Unilateral measurement of maximum bite force in the molar region averages between 216 and 890 Newton in healthy adults with natural teeth. With the transducer placed on the anterior teeth the measured force is about 40% of the unilateral force recorded in the molar region (15), and with the transducer in the premolar region it is about 70%. Maximum occlusal forces up to 909 N (16-20) have been recorded in the molar region. Thus, the maximum mean forces for anterior teeth are around 500 N. It is necessary that the prostheses should bear at least twice this load. This is because the restorations placed in the oral cavity undergo a decrease in strength over time of approximately 50% of the initial value, so when they are placed in the mouth, must have an initial value of strength of about twice of the majority of forces that on average develop in the that areas. So the threshold of 1000 N is very important and has been widely verified that both Zirconia and PEEK FPD framework exceed this limit. Hence both Zirconia and PEEK can be used as a framework material in anterior Fixed Partial Denture.

In a study done by Zahran et al., (20) reult shows that the mean fracture loads of Zirconia crowns were 1459 N. In a study done by Manoharan et al., (21) the mean fracture load of Zirconia group was 2077 N. In a study by Wael Att et al., (22) the mean fracture strength of Zirconia ranged from 1522 N to 1702 N. An in vitro study by Dornhofer et al. (23) showed a mean fracture strength of 2527 N. A Study by Stiesch-Scholz et al (24) showed a mean fracture strength of 1265 N. Study by Tinschert et al (25) the mean fracture value of Zirconia was greater than 2000 N, and a study by Rountree et al (26) showed a mean fracture strength of 1816 N.

From the above mentioned in vitro studies, the mean fracture load of Y-TZP based all-ceramic FPDs is reported to be in the range of 1200 N to 2600 N. The fracture strength of Zirconia framework obtained in this study also ranges within these values.

Different values are obtained in different studies. The reason is that, in some studies procedures for artificial aging (thermal and mechanical cycles) were implemented while in other studies it was not. The artificial aging procedures are intended to simulate conditions which are to establish the patient's mouth that is continuous mechanical stresses and temperature changes of some significance that in time lead to a substantial decrease in the strength of the prostheses.

All Zirconia-ceramic framework fractured involving the whole thickness of the ceramic crown. This is the expected mode of fracture for all ceramic material (27). Unlike Zirconia, PEEK framework did not fracture completely instead formation of a visible crack at the connector region was noted which could be due to the high flexural strength of the material.

Regarding comparison between Zirconia and PEEK, there are two studies regarding the fracture strength of three-unit FPD made of PEEK. Both studies have investigated the fracture strength in posterior region. Vahideh Nazari et al in 2016 compared the fracture strength of bilayered Zirconia and PEEK framework veneered with composite. He concluded that at given load the fracture that occurred in zirconia involved both framework and veneering material where as in PEEK only the veneering material fractured and the framework remained intact which supports this study.

Other study by Bogna Stawarczyk et al in 2013 who investigated the fracture strength of PEEK three-unit FDPs before veneering and showed a mean fracture load of 1383N. However, the PEEK substructure that they used was PEEK whereas in the present study BioHpp PEEK was used which would have been the reason for increased fracture strength.

The fracture strength of PEEK three-unit FDPs on molars found in a manufacturer's material brochure (Scientific Documentation, Invibio), reports an in vitro fracture resistance of 2055 N, which is closer to the values obtained in this study.

However, the connector area, type of cement, thickness of the coping material will also influence the fracture strength of the framework. The strength of an all-ceramic restoration depends not only on the fracture resistance of the material, but also on a suitable preparation design with adequate material thickness. Frameworks for all-ceramic crown and bridges by CAD/CAM have been based upon empirical machine guidelines rather than clinical scientific data. Most of all CAD/CAM systems, the frameworks of the crowns are design to arbitrary thicknesses of 0.4 to 0.6 mm (28-33). Appropriate veneering porcelain thickness and support to minimize internal stress, reduce mechanical failures, and optimize esthetics of the veneering porcelain.

Connector is that part of fixed partial that unites the retainer and pontic. The connector is definitely the weak point of the entire restorations and its size should be adjusted in height and width in order to allow long-term survival of the restoration. In fact, in several studies it was shown that the failure of the restoration is almost always due to a fracture that begins at the gingival portion of the connector.

Study of Studart et al (34) based on the evaluation of some fatigue parameters of the prostheses, found that the size of the connector should be at least 5.7 mm2, 12.6 mm2 and 18.8mm2 for the bridges respectively of 3, 4 and 5 units. Filser et al (35) recommended a minimum connector size of be 6 to 9mm2 and according to Oh et al (36) the connector should be 6mm2 for three unit fixed partial denture. From all these studies it is clear that the connector should not be less than 6.25 mm2 or more. This is valid for 3-unit posterior bridges. The connector area designed in this study fall in the above mentioned values.

In summary, both Zirconia and PEEK can be used for replacing anterior tooth. And also based on the findings in the current study PEEK seem to be interesting alternative for use as core material for restoration of anterior tooth region. Clinical studies with long term follow-up are however, necessary to assess the clinical performance.

Limitation of this in-vitro study are as follows: Number of samples used in the study were limited, The study did not evaluate the type of fracture occurred in the framework and The study did not evaluate the type of failure occurred in the framework

In conclusion, the following conclusion were drawn based on the results obtained in the present in-vitro study, which was conducted to comparatively evaluate the fracture strength of 3 unit CAD/CAM framework made up of Zirconia and PEEK cemented using resin cement.

- The mean fracture strength of CAD/CAM Zirconia framework is1862N.
- The mean fracture strength of CAD/CAM PEEK framework is 2563N.
- PEEK is a reliable material to be used as framework for Fixed Partial Denture.

Conflict of interest

None to declare.

References

1. Agustín-Panadero R, Román-Rodríguez JL, Ferreiroa A, Solá-Ruíz MF, Fons-Font A. Zirconia in fixed prosthesis. A literature review. Journal of clinical and experimental dentistry. 2014; 6: e66. [PubMed] [Google Scholar]
2. Daou EE. The zirconia ceramic: strengths and weaknesses. The open dentistry journal. 2014; 8: 33. [PubMed] [Google Scholar]
3. Lægreid SJ, Nergård JM. Fracture resistance of monolithic zirconia crowns: The importance of the compressive strength of the dental cements used (Master's thesis, UiT Norges arktiske universitet). [Google Scholar]
4. Najeeb S, Zafar MS, Khurshid Z, Siddiqui F. Applications of polyetheretherketone (PEEK) in oral implantology and prosthodontics. J Prosthodont Res. 2016; 60: 12-9. [PubMed] [Google Scholar]
5. Sinha N, Gupta N, Reddy KM, Shastry YM. Versatility of PEEK as a fixed partial denture framework. J Indian Prosthodont Soc. 2017; 17: 80-3. [PubMed] [Google Scholar]
6. Vaishnavi K, Vidyashree Nandini V. Fabrication of peek crowns with improved esthetics–A.
7. Nazari V, Ghodsi S, Alikhasi M, Sahebi M, Shamshiri AR. Fracture Strength of Three-Unit Implant Supported Fixed Partial Dentures with Excessive Crown Height Fabricated from Different Materials. J Dent (Tehran). 2016; 13: 400-6. [PubMed] [Google Scholar]
8. Aslam A, Khan DA, Hassan SH, Ahmed B. Ceramic Fracture in Metal-Ceramic Restorations: The Aetiology. Dent Update. 2017; 44: 448-50, 453-4. [PubMed] [Google Scholar]
9. Ozcan M. Fracture reasons in ceramic-fused-to-metal restorations. J Oral Rehabil. 2003; 30: 265-9. [PubMed] [Google Scholar]
10. Eliasson A, Arnelund CF, Johansson A. A clinical evaluation of cobalt-chromium metal-ceramic fixed partial dentures and crowns: A three- to seven-year retrospective study. J Prosthet Dent. 2007; 98: 6-16. [PubMed] [Google Scholar]
11. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications in fixed prosthodontics. J Prosthet Dent. 2003; 90: 31-41. [PubMed] [Google Scholar]
12. Pelaez J, Cogolludo PG, Serrano B, Serrano JF, Suarez MJ. A four-year prospective clinical evaluation of zirconia and metal-ceramic posterior fixed dental prostheses. Int J Prosthodont. 2012; 25: 451-8. [PubMed] [Google Scholar]
13. Sailer I, Gottnerb J, Kanelb S, Hammerle CH. Randomized controlled clinical trial of zirconia-ceramic and metal-ceramic posterior fixed dental prostheses: a 3-year follow-up. Int J Prosthodont. 2009; 22: 553. [PubMed] [Google Scholar]
14. Kelly JR. Clinically relevant approach to failure testing of all-ceramic restorations. The Journal of prosthetic dentistry. 1999; 81: 652-61. [PubMed] [Google Scholar]
15. Bakke M. Bite force and occlusion. InSeminars in orthodontics 2006 Jun 1 (Vol. 12, No. 2, pp. 120-126). WB Saunders.
16. Mansour RM, Reynik RJ. In vivo occlusal forces and moments: I. Forces measured in terminal hinge position and associated moments. J Dent Res. 1975; 54: 114-20. [PubMed] [Google Scholar]
17. Hellsing E, Hagberg C. Changes in maximum bite force related to extension of the head. Eur J Orthod. 1990; 12: 148-53. [PubMed] [Google Scholar]
18. Helkimo E, Carlsson GE, Helkimo M. Bite force and state of dentition. Acta Odontol Scand. 1977; 35: 297-303. [PubMed] [Google Scholar]
19. Hagberg C, Agerberg G, Hagberg M. Regression analysis of electromyographic activity of masticatory muscles versus bite force. Scand J Dent Res. 1985; 93: 396-402. [PubMed] [Google Scholar]
20. Kikuchi M, Korioth TW, Hannam AG. The association among occlusal contacts, clenching effort, and bite force distribution in man. J Dent Res. 1997; 76: 1316-25. [PubMed] [Google Scholar]
21. Manoharan PS, Rajasimhan NV, Livingstone D, Arivarasan NK. Comparative analysis of fatigue resistance, fracture strength, and fracture patterns in ceramic crowns with zirconia and direct metal laser-sintered cores-An in vitro study. J Advan Clin Res Insights. 2018; 5: 92. [Google Scholar]
22. Att W, Stamouli K, Gerds T, Strub JR. Fracture resistance of different zirconium dioxide three-unit all-ceramic fixed partial dentures. Acta Odontol Scand. 2007; 65: 14-21. [PubMed] [Google Scholar]
23. Dornhofer R, Arnetzl GV, Koller M, Arnetzl G. Comparison of the static loading capacity of all-ceramic bridge frameworks in posterior teeth using three hard core materials. Int J Comput Dent. 2007; 10: 315-28. [PubMed] [Google Scholar]
24. Kohorst P, Herzog TJ, Borchers L, Stiesch-Scholz M. Load-bearing capacity of all-ceramic posterior four-unit fixed partial dentures with different zirconia frameworks. Eur J Oral Sci. 2007; 115: 161-6. [PubMed] [Google Scholar]
25. Tinschert J, Natt G, Mautsch W, Augthun M, Spiekermann H. Fracture resistance of lithium disilicate-, alumina-, and zirconia-based three-unit fixed partial dentures: a laboratory study. Int J Prosthodont. 2001; 14: 231-8. [PubMed] [Google Scholar]
26. Rountree P, Nothdurft F, Pospiech P. In-vitro investigations on the fracture strength of all-ceramic posterior bridge of ZrO2- ceramics. J. Dent. Res. 2001; 80:57. (abstract 173).
27. Kelly JR, Tesk JA, Sorensen JA. Failure of all-ceramic fixed partial dentures in vitro and in vivo: analysis and modeling. J Dent Res. 1995; 74: 1253-8. [PubMed] [Google Scholar]
28. Tripodakis AP, Gousias HC, Andritsakis PD, Tripodaki EA. Evaluation of alternative approaches in designing CAD/CAM frameworks for fixed partial dentures. Eur J Esthet Dent. 2013 Winter; 8: 546-56. [PubMed] [Google Scholar]
29. Porojan L, Topală F, Porojan S, Savencu C. Effect of frame design and veneering material on biomechanical behavior of

zirconia dental crowns veneered with overpressing ceramics. Dent Mater J. 2017; 36: 275-81. [PubMed] [Google Scholar]

30. Beuer F, Steff B, Naumann M, Sorensen JA. Load-bearing capacity of all-ceramic three-unit fixed partial dentures with different computer-aided design (CAD)/computer-aided manufacturing (CAM) fabricated framework materials. Eur J Oral Sci. 2008; 116: 381-6. [PubMed] [Google Scholar]
31. Ha SR, Kim SH, Lee JB, Han JS, Yeo IS. Effects of coping designs on fracture modes in zirconia crowns: Progressive load test. Ceramics International. 2016; 42: 7380-9. [Google Scholar]
32. Ha SR, Kim SH, Lee JB, Han JS, Yeo IS, Yoo SH. Effects of coping designs on stress distributions in zirconia crowns: Finite element analysis. Ceramics International. 2016; 42: 4932-40.[Google Scholar]
33. Urapepon S, Taenguthai P. The effect of zirconia framework design on the failure of all-ceramic crown under static loading. J Adv Prosthodont. 2015; 7: 146-50. [PubMed] [Google Scholar]
34. Studart AR, Filser F, Kocher P, Gauckler LJ. In vitro lifetime of dental ceramics under cyclic loading in water. Biomaterials. 2007; 28: 2695-705. [PubMed] [Google Scholar]
35. Filser F, Kocher P, Weibel F, Lüthy H, Schärer P, Gauckler LJ. Reliability and strength of all-ceramic dental restorations fabricated by direct ceramic machining (DCM). Int J Comput Dent. 2001; 4: 89-106. [PubMed] [Google Scholar]
36. Oh WS, Anusavice KJ. Effect of connector design on the fracture resistance of all-ceramic fixed partial dentures. J Prosthet Dent. 2002; 87: 536-42. [PubMed] [Google Scholar]

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Multi-dimensional assessment of tumor hypoxia, survival outcomes, and molecular stratification in breast cancer using computational skills

(Evaluación multidimensional de la hipoxia tumoral, los resultados de supervivencia y la estratificación molecular en el cáncer de mama mediante habilidades computacionales)

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Abstract(english)

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Tumor hypoxia plays a critical role in cancer progression and treatment resistance, and gene expression-based scoring systems such as Buffa, Ragnum, and Winter have been developed to quantify hypoxia levels. Under- standing the relationship between hypoxia, survival outcomes, and clinical stratifiers like molecular subtype and race is essential for advancing person- alized care in breast cancer. Hypoxia scores were analyzed across tumor stages using Buffa, Ragnum, and Winter models. Kaplan-Meier survival analysis evaluated the prognostic impact of high versus low Buffa scores on progression-free survival (PFS), disease-free survival (DFS), and disease-specific survival (DSS). Stratified analyses were conducted by molecular subtype, AJCC stage, and race. Pearson correlation measured concordance among hypoxia scores. Microsatellite instability (MSI) was assessed using MANTIS and MSI Sensor scores, and their association with genomic instability (Fraction Genome Altered) was explored. Buffa and Winter scores revealed higher hypoxia in inter- mediate stages (IIA, IIB), whereas Ragnum showed more uniform levels. Elevated Buffa scores were significantly associated with worse PFS, DFS, and DSS. Lumi- nal A subtype had better prognosis than Basal-like and Luminal B; advanced stages and Black or African American patients showed poorer outcomes. Strong correlations were found among hypoxia scores (r = 0.65–0.88). Most tumors were microsatellite stable, but a subset with high MSI Sensor scores also showed increased genomic alterations. Hypoxia levels vary by stage and scoring system and are strongly linked to survival outcomes. Molecular subtype, tumor stage, and race significantly affect prognosis, emphasizing the need for multidimensional stratification. Hypoxia scores are concordant and useful, and MSI may contribute to genomic instability in specific subgroups of breast cancer.

Keywords(english)

Hypoxia, Breast Cancer, Buffa Score, Survival Analysis, Molecular Subtypes, Tumor Stage, Race, MSI, Genomic Instability.

Resumen(español)

La hipoxia tumoral desempeña un papel fundamental en la progresión del cáncer y la resistencia al tratamiento, y se han desarrollado sistemas de puntuación basados en la expresión génica como Buffa, Ragnum y Winter para cuantificar los niveles de hipoxia. Comprender la relación entre la hipoxia, los resultados de supervivencia y los estratificadores clínicos como el subtipo molecular y la raza es esencial para avanzar en la atención personalizada en el cáncer de mama. Las puntuaciones de hipoxia se analizaron en todos los estadios tumorales utilizando los modelos Buffa, Ragnum y Winter. El análisis de supervivencia de Kaplan-Meier evaluó el impacto pronóstico de las puntuaciones Buffa altas frente a bajas en la supervivencia libre de progresión (SLP), la supervivencia libre de enfermedad (SSE) y la supervivencia específica de la enfermedad (SEE). Se realizaron análisis estratificados por subtipo molecular, estadio AJCC y raza. La correlación de Pearson midió la concordancia entre las puntuaciones de hipoxia. La inestabilidad de microsatélites (MSI) se evaluó utilizando las puntuaciones MANTIS y MSI Sensor, y se exploró su asociación con la inestabilidad genómica (fracción del genoma alterado). Las puntuaciones de Buffa y Winter revelaron mayor hipoxia en estadios intermedios (IIA, IIB), mientras que Ragnum mostró niveles más uniformes. Las puntuaciones elevadas de Buffa se asociaron significativamente con peores PFS, DFS y DSS. El subtipo luminal A tuvo mejor pronóstico que Basal-like y Luminal B; los pacientes en estadios avanzados y de raza negra o afroamericana mostraron peores resultados. Se encontraron fuertes correlaciones entre las puntuaciones de hipoxia (r = 0,65–0,88). La mayoría de los tumores eran microsatélites estables, pero un subconjunto con puntuaciones altas del sensor MSI también mostró mayores alteraciones genómicas. Los niveles de hipoxia varían según el estadio y el sistema de puntuación y están fuertemente vinculados a los resultados de supervivencia. El subtipo molecular, el estadio del tumor y la raza afectan significativamente el pronóstico, lo que enfatiza la necesidad de una estratificación multidimensional. Las puntuaciones de hipoxia son concordantes y útiles, y el MSI puede contribuir a la inestabilidad genómica en subgrupos específicos de cáncer de mama.

Palabras clave(español)

Hipoxia, cáncer de mama, índice de Buffa, análisis de supervivencia, subtipos moleculares, estadio tumoral, raza, MSI, inestabilidad genómica.

Introduction

Hypoxia is a hallmark of the tumor microenvironment [1] that arises due to an imbal- ance between oxygen supply and consumption [2]. In solid tumors, particularly breast cancer, hypoxia plays a pivotal role in driving tumor progression [3], angiogenesis [3, 4], immune evasion [5], and therapeutic resistance [6]. As a result, it has emerged as both a prognostic indicator and a potential therapeutic target. Quantifying hypoxia through gene expression-based scoring systems has enabled researchers to evaluate tumor oxygenation indirectly, offering insights into the biological aggressiveness of individual tumors [7]. While multiple hypoxia gene expression signatures (Buffa, Rag- num, Winter) have been developed to

quantify this critical microenvironmental feature [8], their prognostic utility and consistency across tumor stages remain poorly charac- terized. These signatures leverage different sets of oxygen-responsive genes to classify tumors based on their transcriptional hypoxic [9–11] states. Despite their widespread use, the degree to which these scoring systems concur, especially across tumor stages and clinical subgroups, remains underexplored. Furthermore, the prognostic relevance of these hypoxia metrics in relation to survival outcomes and how they correlate with known clinical variables such as molecular subtype and race have yet to be fully delin- eated in large breast cancer cohorts. Hypoxia is not only relevant in cancer, where it may further affect TP53 a key gene involved in many cancers [12, 13] but it also plays an important role in testosterone and insulin regulation [14–16], which is itself critical in other serious diseases such as diabetes and cardiovascular complications under hormonal fluctuations [17–21]. This study addresses these questions by evalu- ating hypoxia dynamics [22, 23] across tumor stages, assessing the prognostic utility of the Buffa hypoxia score, and examining survival stratification by clinical features such as tumor stage, race, and molecular subtype. The dynamics of hypoxia can be significantly influenced by the use of medicinal herbs [24–27] as earlier reported but not tested. We also assess the concordance among hypoxia scoring systems and inves- tigate their relationship with genomic instability, particularly microsatellite instability (MSI). Through this integrative approach, we aim to deepen the understanding of how hypoxia influences tumor behavior and outcomes in breast cancer.

Materials and methods

Data Collection and Preprocessing. We utilized clinical and genomic data from The Cancer Genome Atlas (TCGA) Pan- Cancer Atlas project, specifically focusing on patients diagnosed with breast invasive carcinoma (BRCA). The dataset was downloaded from the cBioPortal platform and comprised clinical records for 500 patients. Key clinical variables included patient age, race, tumor subtype, AJCC pathological tumor stage, and follow-up data for survival endpoints such as progression-free survival (PFS), disease-free survival (DFS), and disease-specific survival (DSS). Molecular features such as the BUFFA hypoxia score, mutation count, and aneuploidy score were also included for integrative analysis. After preprocessing and removal of incomplete records, the final cohort size varied slightly across survival types depending on data availability. To ensure consistency in time-to-event analysis, all survival time variables were expressed in months, and status indicators were binary-coded, with 1 representing an event (e.g., progression, recurrence, or disease-specific death) and 0 indicating censoring.

Survival Analysis Using Kaplan–Meier Estimation. We conducted Kaplan–Meier survival analysis to visualize and compare survival out- comes across different clinical and molecular subgroups. The KaplanMeierFitter class from the lifelines Python library was used for this purpose. Tumor Subtype: Patients were grouped by molecular subtype (e.g., Luminal A, Luminal B, HER2-enriched, Basal-like), and survival functions for PFS, DFS, and DSS were compared among these subtypes. AJCC Pathological Tumor Stage: Stratification was based on tumor stage (e.g., Stage I, II, III, IV), evaluating stage-specific survival trends. Race: We explored racial disparities in survival by analyzing groups such as White, Black or African Amer- ican, Asian, and others. BUFFA Hypoxia Score: The hypoxia score was dichotomized using the cohort median into High and Low categories to assess its impact on prog-nosis. Age Group: Patients were classified into three age brackets: < 50, 50–65, and > 65 years. This stratification was used to examine age-related survival differences. For each group comparison, Kaplan–Meier curves were plotted with survival proba- bilities on the y-axis and time in months on the x-axis. Confidence intervals were not displayed to improve visual clarity. The plots included group-specific legends and were standardized in size and formatting using matplotlib.

Cox Proportional Hazards Regression Analysis. To further investigate the effect of specific covariates on progression-free survival, we performed a Cox proportional hazards regression using the CoxPHFitter model from lifelines. The regression model included age, total mutation count, and aneu- ploidy score as explanatory variables. The analysis was performed on 224 patients with complete data, among whom 25 experienced a PFS event. None of the covari-ates demonstrated statistically significant associations with PFS (p-values > 0.05). The hazard ratios (HRs) for age and mutation count were near 1, suggesting negligi-ble influence on the hazard of progression. Aneuploidy score showed a weak negative association (coefficient = −0.01, HR = 0.99), but this effect was also not statistically significant (p = 0.85). Model performance was evaluated using standard metrics: the concordance index (C-index) was 0.47, indicating limited discriminative ability, while the partial AIC was 227.25.

The log-likelihood ratio test yielded a χ2 value of 0.85 with 3 degrees of freedom (p = 0.55), suggesting that the model did not significantly improve fit compared to a null model.

Statistical analysis. All analyses were conducted in Python 3.10, utilizing key libraries such as pandas for data manipulation, lifelines for survival modeling, and matplotlib for visualization. This computational environment ensured reproducibility and efficient handling of clinical and survival data from TCGA.

Results

The Fig. 1 presents a comparative analysis of hypoxia levels across tumor stages using three established hypoxia scoring systems [28–31]: Buffa, Ragnum, and Winter. Each boxplot illustrates the distribution of scores for tumor stages ranging from Stage I through Stage IV, including intermediate substages (e.g., IIA, IIIB) and a miscella- neous group labeled Stage X. This comparison provides insights into how hypoxia, a critical factor influencing tumor aggressiveness and treatment resistance, varies with tumor progression. The Buffa hypoxia score (Fig. 1A) shows considerable variabil- ity across tumor stages. Notably, intermediate stages such as IIA and IIB display elevated median scores with broader interquartile ranges, suggesting increased and heterogeneous hypoxia in these groups. In contrast, early stages like IA and IB tend to have more negative median values, indicating relatively lower hypoxia. Interestingly, Stage IIIC and Stage IV, despite being advanced, do not show a consistent increase in hypoxia scores, implying that hypoxia does not linearly correlate with tumor stage under the Buffa scoring system. The presence of

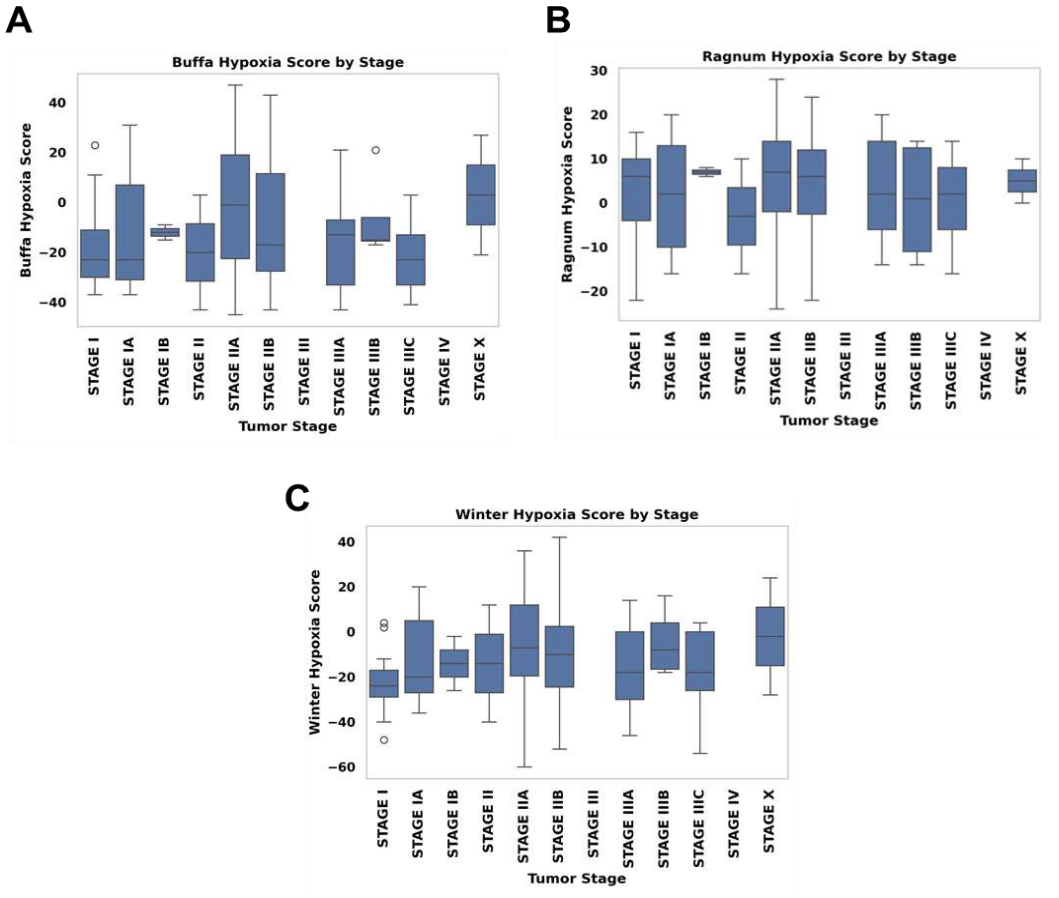


Figure 1 Hypoxia dynamics across tumor stages vary by scoring method. (A) Buffa score: Elevated hypoxia (↑ medians, broad IQRs) in intermediate stages (IIA-IIB) versus lower early stages (IA-IB); advanced stages (IIIC-IV) lack linear progression. Outliers reflect inter-patient heterogeneity- ity. **(B) Ragnum score:** Stable, moderate hypoxia (positive medians) across stages, with minimal variability in IB. **(C) Winter score:** Hypoxia ↑ in IIA-IIB and IV; early stages (I-IA) show lower scores with high variability.

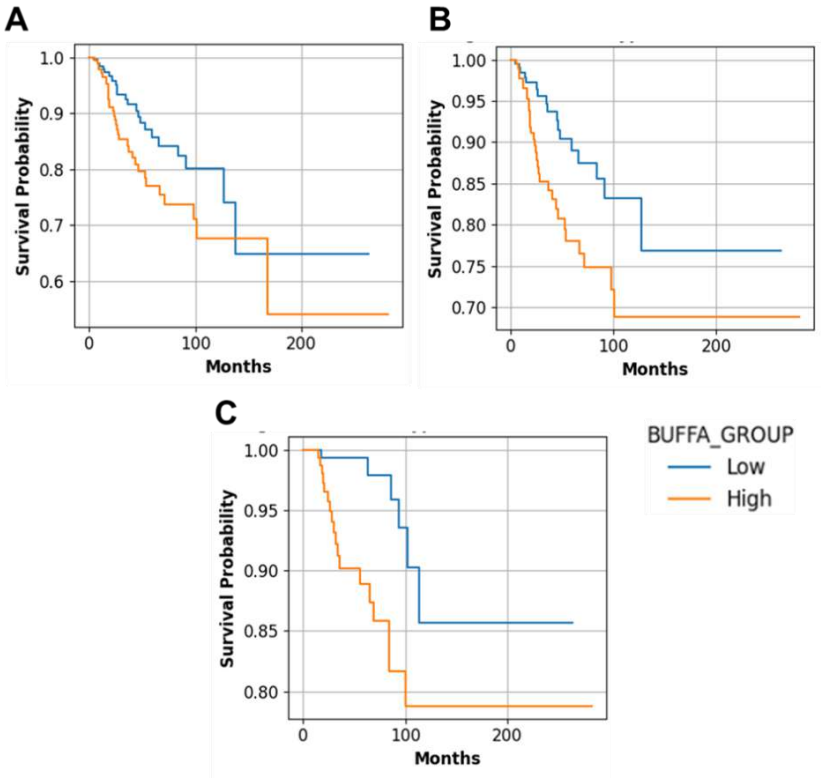


Figure. 2 Kaplan-Meier survival curves comparing High vs. Low BUFFA hypoxia score groups across three outcomes: (A) Progression-Free Survival (PFS), (B) Disease-Free Survival (DFS), and (C) Disease-Specific Survival (DSS). In each panel, survival probability is plotted against time in months. The high hypoxia group is associated with worse survival in all metrics, despite no group reaching a defined median survival.

outliers, particularly in early and intermediate stages, also reflects inter-patient heterogeneity in hypoxic response. The Ragnum hypoxia score (Fig. 1B) presents a more constrained distribution, with scores largely concentrated in the positive range across most stages. This indicates generally moderate levels of hypoxia throughout tumor progression. Stage IA and IIA stand out with slightly higher median scores, while Stage IB demonstrates minimal variability, potentially due to a smaller sample size or consistent tumor characteristics in that group. Unlike the Buffa score, the Ragnum score suggests a more stable hypoxic pro- file across stages, without marked elevation in advanced tumors. The Winter hypoxia score (Fig. 1C), which measures hypoxia on a wider scale, reveals significantly neg- ative scores in early stages such as I and IA, supporting the notion of lower oxygen deprivation in early tumor development. In contrast, intermediate stages IIA and IIB again exhibit a shift toward higher hypoxia, similar to the pattern observed in the Buffa score. Stage IV also shows increased median scores, suggesting heightened hypoxic stress in late-stage tumors. However, this pattern is accompanied by substantial variability and the presence of outliers, especially in early-stage tumors. Overall, the analysis indicates that tumor hypoxia tends to rise in intermediate to late stages of cancer progression, with notable variability depending on the scoring method. While Buffa and Winter scores highlight increased hypoxia in stages IIA and IIB, Ragnum scores suggest a more consistent, moderate hypoxic profile across all stages. These findings underscore the complexity of tumor hypoxia and the importance of considering multiple scoring approaches to capture its dynamic nature across tumor evolution[32? ? ?]

Prognostic Value of BUFFA Hypoxia Score in PFS, DFS, and DSS Survival Outcomes. The prognostic impact of the BUFFA hypoxia score (categorized as High vs. Low) was assessed across three survival metrics: progression-free survival (PFS) (Fig. 2A), disease-free survival (DFS) (Fig. 2B), and disease-specific survival (DSS) (Fig. 2C). In all three Kaplan-Meier analyses, patients in the ”High” hypoxia group demonstrated

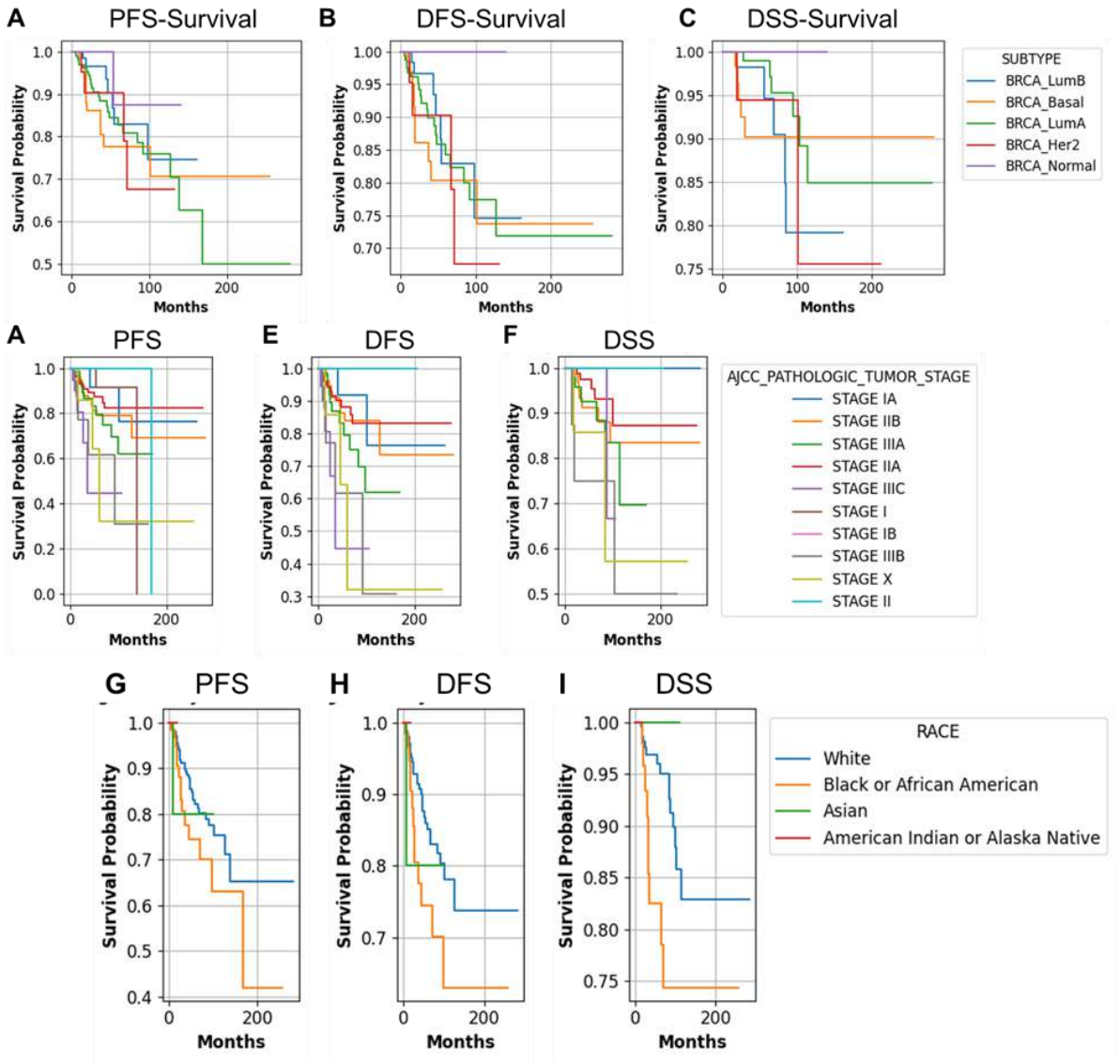


Figure. 3 Kaplan-Meier survival curves illustrating breast cancer patient outcomes across clinical stratifications. (A–C): PFS, DFS, and DSS by molecular subtype (LumA, LumB, Basal, Her2-enriched, Normal-like). (D–F): PFS, DFS, and DSS by AJCC pathologic tumor stage. (G–I): PFS, DFS, and DSS by race (White, Black or African American, Asian, American Indian or Alaska Native). All plots display survival probabilities over time in months. Most groups did not reach a median survival time ("inf"), reflecting censored observations and a favorable prognosis. Differences in event rates suggest prognostic stratification potential based on subtype, stage, and race.

reduced survival probability compared to those in the "Low" hypoxia group. For PFS, the high hypoxia group included 209 patients with 33 events, while the low group had 212 patients with 22 events. Both groups had an undefined median survival time, indicating a substantial proportion of censored data. In DFS, the high group had 31 events among 209 patients, while the low group had 17 events among 212 patients, again with no median survival reached. In the DSS comparison, the disparity was more pronounced with 18 events in the high group and only 6 in the low group, sug- gesting better disease-specific outcomes in patients with lower hypoxia scores. Overall, elevated BUFFA hypoxia scores appear to be associated with poorer outcomes across all survival endpoints, reinforcing the clinical utility of tumor hypoxia as a prognostic marker.

Prognostic Stratification of Breast Cancer Patients by Molecular Subtype, Tumor Stage, and Race Across Survival Outcomes. To explore factors

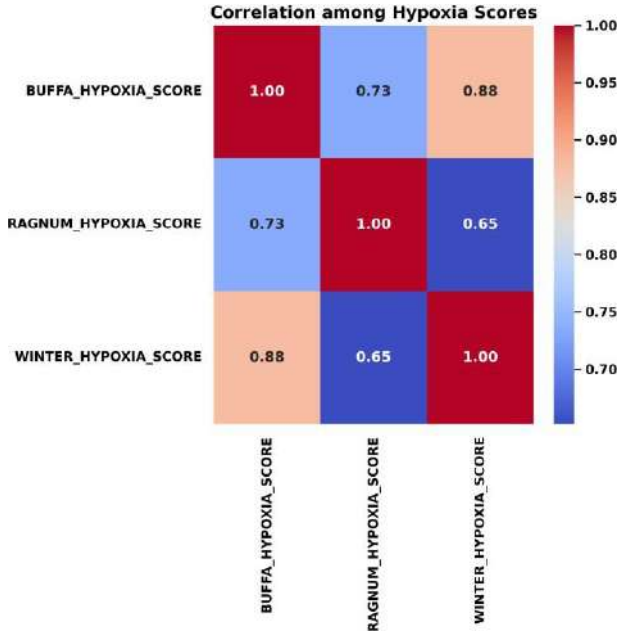


Figure. 4 Heatmap showing Pearson correlation coefficients among three hypoxia signature scores: BUFFA HYPOXIA SCORE, RAGNUM HYPOXIA SCORE, and WIN- TER HYPOXIA SCORE. All pairwise comparisons demonstrated strong positive correlations (rang- ing from 0.65 to 0.88), indicating overall consistency in hypoxia assessment across the three scoring systems

influencing breast cancer survival, we conducted Kaplan-Meier anal- yses evaluating three clinical outcomes, Progression-Free Survival (PFS), Disease-Free Survival (DFS), and Disease-Specific Survival (DSS), stratified by molecular sub- type, AJCC pathologic tumor stage, and race (Fig. 3A–3I). Subtype-specific survival analyses showed that the Luminal A (BRCA LumA) group had the largest patient population (n=180) with relatively few events (PFS: 24, DFS: 20, DSS: 6), followed by Luminal B (BRCA LumB, n = 80) and Basal-like (BRCA Basal, n = 75). All sub- types exhibited undefined median survival times across all three outcomes, indicating long-term survival and censored data. However, the Basal and Luminal B subtypes had noticeably higher event counts compared to Luminal A. HER2-enriched and Normal- like subtypes showed smaller cohorts with few events. When stratified by AJCC tumor stage, patients with earlier stages such as IA and IIA demonstrated improved survival with fewer events and undefined median survival times. In contrast, advanced stages like IIIC, IIIB, and X showed reduced survival durations—most notably Stage IIIC with a median PFS of 35.05 months and a higher event count (PFS: 5/20). This trend held across DFS and DSS metrics, reinforcing the prognostic value of clinical stag- ing. Race-based survival analysis revealed racial disparities. White patients (n=281) consistently showed favorable survival outcomes with lower event counts across all end- points. In contrast, Black or African American patients (n=64) experienced worse PFS outcomes with a median survival of 168.23 months and 14 events, suggesting potential disparities in disease progression. Asian and American Indian or Alaska Native groups had limited representation, with few events and undefined medians. These findings collectively emphasize the prognostic relevance of molecular subtype, tumor stage, and race in breast

Table. 1. Cox Proportional Hazards Model Results for Progression-Free Survival (PFS) with Age, Mutation Count, and Aneuploidy Score as Covariates.

Variable	Coef	HR (exp(coef))	SE (coef)	95% CI (HR)	z	p-value
Age	−0.00	1.00	0.02	0.96–1.03	−0.29	0.77
Mutation Count	−0.00	1.00	0.00	0.99–1.00	−0.67	0.50
Aneuploidy Score	−0.01	0.99	0.03	0.94–1.05	−0.19	0.85

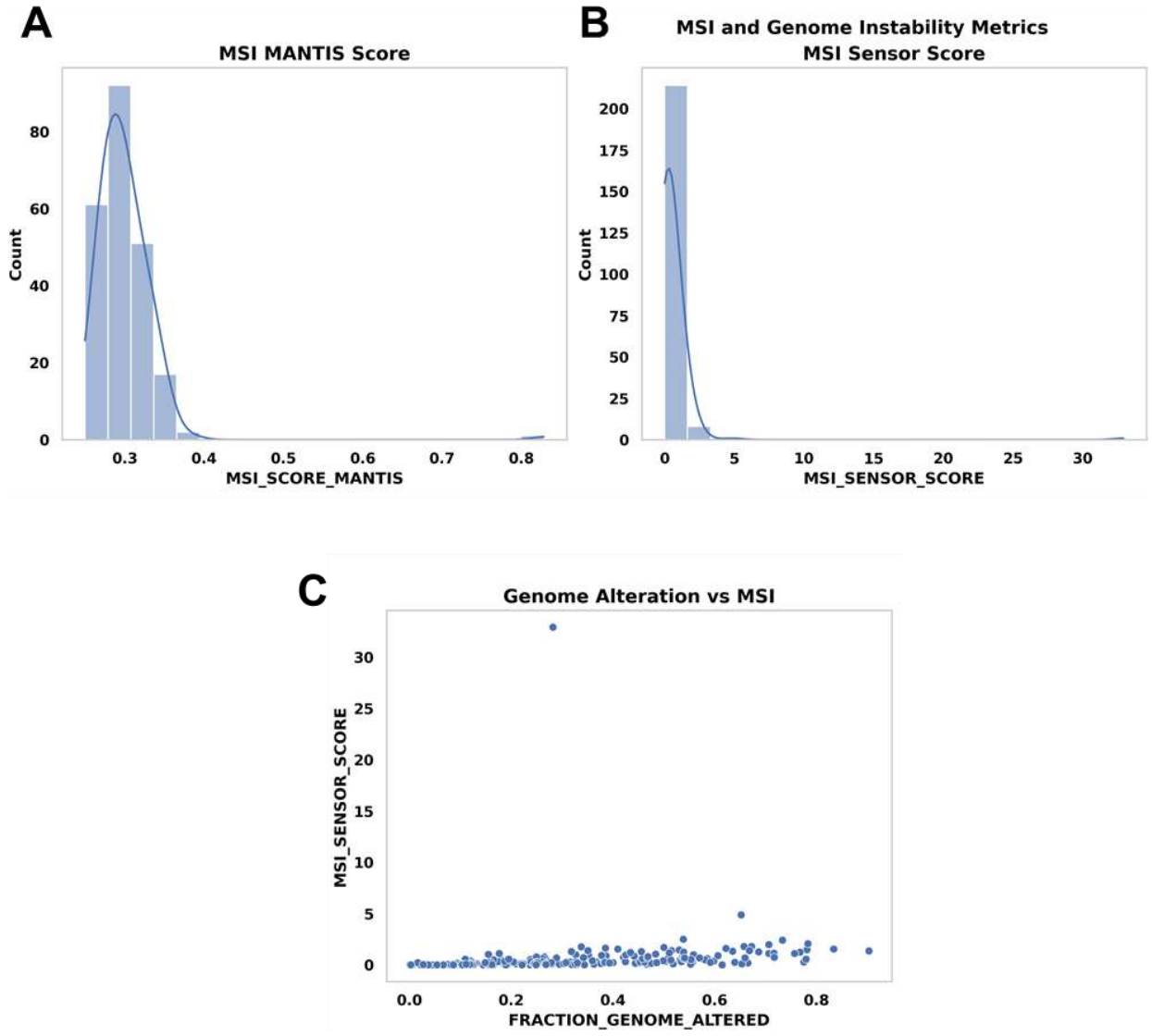


Figure. 5 Microsatellite Instability (MSI) Scores and Genome Alteration Correlation. (A) Histogram displaying the distribution of MSI MANTIS scores across samples. (B) Histogram showing the distribution of MSI Sensor scores, with a sharp peak at low values and a few high outliers. (C) Scatter plot depicting the relationship between genome instability (Fraction Genome Altered) and MSI Sensor score, highlighting a subset of samples with high instability and MSI.

cancer, supporting their use in personalized risk stratification.

Concordance Between Hypoxia Signature Scores in Breast Cancer Cohort. To evaluate the consistency among widely used hypoxia gene expression signa- tures, we computed Pearson correlation coefficients across three hypoxia scor- ing methods, Buffa, Ragnum, and Winter applied to the breast cancer cohort (Fig. 4 4). The analysis revealed strong positive correlations among all three scores, indicating that they capture overlapping yet distinct dimensions of tumor hypoxia. The BUFFA HYPOXIA SCORE showed a high correlation with the WIN- TER HYPOXIA SCORE (r = 0.88), suggesting a strong agreement in hypoxia classification between these two methods. The correlation between BUFFA and RAG- NUM scores was moderately strong (r = 0.73), while the RAGNUM and WINTER scores exhibited a slightly lower correlation (r = 0.65), though still substantial. These results imply that while all three hypoxia signatures are positively associated, the Buffa and Winter scores are more closely aligned in this dataset. This cross-signature concordance [36] supports the robustness of hypoxia profiling in breast cancer and suggests that integrating

or selecting among these scoring systems may depend on the specific biological or clinical context being investigated.

Microsatellite Instability (MSI) Scores and Genome Alteration Correlation. In Fig. 5, we evaluated microsatellite instability using two established scoring systems, MANTIS and MSI Sensor—and examined their relationship with genome alteration. Panel A shows the distribution of MSI MANTIS scores across the cohort. The majority of samples exhibit low MSI MANTIS scores, centered around 0.3, indicating a gener- ally microsatellite-stable (MSS) population. Panel B presents the distribution of MSI Sensor scores, which demonstrates a similar trend with most values concentrated near zero, although a few outliers show elevated scores, suggestive of microsatellite insta- bility (MSI-high) in select cases. Panel C explores the relationship between genomic instability and MSI, as measured by plotting the MSI Sensor Score against the Frac- tion Genome Altered. While most samples cluster at low MSI Sensor scores and low genome alteration fractions, a few samples exhibit both high MSI Sensor scores and increased genome alterations, indicating a potential link between MSI and broader genomic instability in those cases.

Cox Proportional Hazards Model for Progression-Free Survival. We performed a Cox proportional hazards [37–39] regression analysis to evaluate the association between clinical and genomic features and progression-free survival (PFS) using the lifelines.CoxPHFitter model [40]. The analysis included 224 observa- tions, of which 25 experienced a PFS event. The covariates analyzed were age, total mutation count, and aneuploidy score. None of the variables showed statistically sig- nificant associations with PFS ($p - values > 0.05$). Age and mutation count had near-zero coefficients with hazard ratios (exp(coef)) close to 1, suggesting negligible effects on risk. The aneuploidy score also demonstrated a weak negative association (coef = −0.01, HR = 0.99), though not statistically significant ($p = 0.85$). The over- all model fit, measured by partial AIC, was 227.25, and the concordance index was 0.47, indicating limited predictive power. The log-likelihood ratio test was not signif- icant ($\chi 2 = 0.85$, df = 3, $p = 0.55$), further supporting the lack of strong predictive variables in the model.

Discussion

Our analysis offers a detailed portrayal of hypoxia variation [30, 41, 42] across tumor stages and underscores the differential performance of hypoxia scoring methods in cap- turing these dynamics. The Buffa hypoxia score demonstrated the greatest variability among stages, with a clear elevation in intermediate stages (IIA and IIB), highlighting a potential window during tumor evolution where hypoxic stress intensifies. Interest- ingly, advanced stages such as IIIC and IV did not uniformly exhibit higher hypoxia levels, challenging the assumption that hypoxia linearly escalates with tumor stage. These findings suggest a complex interplay between tumor growth, angiogenesis, and local oxygen demand that may vary depending on tumor biology and microenviron- mental context. The Ragnum score [43, 44], in contrast, presented a more uniform hypoxia profile across all stages, with moderate and stable values. This scoring system may be less sensitive to subtle changes in hypoxia during progression or may reflect a gene set that is activated more broadly in solid tumors regardless of stage. Meanwhile, the Winter score partially mirrored Buffa's pattern, with higher scores in intermedi- ate and late stages, although again, variability and outlier presence especially in early

stages point to significant inter-tumoral heterogeneity [45–47]. Collectively, these com- parisons emphasize the need for multi-metric evaluation when interpreting hypoxia in breast tumors. The prognostic significance of hypoxia was particularly evident in the Buffa score analysis. Across all three survival outcomes—progression-free survival (PFS), disease-free survival (DFS), and disease-specific survival (DSS) patients in the high hypoxia group consistently exhibited worse outcomes. Although median sur- vival was not reached in most groups, the higher event counts and visibly separated Kaplan-Meier curves reinforce the role of hypoxia as an adverse prognostic indicator. These results align with the broader literature [6, 48–52], which identifies hypoxia as a contributor to treatment resistance and tumor aggressiveness. When examining clinical stratifications, molecular subtype emerged as a strong determinant of out- come. As expected, Luminal A patients had the best prognosis, with relatively few events and long survival, while Basal-like and Luminal B subtypes experienced poorer outcomes. These differences likely reflect intrinsic biological variations [53–55], such as proliferative capacity, immune response, and therapeutic responsiveness. Similarly, staging analysis reaffirmed the clinical utility of AJCC classifications, with advanced stages correlating with poorer survival. Notably, Stage IIIC consistently had shorter survival durations across all outcomes, underscoring the need for aggressive manage- ment in this group. Racial disparities also

became evident, particularly for Black or African American patients who experienced worse PFS despite similar clinical stag- ing, suggesting potential systemic differences in tumor biology, healthcare access, or comorbidity burden. This finding highlights the importance of incorporating demo- graphic and social determinants into prognostic models. The observed strong positive correlations between hypoxia scores further validate their utility, with Buffa and Win- ter showing the highest concordance. This suggests that despite their unique gene compositions, these signatures largely capture similar hypoxia-related biological pro- cesses. However, the modest discrepancy between Ragnum and the other two scores suggests that certain gene sets may respond differently to hypoxic stress or reflect distinct temporal windows of oxygen deprivation. Lastly, our evaluation of MSI using MANTIS and MSI Sensor revealed a predominantly microsatellite-stable cohort, with a few outliers indicating possible MSI-high tumors. A subset of samples showed con- current high MSI Sensor scores and elevated genome alterations, suggesting that, in some cases, MSI may contribute to broader genomic instability [56–59]. However, the rarity of these cases in breast cancer supports existing knowledge that MSI is less prevalent [61?] in this tumor type compared to colorectal or endometrial cancers.

In conclusion, this integrative analysis highlights the heterogeneity and prognostic significance of tumor hypoxia in breast cancer. While intermediate stages exhibit heightened hypoxia in some scoring systems, overall survival outcomes are consistently worse in hypoxic tumors. These findings underscore the value of combining multiple hypoxia metrics with clinical and molecular stratifiers to refine prognostic assessments and inform targeted interventions.

Conflict of interest

None to declare.

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None

References

1. Ruan K, Song G, Ouyang G. Role of hypoxia in the hallmarks of human cancer. J Cell Biochem. 2009; 107: 1053-62. [PubMed] [Google Scholar]
2. Sarkar M, Niranjan N, Banyal PK. Mechanisms of hypoxemia. Lung India. 2017; 34: 47-60. [PubMed] [Google Scholar]
3. Semenza GL. The hypoxic tumor microenvironment: A driving force for breast cancer progression. Biochim Biophys Acta. 2016; 1863: 382-91. [PubMed] [Google Scholar]
4. Boudreau N, Myers C. Breast cancer-induced angiogenesis: multiple mechanisms and the role of the microenvironment. Breast Cancer Res. 2003, 5, 1–7. [PubMed] [Google Scholar]
5. Wang M, Zhang C, Song Y, Wang Z, Wang Y, Luo F, Xu Y, Zhao Y, Wu Z, Xu Y. Mechanism of immune evasion in breast cancer. Onco Targets Ther. 2017 Mar 14; 10: 1561–73. [PubMed] [Google Scholar]
6. Jing X, Yang F, Shao C, Wei K, Xie M, Shen H, Shu Y. Role of hypoxia in cancer therapy by regulating the tumor microenvironment. Mol Cancer. 2019; 18: 157: 1–15. [PubMed] [Google Scholar]
7. Zeng J, Wang J, Gao W, Mohammadreza A, Kelbauskas L, Zhang W, Johnson RH, Meldrum DR. Quantitative single-cell gene expression measurements of multiple genes in response to hypoxia treatment. Anal Bioanal Chem. 2011; 401:3-13. [PubMed] [Google Scholar]
8. Badowska-Kozakiewicz AM, Budzik MP, Przybylski J. Hypoxia in breast cancer. Pol J Pathol. 2015; 66: 337-46. [PubMed] [Google Scholar]
9. Bracken, C., Whitelaw, M., Peet, D. The hypoxia-inducible factors: Key tran-scriptional regulators of hypoxic responses. Cellular and Molecular Life Sciences (CMLS) 2003, 60, 1376–93. [PubMed] [Google Scholar]
10. Dengler, V.L., Galbraith, M.D., Espinosa, J.M. Transcriptional regulation by hypoxia inducible factors. Critical Reviews in Biochemistry and Molecular Biology 2014, 49, 1–15. [PubMed] [Google Scholar]
11. Liu L, Simon MC. Regulation of transcription and translation by hypoxia. Cancer Biol Ther. 2004 Jun;3(6):492-7. [PubMed] [Google Scholar]
12. Khan SU, Ullah Z, Shaukat H, Unab S, Jannat S, Ali W, Ali A, Irfan M, Khan MF, Cervantes-Villagrana RD. TP53 and its Regulatory Genes as Prognosis of Cutaneous Melanoma. Cancer Inform 2023; 22: 11769351231177267. [PubMed] [Google Scholar]
13. Haensgen G, Krause U, Becker A, Stadler P, Lautenschlaeger C, Wohlrab W, Rath FW, Molls M, Dunst J. Tumor hypoxia, p53, and prognosis in cervical cancers. Int J Radiat Oncol Biol Phys. 2001; 50: 865-72. [PubMed] [Google Scholar]
14. Regazzetti C, Peraldi P, Grémeaux T, Najem-Lendom R, Ben-Sahra I, Cormont M, Bost F, Le Marchand-Brustel Y, Tanti JF, Giorgetti-Peraldi S. Hypoxia decreases insulin signaling pathways in adipocytes. Diabetes. 2009; 58:95-103. [PubMed] [Google Scholar]
15. Alyas J, Rafiq A, Amir H, Khan SU, Sultana T, Ali A, Hameed A, Ahmad I, Kazmi A, Sajid TJBR. Human insulin: History, recent advances, and expression systems for mass production. Biomed Res Ther. 2021, 8, 4540–4561. [Google Scholar]

16. Khan SU, Jannat S, Shaukat H, Unab S, Tanzeela, Akram M, Khan Khattak MN, Soto MV, Khan MF, Ali A, Rizvi SSR. Stress Induced Cortisol Release Depresses The Secretion of Testosterone in Patients With Type 2 Diabetes Mellitus. Clin Med Insights Endocrinol Diabetes. 2023; 16: 11795514221145841. [PubMed] [Google Scholar]
17. Khan SU, Akram M, Iqbal Z, Javid M, Unab S, Jannat S, Ali A, Khan MF, Ali W, Rafi MJRJoDN, Diseases M. 2022. Relationship between testosterone and cortisol levels and body mass index in men with type 2 diabetes mellitus. 29:341-348. [Google Scholar]
18. Ullah Khan S, Daniela Hernández-González K, Ali A, Shakeel Raza Rizvi S. Diabetes and the fabkin complex: A dual-edged sword. Biochem Pharmacol. 2024; 223: 116196. [PubMed] [Google Scholar]
19. Catrina, S.-B., Zheng, X. Hypoxia and hypoxia-inducible factors in diabetes and its complications. Diabetologia 2021, 64, 709–716. [PubMed] [Google Scholar]
20. Javid M, Khan SU, Akram M, Cervantes-Villagrana RD, Rafi M, Khan MF, Raza Rizvi SS. Higher cortisol level and reduced circulating triiodothyronine in patients with cardiovascular diseases: A case-control study. JRSM Cardiovasc Dis. 2025, 14, 20480040251340609. [PubMed] [Google Scholar]
21. Giussani, D.A. Breath of life: Heart disease link to developmental hypoxia. Circulation 2021, 144, 1429–43. [PubMed] [Google Scholar]
22. Rabalais, N., Diaz, R.J., Levin, L., Turner, R.E., Gilbert, D., Zhang, J. Dynamics and distribution of natural and human-caused hypoxia. Biogeosciences 2010, 7, 585–619. [Google Scholar]
23. Saxena, K., Jolly, M.K. Acute vs. chronic vs. cyclic hypoxia: Their differential dynamics, molecular mechanisms, and effects on tumor progression. Biomolecules 2019, 9, 339. [PubMed] [Google Scholar]
24. Ali A, Mashwani ZU, Ahmad I, Raja NI, Mohammad S, Khan SU. Plant in vitro cultures: A promising and emerging technology for the feasible production of antidiabetic metabolites in Caralluma tuberculata. Front Endocrinol (Lausanne). 2022, 13, 1029942. [PubMed] [Google Scholar]
25. Aravinth A, Dhanasundaram S, Perumal P, Kamaraj C, Khan SU, Ali A, Ragavendran C, Amutha V, Rajaram R, Santhanam P, Luna-Arias JP, Mashwani ZU. Evaluation of Brown and red seaweeds-extracts as a novel larvicidal agent against the deadly human diseases-vectors, Anopheles stephensi, Aedes aegypti and Culex quinquefasciatus. Exp Parasitol. 2024, 256, 108651. [PubMed] [Google Scholar]
26. Iftikhar F, Qureshi R, Siddiqa A, Anwar K, Arshad F, Mashwani Z-U-R, Riaz A, Khan SU, Ali A, Iqbal SJCJoFS. Harnessing nature's secrets: Silver nanoparticles from Withania coagulans fruit and root extracts unveil exceptional antioxidant and antimicrobial properties. Czech Journal of Food Sciences 2024,42, 192–206. [Google Scholar]
27. Murugesan S, Ragavendran C, Ali A, Arumugam V, Lakshmanan DK, Palanichamy P, Venkatesan M, Kamaraj C, Luna-Arias JP, Fabián F-LJIJoTM. Screening and druggability analysis of marine active metabolites against SARS-CoV-2: An integrative computational approach. International Journal of Translational Medicine 2022, 3, 27–41. [Google Scholar]
28. Thompson CM, Puterman AS, Linley LL, Hann FM, van der Elst CW, Molteno CD, Malan AF. The value of a scoring system for hypoxic ischaemic encephalopathy in predicting neurodevelopmental outcome. Acta Paediatr. 1997, 86, 757–761. [PubMed] [Google Scholar]
29. Arjun R, Acharya S, Shender BS, Rorres C, Hrebien L, Kam M. Correlation of Cognitive Scores and the Onset of Hypoxia. Aerosp Med Hum Perform. 2019, 90, 429–39. [PubMed] [Google Scholar]
30. Jubb, A.M., Buffa, F.M., Harris, A.L. Assessment of tumour hypoxia for prediction of response to therapy and cancer prognosis. Journal of Cellular and Molecular Medicine 2010, 14, 18–29. [PubMed] [Google Scholar]
31. Liu Z, Tang Q, Qi T, Othmane B, Yang Z, Chen J, Hu J, Zu X. A Robust Hypoxia Risk Score Predicts the Clinical Outcomes and Tumor Microenvironment Immune Characters in Bladder Cancer. Front Immunol. 2021, 12, 725223. [PubMed] [Google Scholar]
32. McGranahan, N., Swanton, C. Clonal heterogeneity and tumor evolution: Past, present, and the future. Cell 2017, 168, 613–28. [PubMed] [Google Scholar]
33. Amirouchene-Angelozzi, N., Swanton, C., Bardelli, A. Tumor evolution as a therapeutic target. Cancer Discovery 2017, 7, 805–17. [PubMed] [Google Scholar]
34. Galon, J., Bruni, D. Tumor immunology and tumor evolution: Intertwined histories. Immunity 2020, 52, 55–81. [PubMed] [Google Scholar]
35. Lorusso, G., Ru¨egg, C. The tumor microenvironment and its contribution to tumor evolution toward metastasis. Histochemistry and Cell Biology 2008, 130, 1091–103. [PubMed] [Google Scholar]
36. Graham NA, Minasyan A, Lomova A, Cass A, Balanis NG, Friedman M, Chan S, Zhao S, Delgado A, Go J, Beck L, Hurtz C, Ng C, Qiao R, Ten Hoeve J, Palaskas N, Wu H, Müschen M, Multani AS, Port E, Larson SM, Schultz N, Braas D, Christofk HR, Mellinghoff IK, Graeber TG. Recurrent patterns of DNA copy number alterations in tumors reflect metabolic selection pressures. Mol Syst Biol. 2017, 13, 914. [PubMed] [Google Scholar]
37. Broglio KR, Berry DA. Detecting an overall survival benefit that is derived from progression-free survival. J Natl Cancer Inst. 2009, 101, 1642–9. [PubMed] [Google Scholar]
38. Halabi, S., Vogelzang, N.J., Ou, S.-S., Owzar, K., Archer, L., Small, E.J. Progression-free survival as a predictor of overall survival in men with castrate-resistant prostate cancer. Journal of Clinical Oncology 2009, 27, 2766–71. [PubMed] [Google Scholar]
39. Fleischer, F., Gaschler-Markefski, B., Bluhmki, E. A statistical model for the dependence between progression-free survival and overall survival. Statistics in Medicine 2009, 28, 2669–86. [PubMed] [Google Scholar]
40. Araldi, E., Jutzeler, C.R., Ristow, M. Lithium treatment extends human lifespan: Findings from the UK Biobank. Aging (Albany NY) 2023, 15, 421. [PubMed] [Google Scholar]
41. Bader, S.B., Dewhirst, M.W., Hammond, E.M. Cyclic hypoxia: An update on its

characteristics, methods to measure it and biological implications in cancer. Cancers 2020, 13, 23. [PubMed] [Google Scholar]

42. Chi JT, Wang Z, Nuyten DS, Rodriguez EH, Schaner ME, Salim A, Wang Y, Kristensen GB, Helland A, Børresen-Dale AL, Giaccia A, Longaker MT, Hastie T, Yang GP, van de Vijver MJ, Brown PO. Gene expression programs in response to hypoxia: cell type specificity and prognostic significance in human cancers. PLoS Med. 2006, 3, e47. [PubMed] [Google Scholar]
43. Ragnum HB, Vlatkovic L, Lie AK, Axcrona K, Julin CH, Frikstad KM, Hole KH, Seierstad T, Lyng H. The tumour hypoxia marker pimonidazole reflects a transcriptional programme associated with aggressive prostate cancer. Br J Cancer. 2015, 112, 382–90. [PubMed] [Google Scholar]
44. Ragnum HB, Røe K, Holm R, Vlatkovic L, Nesland JM, Aarnes EK, Ree AH, Flatmark K, Seierstad T, Lilleby W, Lyng H. Hypoxia-independent downregulation of hypoxia-inducible factor 1 targets by androgen deprivation therapy in prostate cancer. Int J Radiat Oncol Biol Phys.2013, 87, 753–60. [PubMed] [Google Scholar]
45. Torrecilla S, Sia D, Harrington AN, Zhang Z, Cabellos L, Cornella H, Moeini A, Camprecios G, Leow WQ, Fiel MI, Hao K, Bassaganyas L, Mahajan M, Thung SN, Villanueva A, Florman S, Schwartz ME, Llovet JM. Trunk mutational events present minimal intra- and inter-tumoral heterogeneity in hepatocellular carcinoma. J Hepatol. 2017, 67, 1222–31. [PubMed] [Google Scholar]
46. Jeantet M, Tougeron D, Tachon G, Cortes U, Archambaut C, Fromont G, Karayan-Tapon L. High Intra- and Inter-Tumoral Heterogeneity of RAS Mutations in Colorectal Cancer. Int J Mol Sci. 2016, 17, 2015. [PubMed] [Google Scholar]
47. Chiu AM, Mitra M, Boymoushakian L, Coller HA. Integrative analysis of the inter-tumoral heterogeneity of triple-negative breast cancer. Sci Rep. 2018, 8, 11807. [PubMed] [Google Scholar]
48. Vaupel P. Hypoxia and aggressive tumor phenotype: implications for therapy and prognosis. Oncologist. 2008, 13, 21–6. [PubMed] [Google Scholar]
49. Muz, B., De La Puente, P., Azab, F., Kareem Azab, A. The role of hypoxia in cancer progression, angiogenesis, metastasis, and resistance to therapy. Hypoxia 2015, 83–92. [PubMed] [Google Scholar]
50. Karakashev SV, Reginato MJ. Progress toward overcoming hypoxia-induced resistance to solid tumor therapy. Cancer Manag Res. 2015, 253– 64. [PubMed] [Google Scholar]
51. Vaupel P. The role of hypoxia-induced factors in tumor progression. Oncologist. 2004, 9, 10–7. [PubMed] [Google Scholar]
52. Vasseur, S., Tomasini, R., Tournaire, R., Iovanna, J.L. Hypoxia induced tumor metabolic switch contributes to pancreatic cancer aggressiveness. Cancers 2010, 2, 2138–52. [PubMed] [Google Scholar]
53. Wu S, Zhu W, Thompson P, Hannun YA. Evaluating intrinsic and non-intrinsic cancer risk factors. Nat Commun. 2018, 9, 3490. [PubMed] [Google Scholar]
54. Sun XX, Yu Q. Intra-tumor heterogeneity of cancer cells and its implications for cancer treatment. Acta Pharmacol Sin. 2015, 36, 1219–27. [PubMed] [Google Scholar]
55. Yuan R, Zhu X, Wang G, Li S, Ao P. Cancer as robust intrinsic state shaped by evolution: a key issues review. Rep Prog Phys. 2017, 80, 042701. [PubMed] [Google Scholar]
56. Abbas T, Keaton MA, Dutta A. Genomic instability in cancer. Cold Spring Harb Perspect Biol. 2013, 5, a012914. [PubMed] [Google Scholar]
57. Charames GS, Bapat B. Genomic instability and cancer. Curr Mol Med. 2003, 3, 589–97. [PubMed] [Google Scholar]
58. Yao Y, Dai W. Genomic Instability and Cancer. J Carcinog Mutagen. 2014, 5, 1000165. [PubMed] [Google Scholar]
59. Shen, Z. Genomic Instability and Cancer: An Introduction. Oxford University Press: 2011; Vol. 3, pp. 1–3. [Google Scholar]
60. Halford SE, Sawyer EJ, Lambros MB, Gorman P, Macdonald ND, Talbot IC, Foulkes WD, Gillett CE, Barnes DM, Akslen LA, Lee K, Jacobs IJ, Hanby AM, Ganesan TS, Salvesen HB, Bodmer WF, Tomlinson IP, Roylance RR. MSI-low, a real phenomenon which varies in frequency among cancer types. J Pathol. 2003, 201, 389–94. [PubMed] [Google Scholar]
61. Ashktorab H, Ahuja S, Kannan L, Llor X, Ellis NA, Xicola RM, Laiyemo AO, Carethers JM, Brim H, Nouraie M. A meta-analysis of MSI frequency and race in colorectal cancer. Oncotarget. 2016, 7, 34546. [PubMed] [Google Scholar]

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Patients' perception of replacement of missing teeth – a cross sectional study

(Percepción de los pacientes sobre la reposición de dientes perdidos: un estudio transversal)

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Abstract(english)

There are multiple options for replacing missing teeth, many patients are unaware of the full range of available choices. The aims and objectives was to assess the patients needs and awareness of replacing missing teeth with prosthesis. This cross-sectional study was conducted at Karpaga Vinayaga Institute of Dental Sciences over a period of 6 months. The study targeted patients aged 20-60 years, residing in Tamil Nadu. The inclusion criteria were patients within the specified age range and residing in Tamil Nadu, while patients below 20 years and above 60 years were excluded. The sample size was determined using the Krejicie & Morgan (1970) formula, with a required sample size calculated using t-tests for means. The study employed a pre-validated structured questionnaire consisting of 15 closed-ended questions, including multiple-choice and yes/no questions. Data collection involved administering the questionnaire to gather information on perceptions of missing teeth. 33The collected data was compiled in an Excel sheet and analysed using SPSS software version 20, with descriptive statistics performed to summarize the findings. In conclusion, most of the patients understood that the long term costs of non replacing the missing teeth would be higher than the cost of replacement.

Keywords(english)

Teeth Replacement, Prosthodontics ,Patient Perception , Awareness, Education , Dental Health, Oral Health , Quality of Life.

Resumen(español)

Existen diversas opciones para reemplazar dientes perdidos, pero muchos pacientes desconocen la gama completa de alternativas disponibles. El objetivo de este estudio transversal fue evaluar las necesidades y el conocimiento de los pacientes sobre el reemplazo de dientes perdidos con prótesis. El estudio se llevó a cabo en el Instituto de Ciencias Dentales Karpaga Vinayaga durante un período de seis meses. Se incluyeron pacientes de entre 20 y 60 años residentes en Tamil Nadu. Los criterios de inclusión fueron pacientes dentro del rango de edad especificado y residentes en Tamil Nadu; se excluyeron los pacientes menores de 20 años y mayores de 60. El tamaño de la muestra se determinó mediante la fórmula de Krejicie y Morgan (1970), y el tamaño de muestra requerido se calculó mediante pruebas t para medias. Se utilizó un cuestionario estructurado previamente validado, compuesto por 15 preguntas

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cerradas, incluyendo preguntas de opción múltiple y de sí/no. La recolección de datos consistió en la aplicación del cuestionario para obtener información sobre la percepción de la ausencia de dientes. Los datos recopilados se organizaron en una hoja de cálculo de Excel y se analizaron con el software SPSS versión 20. Se realizó un análisis estadístico descriptivo para resumir los resultados. En conclusión, la mayoría de los pacientes comprendieron que los costos a largo plazo de no reemplazar las piezas dentales faltantes serían mayores que el costo de su reemplazo.

Palabras clave(español)

Reemplazo dental, Prótesis dental, Percepción del paciente, Concienciación, Educación, Salud dental, Salud bucal, Calidad de vida.

Introduction

Teeth is an important factor in our day to day life it helps us to grind food and our digestion starts from oral cavity by grinding of food. also teeth is very important in many ways as such it reflects ones personality, aesthetic , functional ability etc..(1). Loss of a teeth can be due to various reasons which includes dental caries , periodontal problems , trauma etc.. those affects the patients oral health and has negative impact on it, which causes to drifting or migration ,overeruption of opposing teeth and further loss of other teeth and may lead to temporomandibular diseases or problems (2,3). also loosing teeth is very traumatic and affects th day to day life and in extent it may lead to require psychological guidance (4), if the lost teeth is not replaced it may lead to deuteriation of oral health and also has negative influence in social activity and social life thus affects the quality of life(5). recent advances in dentistry correlates with emotional and psychology of patients in dental situations, especially aesthetics (6).

There are various treatment modalities for replacement of missing teeth which includes removable partial dentures, fixed partial dentures, dental implants etc...(7). Each treatment modalities has its own pros and cons (8). the final treatment is decided by various factors and is differs from patient to patient (9). To ensure the patients satisfaction , it is very important to assess the knowledge , awareness and attitude about the prostheses (10).

Materials and methods

This cross-sectional study, conducted at Karpaga Vinayaga Institute of Dental Sciences, aimed to investigate patients' perceptions of missing teeth. The study population consisted of 400 patients aged 20-60 years, residing in Tamil Nadu over a period of 6 months from February 2024 to august 2024. A pre-validated structured questionnaire with 15 closed-end questions was used to collect data. The sample size was estimated using the Krejicie & Morgan (1970) formula, with a total sample size of 373, rounded to 400. Data analysis was performed using SPSS software 20, with descriptive statistics. The study expected to provide insights into patients' perceptions of functional and aesthetic needs of missing teeth. The study was conducted over a period of 6 months, with approval from the Institutional Review Board , Institutional ethical committee (IEC) .The IEC approval no .

Results

The field of prosthodontics focuses on restoring missing teeth, a crucial aspect of maintaining oral health and overall well-being. The loss of teeth can have far-reaching consequences, including impaired nutrition and compromised dietary habits. Fortunately, various treatment options are available to address teeth loss, including removable partial dentures, fixed bridges, and dental implants. To assess public awareness of treatment options for missing teeth, we developed a questionnaire. This study builds upon existing research in the field, which has explored similar topics.

The survey revealed that 52.4% of patients reason for edentulism is due to missing teeth, while 22.1% of population due to periodontal problems and 18.6% due to dental caries (Fig 1a).

Most patients ie.91.1% of the study population are aware of the prosthodontics specialist and about 62.3% of population are aware of various treatment objectives for replacement of missing teeth. The majority (73%) of study population need prosthesis for both functional and aesthetic purposes (Figure 1b).

Patients cited fear (9.2%), cost (31.3%), and unawareness (37.2%) as these are the reasons for delaying treatment (Figure 2a).

Many patients believed that the consequences of not replacing the missing teeth are shifting of teeth

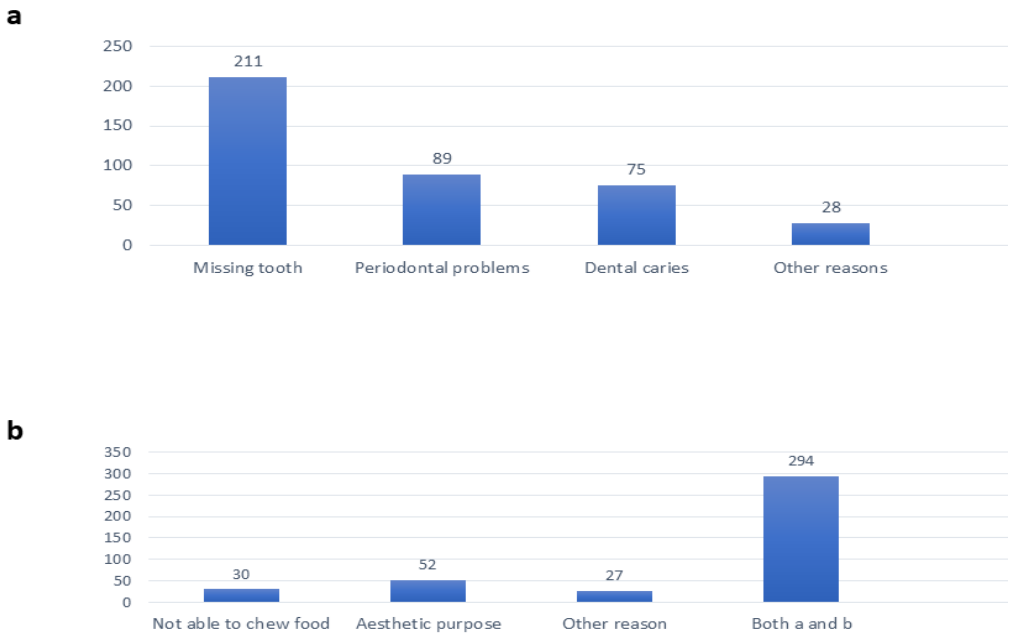


Figure 1. 1 a . Reason for Edentulism and 1b Primary Reason for you to need a prosthesis

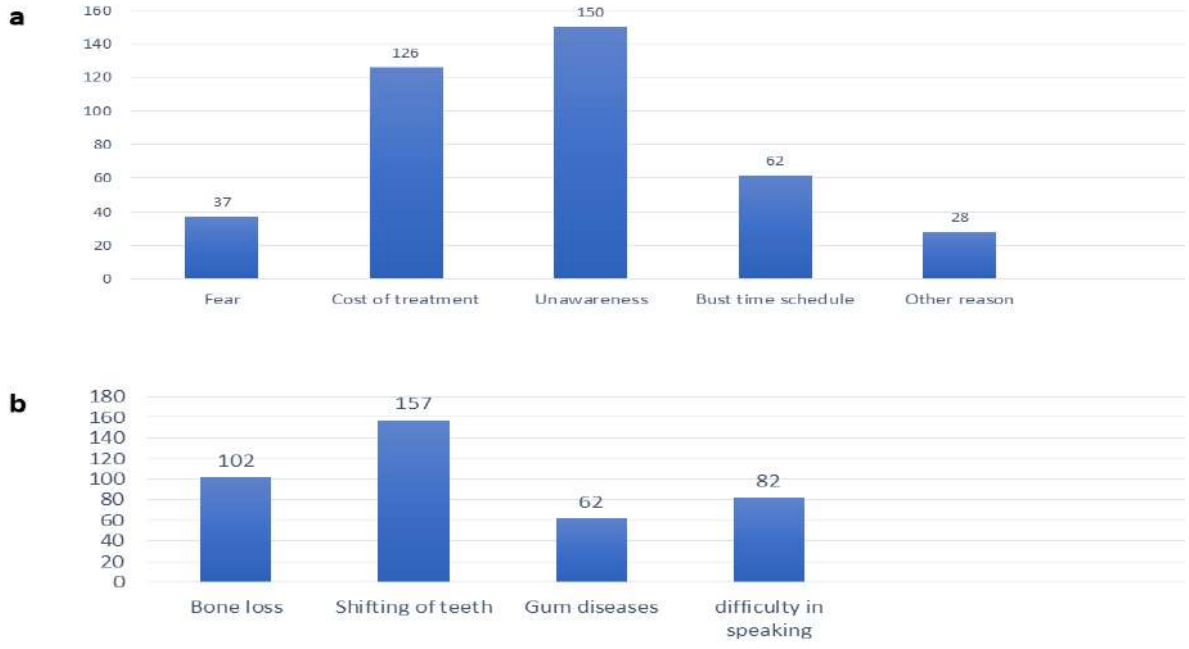


Figure 2. 2 a . Possible reason for the treatment getting delayed and 2b Consequences of not replacing missing teeth

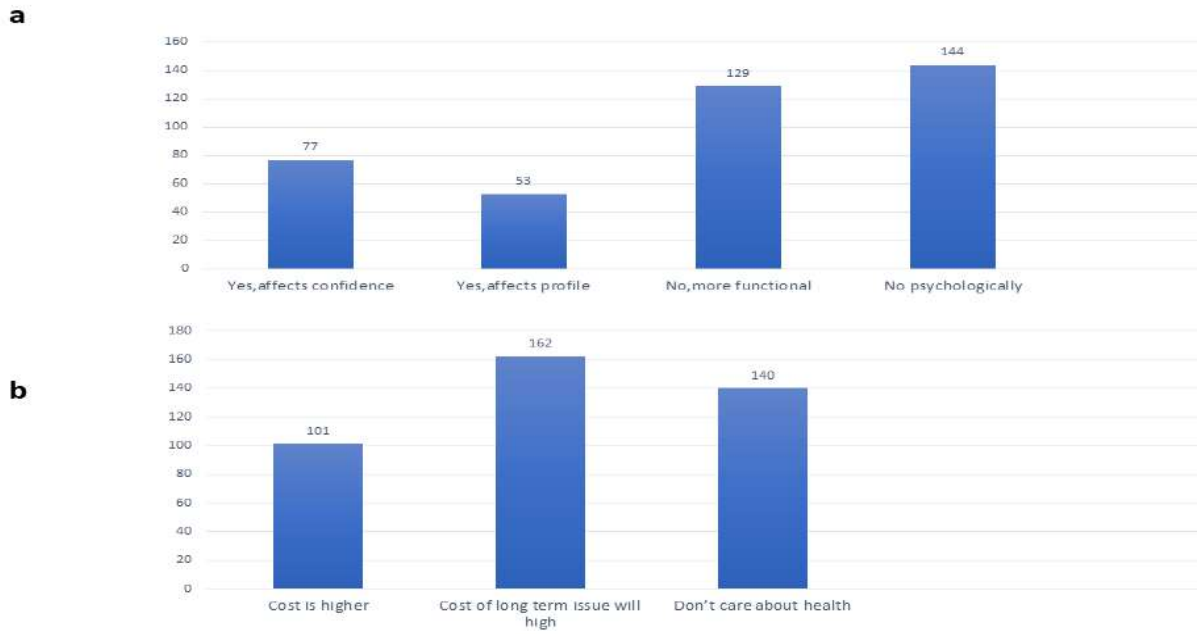


Figure 3. 3 a . Ever got psychologically affected for receiving a prosthesis, and 3b Cost of teeth replacement compares to the long term costs of not replacing teeth

(38.9%), bone loss (25.3%) , gum diseases (15.4%) and difficulty in speaking (20.4%) (Figure 2b) .

However 19 % of patients are psychologically affected by teeth loss, and 13.2% of patients reported to being embarrassed (Figure 3a).

Most patients received positive feedback from other patients who had undergone similar treatment , and also about facial aesthetics after visiting prosthodontist . whereas 67% of patients are aware of oral hygiene procedure , 58.8% believed that treatment options depend on the underlying or per treatment conditions .

Finally about 40.2% of patients of study population thought that long term costs of non replacing the missing teeth would be higher than the cost of replacement (Figure 3b).

Discussion

Reasons for teeth loss: The majority of patients (52.4%) lost teeth due to missing teeth, followed by periodontal problems (22.1%) and dental caries (18.6%). Awareness of prosthodontics: Most patients (91.1%) were aware of the prosthodontics specialty, indicating a high level of awareness among patients. Treatment options: A significant proportion of patients (62.3%) knew about various treatment options for edentulous areas, including RPD, FPD, CD, and implants. Psychological impact: A considerable number of patients (19.1%) reported feeling psychologically affected by teeth loss, highlighting the need for emotional support and counselling. The most common barriers to timely treatment were cost (31.3%), unawareness (37.2%), and fear (9.2%).

In conclusion, the study highlights the importance of awareness and education among patients regarding teeth replacement options. While most patients were aware of the prosthodontics specialty, there is still a need to educate patients about the consequences of not replacing missing teeth and the available treatment options. The study also emphasizes the need for emotional support and counseling for patients who have experienced teeth loss. Furthermore, the findings suggest that cost, unawareness, and fear are significant barriers to timely treatment, and efforts should be made to address these issues and improve access to care.

Conflict of interest

None to declare.

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References

1. Levinson NA. Psychologic facets of esthetic dental health care: a developmental perspective. J Prosthet Dent. 1990; 64: 486-91. [PubMed] [Google Scholar]
2. Rahman MS. Awareness and knowledge of various options for treatment of missing teeth in patients at a speciality dental hospital in Hyderabad, India. Asian Pac J Health Sci. 2016; 3: 89-93.
3. Kida IA, Astrøm AN, Strand GV, Masalu JR. Clinical and socio-behavioral correlates of tooth loss: a study of older adults in Tanzania. BMC Oral Health. 2006 Mar 15;6:5. [PubMed] [Google Scholar]
4. Petersen PE, Yamamoto T. Improving the oral health of older people: the approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol. 2005; 33: 81-92. [PubMed] [Google Scholar]
5. Lin HC, Corbet EF, Lo EC, Zhang HG. Tooth loss, occluding pairs, and prosthetic status of Chinese adults. J Dent Res. 2001; 80: 1491-5. [PubMed] [Google Scholar]
6. Burt BA, Ismail AI, Morrison EC, Beltran ED. Risk factors for tooth loss over a 28-year period. J Dent Res. 1990; 69: 1126-30. [PubMed] [Google Scholar]
7. Brown LJ. Trends in tooth loss among U.S. employed adults from 1971 to 1985. J Am Dent Assoc. 1994; 125: 533-40. [PubMed] [Google Scholar]
8. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. Bull World Health Organ. 2005; 83: 661-9. [PubMed] [Google Scholar]
9. "Patient satisfaction with dental implants: A systematic review". PLOS ONE. 2020; 15, e0243333. doi: 10.1371/journal.pone.0243333.
10. "Perception of dental aesthetics and satisfaction with dental implants". J Clin Diag Res. 2019; 13: ZC01-ZC04. doi: 10.7860/JCDR/2019/44343.13043.
11. "Patient-reported outcomes of dental implant treatment: A systematic review". J Dentis. 2019, 75, 12-22.
12. "Satisfaction with dental implants: A survey of patients' perceptions" J Prosthetic Dent. 2016; 118: 354-9. doi: 10.1016/j.prosdent.2016.12.004.
13. "Patients' perceptions of dental implant treatment: A qualitative study" Eur J Oral Scien. 2016, 124: 257-64. doi: 10.1111/eos.12273.
14. "Dental implant patients' satisfaction and quality of life: A systematic review". J Oral Rehab, 2015; 42: 761-74. doi: 10.1111/joor.12302.
15. "Patient satisfaction with fixed partial dentures and dental implants". J Oral Science, 2014; 56: 151-6. doi: 10.2334/josnusd.56.151.
16. "Perceptions of dental aesthetics and satisfaction with dental implants". J Prosthetic Dent. 2013; 109: 241-6. doi: 10.1016/S0022-3913(13)60042-8.
17. "Satisfaction with dental implant treatment: A survey of patients' perceptions" J Clin Diag Res. 2012; 6: 1531-4. doi: 10.7860/JCDR/2012/4454.2558.
18. "Patients' perceptions of dental implant treatment: A pilot study" Eur J Oral Sciences. 2011; 119: 259-264. doi: 10.1111/j.1600-0722.2011.00823.x.
19. "Dental implant patients' satisfaction and quality of life: A pilot study" (2010) J Oral Rehab. 2010; 37: 751-8. doi: 10.1111/j.1365-2842.2010.02095.x.
20. "Patient satisfaction with dental implants: A review of the literature" J Prosthetic Dent. 2009; 102: 247-54. doi: 10.1016/S0022-3913(09)60143-3.
21. "Patient satisfaction and quality of life after dental implant placement: A systematic review". J Clin Periodontol. 2020; 47: 257-67. doi: 10.1111/jcpe.13263.
22. "Perceptions of dental aesthetics and satisfaction with dental implant-supported restorations". J Prosthetic Dent. 2019; 122: 541-6. doi: 10.1016/j.prosdent.2019.02.006.
23. "The impact of dental implant treatment on patients' oral health-related quality of life: A systematic review". J Dent. 2018; 76: 53-62. doi: 10.1016/j.jdent.2018.05.012.

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Infectious nature of packed red blood cells from the perspective of pathology, medical laboratory technology and haematology - An original research

(Naturaleza infecciosa de los concentrados de hematíes desde la perspectiva de la patología, la tecnología de laboratorio clínico y la hematología: una investigación original)

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Abstract(english)

Transfusion of packed red blood cells remains a mainstay and integral part in patient management. The blood is a limited and precious resource and the attempts to come up with alternate to blood have not yielded any satisfactory results, the judicious and appropriate use of blood and its component become very important. This was a prospective study conducted in Blood bank, Department of pathology at Mahatma Gandhi Medical College and Research Institute carried out after approval of institutional ethics committee for a period of one year (May 2020- May2021). 600 patients were included in the study. All the requests form for packed red blood cells referred to blood bank more than 18 years of age from all the clinical departments included in the study. Overall, 1487 Packed red blood cell units were requested and cross-matched, 939 PRBC units were utilized by 600 patients during the study period. The maximum number of units 52.6% were utilized by female patients 53.6% and 47.3% requests from 46.3% males. We analyzed appropriate utilization of PRBC using quality indicators. In which overall, CT ratio is 1.5, TI is 1.3, TP is 84%, thereby indicating appropriate usage of packed red blood cell unit in our study. However, considering individual specialty department showed excess ordering and cross-matching of blood. NUP was observed to be 36.8%, resulting in excessive crossmatching of red cell units and non-utilization.

Keywords(english)

Pathology, laboratory, packed red blood cells, morbidity, transfusion

Resumen(español)

La transfusión de concentrados de hematíes sigue siendo un pilar fundamental en el tratamiento de los pacientes. La sangre es un recurso limitado y valioso, y los intentos por encontrar alternativas no han dado resultados satisfactorios, por lo que su uso racional

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y adecuado, así como el de sus componentes, adquiere gran importancia. Se realizó un estudio prospectivo en el Banco de Sangre del Departamento de Patología del Instituto de Investigación y Facultad de Medicina Mahatma Gandhi, tras la aprobación del comité de ética institucional, durante un año (mayo de 2020 - mayo de 2021). Se incluyeron 600 pacientes. Se analizaron todas las solicitudes de concentrados de hematíes remitidas al Banco de Sangre por pacientes mayores de 18 años de todos los departamentos clínicos participantes. En total, se solicitaron y realizaron pruebas de compatibilidad cruzada a 1487 unidades de concentrados de hematíes; 939 unidades fueron utilizadas por 600 pacientes durante el periodo de estudio. El 52,6% de las unidades fueron utilizadas por pacientes femeninas (53,6%) y el 47,3% por pacientes masculinos (46,3%). Analizamos la utilización adecuada de concentrados de hematíes mediante indicadores de calidad. En general, el índice CT fue de 1,5, el índice TI de 1,3 y el TP del 84%, lo que indica un uso adecuado de las unidades de concentrado de hematíes en nuestro estudio. Sin embargo, al analizar cada departamento de especialidad, se observó un exceso de solicitudes y pruebas de compatibilidad sanguínea. El NUP fue del 36,8%, lo que resultó en un exceso de pruebas de compatibilidad y subutilización de unidades de hematíes.

Palabras clave(español)

Patología, laboratorio, concentrado de hematíes, morbilidad, transfusión.

Introduction

Transfusion of packed red blood cells remains a mainstay and integral part in patient management. The blood is a limited and precious resource and the attempts to come up with alternate to blood have not yielded any satisfactory results, the judicious and appropriate use of blood and its component become very important (1). Audit of blood components usage of packed red blood cells are essential to assess the blood utilization pattern in any hospital or health setup. Owing to growth in demand for blood and blood products, as well as increased transfusion-related costs and morbidity it is essential to analyze the appropriateness of blood ordering practices. Due to declining donation rate and an increase in the consumption of blood components require a novel approach to access the blood utilization. Previous studies did not use quality indicators for utilization of PRBC. The practice of over-ordering of blood for elective and emergency surgical procedures often ends with wastage. Transfusion is considered appropriate when it is used to treat conditions leading to significant morbidity and mortality and which cannot be prevented or managed effectively by other means. Physicians most commonly use hemoglobin concentration level as a benchmark to decide when to transfuse. However, most guidelines emphasize that transfusion should be given for symptoms of anemia and should not be based on hemoglobin concentration alone. Therefore, inappropriate use of transfusion adds additional cost to the treatment of disease (2). An evaluation of transfusion patterns in a hospital setting can aid in identifying key areas where policy improvements are required and developing initiatives for clinician education

This study analyzes the pattern of utilization of packed red blood cells and determine the most common clinical indication for transfusion and assessing the appropriate utilization of PRBC by crossmatch transfusion ratio, transfusion index, transfusion probability and non-usage probability. The present study is intended to provide improved opportunities and to find strategies for such improvements in PRBC transfusion.

Materials and methods

Subjects and methods. This was a prospective study conducted in Blood bank, Department of pathology at Mahatma Gandhi Medical College and Research Institute carried out after approval of institutional ethics committee for a period of one year (May 2020- May2021). 600 patients were included in the study. All the requests form for packed red blood cells referred to blood bank more than 18 years of age from all the clinical departments included in the study.

Source of data was blood bank requisition forms and blood bank registers of patients who underwent packed red blood cell transfusion in the hospital, for which blood was ordered. All data regarding demographic details of the patient, number of units requested, specialty in which the patient was admitted, blood group of the patient, type of request (Routine or emergency) and hemoglobin levels was obtained. The number of units cross-matched and the subsequent number of units utilized for transfusion were noted. Appropriate Utilization of PRBC was assessed by calculating Crossmatch: transfusion ratio, Transfusion index, Transfusion probability and non-usage probability calculation and the values are entered. For our audit, all the collected data were evaluated as a whole and then divided into two

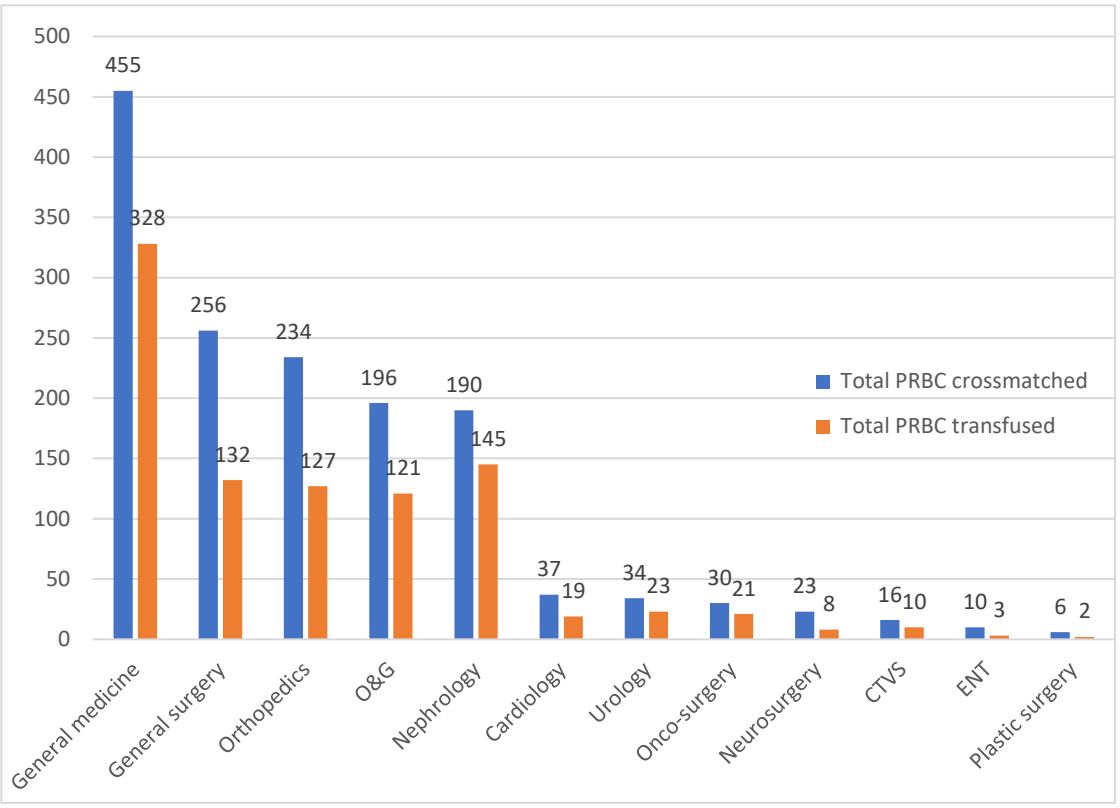


Figure. 1 Overall department wise distribution of PRBC utilization

categories as medical and surgical divisions. Medical division comprise of general medicine, cardiology, nephrology. Surgical division comprise of general surgery, orthopedics, O&G, CTVS, urology, onco-surgery, neuro-surgery, ENT, plastic surgery.

Statistical analysis. Was carried out using Microsoft Excel, the numerical variables were expressed in terms of percentage, frequency and ratios. The appropriate utilization of PRBC were assessed by using formula as follows: **1.** Crossmatch to transfusion ratio (C/T ratio) = number of units crossmatched/number of units transfused. A ratio of 2.0 and below is considered indicative of significant/efficient blood usage(3). **2.** Transfusion index (TI)= No of units transfused/ No of patient cross-matched. A value of 0.5 or more will be considered indicative of significant blood utilization(4). **3.** Transfusion probability % (TP)= No of patients transfused/ No of patients crossmatched x 100. A value of 30% and above will be considered indicative of significant blood usage (4). **4.** Non-usage probability % (NUP) = total number of units requested(cross-matched) but not used × 100/total number of units requested(cross-matched). The value >50% indicates significant wastage due to over cross-matching of blood units and not transfused (5)

Results

Overall, 1487 Packed red blood cell units were requested and cross-matched, 939 PRBC units were utilized by 600 patients during the study period. The maximum number of units 52.6% were utilized by female patients 53.6% and 47.3% requests from 46.3% males.

The Majority of the red cell units utilized, 52.4% were from the medical department and 47.6% were from the surgical department. In the medical division, the maximum utilization was from general medicine and nephrology accounted for 34.9%, 15.4% respectively. In the surgical division, the maximum utilization was from general surgery14.0% and orthopedics 13.5% as shown in figure 1.

The most common indication for transfusion were due to anemia 72% as followed by postoperative blood loss 19.1% as shown in figure 2.

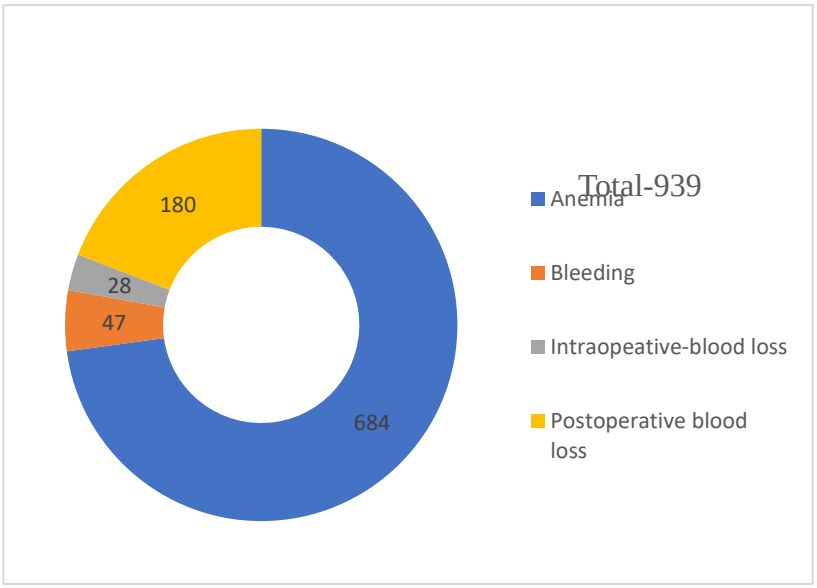


Figure. 2 Indication for transfusion

1487 red cell units cross matched 939 red cell units were transfused for 600 patient Overall CT ratio was 1.5 during the study period. The surgical division had a maximum CT ratio 1.8 and the minimum by medical division with a CT ratio of 1.3. In surgical division maximum CT ratio from ENT 3.3 followed by plastic surgery 3.0 and neuro-surgery 2.8. Blood was crossmatched for 712 patients and 600 patients utilized 939 red blood cell units. Overall TI was 1.3. The medical division has a TI 1.5 and a surgical division with a TI of 1.1. In surgical division, the least transfusion index was from ENT 0.4 and neuro-surgery 0.4. Overall transfusion probability was 84.2%. The medical division has a transfusion probability of 87.3% and the surgical division with 81.6%. In surgery division maximum highest transfusion probability was orthopedics 90.5% followed by O&G 89.6% and the least transfusion probability was plastic surgery (25%). NUP% maximum in surgical division 44% followed by medical division 27%. In surgical division the larger proportion of units cross-matched and unutilized in the department of ENT (70.1%) followed by plastic surgery (66.6%) shown in table 2.

A total of 1487 red cell units were subjected to cross-matching in our study. Out of 1487 red cell units, 939 (63.1%) red cell units were transfused. 548 (36.8%) units were unutilized. Among those, maximum number of the patients (83.0%) did not require transfusion followed by units returned with 2 hours to blood bank (8.5%) mainly due to adverse transfusion reaction as shown in table 2.

Discussion

It is important to study the pattern of utilization of packed red blood cells in the hospital. Such studies help to find out the trend of usage which helps in reducing the wastage of blood thereby decreasing the cost of treatment to the patients and aids in the improvement of transfusion practice for the future. One important tool for the improvement of blood transfusion practice is an audit of blood requisition forms and blood component utilization (6).

The maximum number of units 494 (52.6%) were utilized by female patients 322 (53.6%) and 445 (47.3%) requests from 278 (46.3%) males. 61.7% of red cell unit were given to the patients for hemoglobin level of 3-7g/dl. The rest 38.3% were to hemoglobin level more than 7g/dl. 72% of the red cell unit were utilized for anemia as an indication. Only 5% of red blood cells were utilized for bleeding in our study due to nutritional anemia and anemia of chronic disease which was low when compared to Gaur DS et al (7) showed anaemia 41.1% followed by 13% bleeding as the patient's requiring blood was due to trauma including fractures, head injuries. Intraoperative 2.9% and post-operative 19.1% which was low than that reported from

Table. 1. Overall CT, TI, TP, NUP in department wise .

S.no	Department	Crossmatch to transfusion ratio (CT)	Transfusion index (TI)	Transfusion probability (TP%)	Nonusage probability (NUP%)
1	General medicine	1.3	1.5	91.5%	27.9%
2	Cardiology	1.9	0.9	45.0%	48.6%
3	Nephrology	1.3	1.5	87.0%	23.6%
4	General surgery	1.9	1.2	88.7%	48.4%
5	Orthopedics	1.8	1.4	90.5%	45.7%
6	O&G	1.6	1.1	89.6%	38.2%
7	CTVS	1.6	0.7	78.5%	37.5%
8	Urology	1.4	1.1	65.0%	32.2%
9	Onco-surgery	1.4	0.8	86.6%	30.0%
10	Neuro-surgery	2.8	0.4	42.1%	65.2%
11	ENT	3.3	0.4	42.8%	70.0%
12	Plastic surgery	3.0	0.5	25.0%	66.6%
	Average	1.5	1.3	79%	36.8%

O&G – obstetrics and gynaecology, CTVS- cardiothoracic and vascular surgery, ENT- ear , nose, throat.

Chandrasekar, et al (8) showed intraoperative red cell utilization 19.3% and postoperative utilization 29.3% which is higher due to more elective and emergency surgeries.

The crossmatch to transfusion ratio is an important quality indicator that is used to provide the appropriate use of services offered by the transfusion laboratory service. C/T ratio of less than 2.0 is favorable, and value above 2.0 denotes over-ordering and cross-matching of blood. Overall CT ratio was 1.5 during the study period signifies appropriate utilization. Some studies showed a higher CT ratio compared to our study conducted by Obi, et al(9) with an overall CT ratio of 8.4 maximum CT ratio in ENT, Zewdie et al(10) 7.6. This is due to variable blood stores and varying transfusion regulations at different hospitals could explain the observed variations. Furthermore, blood transfusion indications differ based on the clinical status of patients and their treating doctors. But in our study showed maximum CT ratio from the surgical division was from Ent surgery 3.3 followed by plastic surgery 3, neurosurgery 2.8 signifies over-ordering of PRBC. This over ordering of blood might due to subjective over blood loss estimation of a procedure by surgeons. When deciding on a transfusion, it is necessary to review whether the patient needs a transfusion and how many units of blood should be transfused to the patient.

Transfusion index (TI) signifies the appropriateness of number of units crossmatched. A value of 0.5 or more is indicative of efficient blood usage. Overall TI was 1.3 during the study period signifies appropriate utilization similar results were reported by studies conducted by Mangwana S, et al (11) showed overall TI was 1.2, Kaur et al (12) 1.8, Banerjee, et al(13) 1. Plastic surgery TI was 0.5 which is lower due to less utilization of blood compared to study by SZ Ibrahim et al (14)showed TI 1.8 in plastic surgery. neuro-surgery TI 0.4 results were compared with study conducted by Obi, et al (9) TI 0.1 Overall, TI index in our study shows efficient blood usage even though few departments show low TI due to over requesting of blood, it should be minimized and Pattern of blood requesting should be revised with the help of maximum

Table. 2. Distribution of unutilized PRBC.

Department	Total PRBCs allotted (Cross matched)	Total PRBCs utilized (Transfused)	Units unutilized and reason for non-utilization				Total units not utilized
			Transfusion not required	Surgical procedure postponed	Patient expired	Issued but returned within 2 hours	
General medicine	455	328	111	0	6	10	127 (27.3%)
General surgery	256	132	104	7	2	11	124 (22.6%)
Orthopedics	234	127	94	4	1	8	107 (19.5%)
O&G	196	121	60	10	1	4	75 (13.6%)
Nephrology	190	145	40	0	1	4	45 (8.2%)
Cardiology	37	19	15	0	1	2	18 (3.2%)
CTVS	16	10	5	0	0	1	6 (1.0%)
Urology	34	23	9	1	0	1	11 (2.0%)
Once-surgery	30	21	3	4	1	1	9 (1.6%)
Neurosurgery	23	8	12	0	1	2	15 (2.7%)
ENT	10	3	5	1	0	1	7 (1.2%)
plastic surgery	6	2	2	0	0	2	4 (0.7%%)
Total	**1487**	**939**	**455**	**27**	**14**	**47**	**548**

surgical blood ordering schedules (MSBOS) for each procedure and clinical department.

The transfusion probability % which indicates efficient use of blood. Accordingly, a value of 30% and above has been suggested to be appropriate and signifies the appropriateness of number of units crossmatched. Overall transfusion probability was 84.2%. similar results were seen in studies conducted by Mangwana, et al (11)83.07%, Kaur et al(12) 79% indicates appropriate utilization. some studies showed low transfusion probability studies conducted by Obi, et al(9) T% 15.6, Zewdie et al(10) T% 24, AP Yazdi et al(15) 16.8% signifies inappropriate utilization that means there are over-ordering and a greater number of PRBCs is crossmatched for patients as compared to number of patient transfused without any absolute indication for transfusion.

Non-usage probability (NUP %) the value >50% indicates significant wastage due to over cross-matching of blood units and not transfused. In our study overall NUP was 36.8%, maximum in surgical department 44% followed by medical department 27%. The result correlated with study conducted by Banerjee et al(13) showed overall NUP 24%, maximum in surgery 37% signifies less wastage of red cell units. Study conducted by AU Musa et al(5)showed overall NUP 67%, maximum in obstetrics and gynecology signifies wastage of blood due to over-ordering of when compared to study. In our study most of the PRBC units unutilized as these patients 83.0% did not require transfusion, the results correlated with the study conducted by S Kumari et al(16) showed 93% did not require transfusion due to over ordering of blood by interns and junior consultant which were cancelled after reviewed by senior consultant this indirectly increased the workload on blood bank technician's as well as wastage of cross matching reagents with cost implication to both the patients as well as blood bank .

Limitation of the study:

The availability of data was restricted only to the blood bank forms. There is not much of literature specifically addressing the issue of supply, demand, and utilization. Hence comparisons are limited. Utilization of other blood component such as platelets, fresh frozen plasma, and cryoprecipitate was not included

In conclusion, we analyzed appropriate utilization of PRBC using quality indicators. In which overall, CT ratio is 1.5, TI is 1.3, TP is 84%, thereby indicating appropriate usage of packed red blood cell unit in our study. However, considering individual specialty department showed excess ordering and cross-matching of blood. NUP was observed to be 36.8%, resulting in excessive crossmatching of red cell units and non-utilization. These are recommendation to improve transfusion service by introduction of maximum surgical blood ordering schedule (MSBOS) of patients undergoing specific surgical procedures will help to improve the transfusion practice and appropriate usage of blood resources in the tertiary care hospital. Communication pathway between clinical and laboratory staff and at the clinical interface between surgeons and anesthetists will help in reducing excess ordering of blood. The hospital transfusion committee has established guidelines, continuously monitors and evaluates clinical practice is necessary for improvement of transfusion practices.

Conflict of interest

None to declare.

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References

1. Joshi AR, Ajmera RJ, Kulkarni AS, Bindu RS, Kulkarni SS. Observational study in utilization of blood and blood products at tertiary care centre. IJHSR. 2014;4: 38–47.
2. Carson JL, Grossman BJ, Kleinman S, Tinmouth AT, Marques MB, Fung MK, Holcomb JB, Illoh O, Kaplan LJ, Katz LM, Rao SV, Roback JD, Shander A, Tobian AA, Weinstein R, Swinton McLaughlin LG, Djulbegovic B; Clinical Transfusion Medicine Committee of the AABB. Red Blood Cell Transfusion: A Clinical Practice Guideline From the AABB*. Ann Intern Med. 2012; 157: 49–58. [PubMed] [Google Scholar]
3. Trisal M, Rana S, Khetrapal S, Jetley S, Mohroo RN, Jairajpuri Z. Blood Utilisation Practices and Quality Indicators at a Tertiary Care Hospital in South Delhi-A Retrospective Study. 2020. [Google Scholar]
4. Belayneh T, Messele G, Abdissa Z, Tegene B. Blood requisition and utilization practice in surgical patients at university of gondar hospital, northwest ethiopia. J Blood Transfus. 2013;2013:758910. [PubMed] [Google Scholar]
5. Musa AU, Ndakotsu MA, Hassan AA, Kilishi A, Kwaifa IK. Pattern of blood transfusion request and utilization at a Nigerian University Teaching Hospital. Sahel Med J. 2014; 17: 19. [Google Scholar]
6. Gombotz H, Rehak PH, Shander A, Hofmann A. Blood use in elective surgery: the Austrian benchmark study. Transfusion. 2007; 47: 1468-80. [PubMed] [Google Scholar]
7. Gaur DS, Negi G, Chauhan N, Kusum A, Khan S, Pathak VP. Utilization of blood and components in a tertiary care hospital. Indian J Hematol Blood Transfus. 2009; 25: 91-5. [PubMed] [Google Scholar]
8. Chandrasekar M, Balakrishnan V, Ponnaiyan A, Ramachandran T. Audit of clinical use of blood products in a tertiary care hospital. J Hematol Allied Sci. 2021; 1: 22–7. [Google Scholar]
9. Obi EI, Pughikumo OC, Korubo KI, Ejele AO. Prevalence of clinically significant antibodies in patients undergoing elective surgery in a Nigerian teaching hospital: A case for the type and screen method. Niger J Clin Pract. 2020; 23: 138-46. [PubMed] [Google Scholar]
10. Zewdie K, Genetu A, Mekonnen Y, Worku T, Sahlu A, Gulilalt D. Efficiency of blood utilization in elective surgical patients. BMC Health Serv Res. 2019; 19: 804.. [PubMed] [Google Scholar]
11. Mangwana S, Bedi N, Yadav P, Chugh R. Optimization of blood transfusion services: Analysis of blood requisition and utilization practices in cardiac surgical patients in a tertiary care hospital, India. Glob J Transfus Med. 2017; 2: 47. [Google Scholar]
12. Kaur D, Kandwal M. Blood utilization and quality indicators–Trend at a superspeciality hospital in Northern India. Hematol Transfus Int J. 2016; 2: 00037. [Google Scholar]
13. Banerjee S, Puttaiah P, Subramanian S. Revisit of efficiency of blood usage–Need for continuous audit. Glob J Transfus Med. 2019; 4: 52. [Google Scholar]
14. Ibrahim SZ, Mamdouh HM, Ramadan AM. Blood utilization for elective surgeries at main University Hospital in Alexandria, Egypt. J Am Sci. 2011; 7: 683-9. [Google Scholar]
15. Yazdi AP, Alipour M, Jahanbakhsh SS, Gharavifard M, Gilani MT. A Survey of Blood Request Versus Blood Utilization at a University Hospital in Iran. Arch Bone Jt Surg. 2016; 4: 75-9. [PubMed] [Google Scholar]
16. Kumari S. Blood transfusion practices in a tertiary care center in Northern India. J Lab Physicians. 2017; 9: 71-5. [PubMed] [Google Scholar]

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Effect of different chemical cleanser on surface roughness of silicone relining material – an in vitro study

(Efecto de diferentes limpiadores químicos sobre la rugosidad de la superficie del material de revestimiento de silicona: un estudio in vitro)

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Abstract(english)

The objective of the study was to evaluate surface roughness and to determine the effectiveness of denture cleansers in the disinfection of silicone-based soft relining materials. ilicone soft relining materials were immersed in three different types of cleansers. In the immersion test specimens were immersed in neutral peroxide, sodium hypochlorite, polident, and distilled water for 1440 hours of. Surface roughness of the specimens has been recorded using a White Light Interferometry system. The immersion test revealed significant differences in surface roughness of the silicone soft relining material when exposed to different solutions. Specifically, Polident showed significant differences in surface roughness compared to Neutral peroxide, Sodium hypochlorite, and Distilled water. This suggests that Polident had a distinct effect on the surface roughness of the silicone soft relining material, differing from the other tested solutions.

Keywords(english)

Denture cleanser, disinfection, Relining, Surface roughness.

Resumen(español)

El objetivo del estudio fue evaluar la rugosidad superficial y determinar la efectividad de los limpiadores para dentaduras postizas en la desinfección de materiales de rebase blandos a base de silicona. Los materiales de rebase blandos de silicona se sumergieron en tres tipos diferentes de limpiadores. En la prueba de inmersión, las muestras se sumergieron en peróxido neutro, hipoclorito de sodio, Polident y agua destilada durante 1440 horas. La rugosidad superficial de las muestras se registró utilizando un sistema de interferometría de luz blanca. La prueba de inmersión reveló diferencias significativas en la rugosidad superficial del material de rebase blando de silicona cuando se expuso a diferentes soluciones. Específicamente, Polident mostró diferencias significativas en la rugosidad superficial en comparación con el peróxido neutro, el hipoclorito de sodio y el agua destilada. Esto sugiere que Polident

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tuvo un efecto distintivo en la rugosidad superficial del material de rebase blando de silicona, que difiere de las otras soluciones probadas.

Palabras clave(español)

Limpiador de prótesis dentales, desinfección, rebase, rugosidad superficial.

Introduction

Residual ridge resorption is a common phenomenon in dentulous patients. The average rate of ridge resorption in denture wearers is about -0.01+ 0.22 or -0.01-0.22 in 12 months. As clinicians we face challenges in restoring patients with complete denture, and also during their follow up with ill-fitting denture.

Management of alveolar bone resorption is considered to be a challenge in prosthodontic treatment (1). Numerous methods, techniques and materials are used to reduce the residual ridge resorption. In consideration of age and inability to fabricate a new denture, the only option left is to reline the denture. Silicone soft relining material has been used since in denture ,the hardness of the silicone soft relining material is relatively stable owing to its stable siloxane polymer, and has long-lasting cushioning effects. Therefore, silicone is the first choice in soft relining materials compared to hard acrylic resin. Although they are the available option, they come with some challenges.

The longevity of a denture mainly lies in its maintenance. Denture wearers are suggested with use chemical and mechanical cleansing for disinfection of the prosthesis. The silicone soft relining material being shore A hardness, adhesion strength, water absorb-ability and solubility of the material. Mechanical cleaning physically removes the biofilm on the denture, but chemical cleaning is recommended because it yields better results by reducing the surface roughness and by reducing the amount of bacteria and fungi attached to the denture. In mechanical cleaning , popularly dental brushes were used. In chemical cleaning sodium hypochorite, neutral peroxide, polident were used. Chemical cleaning is recommended because it yield better result. Nowadays, dentists may instruct the patient to use chemical cleaning alone for cleaning silicone soft relining material to avoid the increase in surface roughness caused by mechanical cleaning.

The current study investigated the effects of chemical cleaning using sodium hypochlorite, neutral peroxide, polident on the surface roughness of silicone relining material and aimed to identify a cleaning method that least roughens the soft relining surface. The clinically acceptable limit for surface roughness is 0.2 µm (2). Rougher denture surfaces can promote, plaque buildup bacterial adhesion and colonization, making them harder to remove during cleaning. All this can eventually lead to frequent ulcerations landing into denture stomatitis.

Denture stomatitis is an inflammatory fungal infection that affects many denture wearers. It can be caused by a number of factors, including surface roughness, and can lead to symptoms like redness, irritation, swelling, and thrush. This can be reduced by decreasing the surface roughness. Thus, the rougher the surface, the higher the chance for mucosal inflammation turning to infections

This study focuses on identifying the chemical cleanser that causes the least surface roughness on the denture silicone relining material. The null hypothesis are that there is no difference in surface roughness among all three denture cleansers.

Materials and methods

Sample preparation. A rectangle-shaped sample with 2 mm thickness of heat-cured acrylic block was prepared (3). The 2mm block of silicone soft reline

Table 1. Samples.

Group	Cleanser solution
I	Distilled water (control)
II	Sodium hypochloride 0.5%
III	Polident
IV	Neutral peroxide 1%

Table. 2. Samples further analysis.

GROUPS	SAMPLE	Ra
POLIDENT	I	15.6
	II	22.2
	III	23.2
SODIUM HYPOCHLORITE	I	21.7
	II	20.2
	III	19.8
NEUTRAL	I	16.3
PEROXIDE	II	21.8
	III	22.4
DISTILLED WATER	I	18.5
	II	18.7
	III	19

(GC TOKYO CORPORATIO) here placed above the block and allowed to set for 30 minutes. A total of 12 samples were prepared. the surface roughness and by reducing the amount of bacteria and fungi attracted to the denture (5).

Immersion test. Samples were divided into 4 groups, each group has 3 samples (table 1). The specimens were immersed for 1440 hours of duration of, being 6 months of usage, and the solution was replaced every 8 hours (5). Post surface roughness analysis: The samples were further sent for post elevation for surface roughness, and the results were recorded (Table 2 and figure 1).

Statistical Analysis. SPSS SOFWARE was used to analyse the data. Samples were analysed and graphs were used to display mailed data (figure 2).

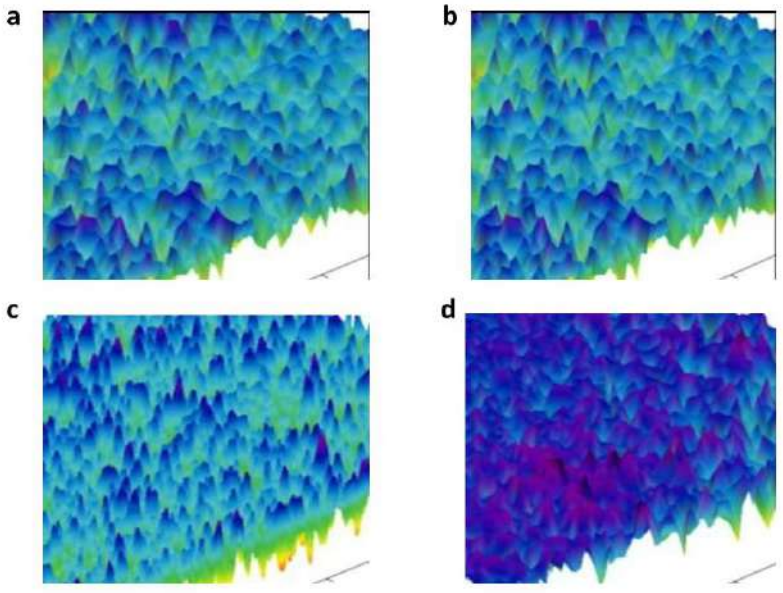


Figure 1. 1a. Distilled water **1b.** Polident**. 1c** Neutral peroxide**,** and **1d.** Sodium hyphochlorite.

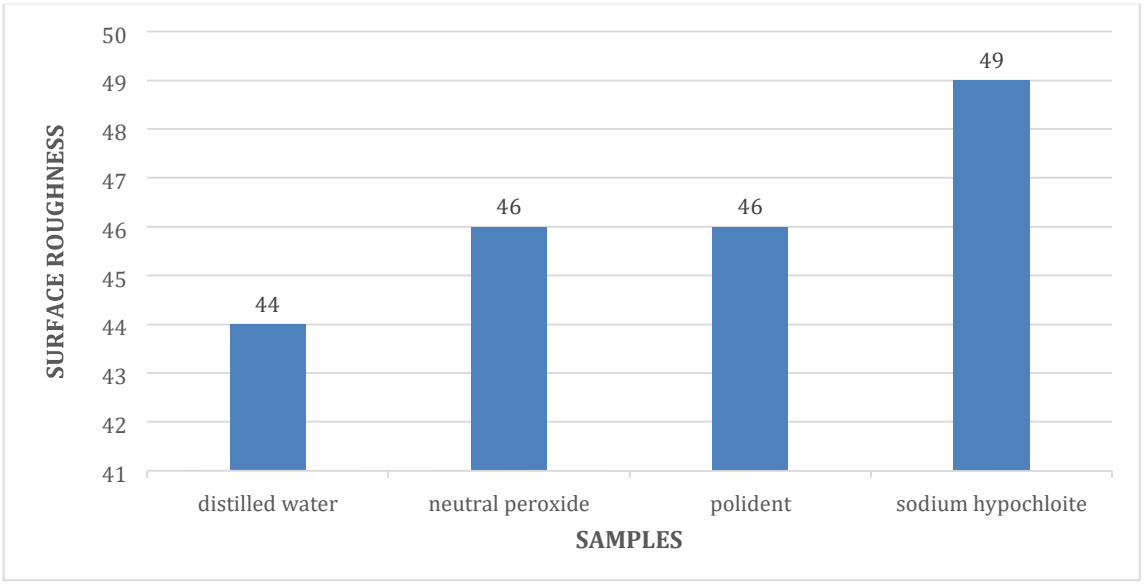


Figure 2. Surface roughness.

Results and discussion

Based on the immersion test and data analysis there is a rejection in null hypothesis. distilled water shows less surface roughness' 44Ra, neutral peroxide 46Ra sodium hypochlorite, and the polydent because it doesn't have adequate antifungal and antibacterial property which indicates less removal of plaques, calculus, and bacteria etc. Hence result shows decreased surface roughness.

The surface roughness of Hypochlorite was considered to increase by the cross-linked structure of the silicone soft relining material owing to the oxidizing action of the denture cleanser (6). Peroxide-based neutral peroxide denture cleansers have lower oxidizing properties than hypochlorite. The neutral peroxide cleansers used in the current study contain peroxide, which has a bleaching effect. They also contain other acidic ingredients, such as citric acid, to nullify the effect. This inhibitory effect depends on the oxidizing properties of peroxide. These results indicate that neutral peroxide denture cleansers have less influence on the surface properties of the silicone soft relining material than hypochlorite denture cleansers (7). The hypochlorite used had a pH of 12.5, whereas the neutral peroxide denture cleanser had a pH of 7.4. whereas, pH affects the ion content of the fluid, at pH < 7, the amount of hydrogen increases, and at pH > 7, the amount of hydroxide ions increases. A greater amount of hydroxide ions increases the denaturation properties of the fluid. Hence, neutral peroxide denture cleansers with a pH close to 7 do not roughen the silicone soft relining material. Incorporating Polident into your daily denture cleaning routine can effectively preserve surface smoothness, thereby reducing the likelihood of bacterial accumulation and plaque buildup. (8) Sodium hypochlorite is recommended for occasional deep cleaning and disinfection, but exercise caution and follow up with a thorough rinse to counteract its potential impact on surface texture (2)

In conclusion, the immersion test demonstrated that Polydent chemical cleanser effectively reduces surface roughness of silicone soft reline material, making it a suitable option for maintaining its surface quality.

Conflict of interest

None to declare.

References

1. El-Hadary A, Drummond JL. Comparative study of water sorption, solubil- ity, and tensile bond strength of two soft lining materials. J Prosthet Dent 2000; 83: 356–61. [PubMed] [Google Scholar]
2. Ueda T, Kubo K, Saito T, Obata T, Wada T, Yanagisawa K, Sakurai K. Surface morphology of silicone soft relining material after mechanical and chemical cleaning. J Prosthodont Res. 2018; 62: 422-5. [PubMed] [Google Scholar]
3. Pahuja RK, Garg S, Bansal S, Dang RH. Effect of denture cleansers on surface hardness of resilient denture liners at various time intervals-an in vitro study. J Adv Prosthodont 2013; 5: 270–7. [PubMed] [Google Scholar]
4. Murata H, Taguchi N, Hamada T, Kawamura M, McCabe JF. Dynamic viscoelas- ticity of soft liners and masticatory function. J Dent Res 2002; 81: 123–8. [PubMed] [Google Scholar]
5. Chan EC, Iugovaz I, Siboo R, Bilyk M, Barolet R, Amsel R, Wooley C, Klitorinos A. Comparison of two popular methods for removal and killing of bacteria from dentures. J Can Dent Assoc. 1991; 57: 937-9. [PubMed] [Google Scholar]
6. Webb BC, Willcox MD, Thomas CJ, Harty DW, Knox KW. The effect of sodium hypochlorite on potential pathogenic traits of Candida albicans and other Can- dida species. Oral Microbiol Immunol 1995; 10: 334–41. [PubMed] [Google Scholar]
7. Baba Y, Sato Y, Owada G, Minakuchi S. Effectiveness of a combination denture– cleaning method versus a mechanical method: comparison of denture cleanli- ness, patient satisfaction, and oral health-related quality of life. J Prosthodont Res 2018; 62: 353–8. [PubMed] [Google Scholar]
8. Salloum AM. Effect of 5.25 % sodium hypochlorite on color stability of acrylic and silicone based soft liners and a denture base acrylic resin. J Indian Prosthodont Soc 2014; 14: 179–86. [PubMed] [Google Scholar]

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Conglomeration of infectious lesions of prostate and mucin - An original research

(Acumulo de lesiones infecciosas de próstata y mucina - Una investigación original)

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Abstract(english)

Microscopic differentiation of benign and low grade malignant lesions of prostate pose a challenging task for the pathologists. Immunohistochemistry markers can prove costlier in resource poor settings. To assess the utility of mucin stains in evaluating and differentiating benign and malignant lesions of prostate. 100 prostatic biopsies received in the Pathology department of a tertiary care hospital over a period of one and half years were included in this study. In addition to routine H&E, the sections were stained with Periodic acid Schiff (PAS), Alcian blue (AB) and Mucicarmine (MC) stains. Out of 100 prostatic biopsies studied, 90% of benign cases and 53% malignant lesions showed positivity with Periodic acid Schiff (PAS) stain. With Alcian blue, 67% of malignant lesions showed positivity and with Mucicarmine 60% of malignant lesions showed positivity. In contrast only 1% of benign lesions were positive with Alcian blue and Mucicarmine. Neutral mucin was found to be more frequently positive in benign lesions of prostate whereas acidic mucin is expressed only in malignant lesions.

Keywords(english)

Prostate, Periodic acid Schiff (PAS), Alcian blue (AB) and Mucicarmine (MC) stains.

Resumen(español)

La diferenciación microscópica de lesiones benignas y malignas de bajo grado en la próstata plantea un reto para los patólogos. Los marcadores inmunohistoquímicos pueden resultar más costosos en entornos con recursos limitados. Para evaluar la utilidad de las tinciones de mucina en la evaluación y diferenciación de lesiones benignas y malignas en la próstata, se incluyeron en este estudio 100 biopsias prostáticas recibidas en el departamento de Patología de un hospital de tercer nivel durante un período de un año y medio. Además de la hematoxilina y eosina (H&E) de rutina, las secciones se tiñeron con ácido peryódico de Schiff (PAS), azul alcián (AB) y mucicarmín (MC). De las 100 biopsias prostáticas estudiadas, el 90% de los casos benignos y el 53% de las lesiones malignas mostraron positividad con la tinción de ácido peryódico de Schiff (PAS). Con azul alcián, el 67% de las lesiones malignas mostraron

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positividad y con mucicarmín, el 60%. En contraste, solo el 1% de las lesiones benignas fueron positivas con azul alcián y mucicarmín. La mucina neutra fue más frecuentemente positiva en las lesiones benignas de próstata, mientras que la mucina ácida se expresa solo en las lesiones malignas.

Palabras clave(español)

Próstata, tinciones de ácido peryódico de Schiff (PAS), azul alcián (AB) y mucicarmín (MC).

Introduction

Incidence of prostatic carcinoma is more common in western setup and it is the second most leading cause of cancer related deaths in USA.1 Incidence is on the rise in India due to increase in urban population and modifications in life style.

In suspected cases of prostatic carcinoma, needle core biopsy is the common specimen received for confirmation. But because of limited amount of tissue, it sometimes becomes difficult to confirm carcinoma. Screening with PSA can be misleading, as the levels of it can be increased even in some benign conditions and after prostatic massage.

Microscopic differentiation of low grade adenocarcinoma and benign lesions can be a challenge for the reporting pathologists. Immunohistochemistry (IHC) can prove costly in resource poor settings. So, in these situations, there is a necessity for a cost effective way for distinguishing the cases of well differentiated malignancies from benign lesions.

There is a presence of neutral mucins in benign lesions of prostate and acidic mucins in low grade malignant lesions.2 So, in this study we tried to demonstrate those mucins using mucin stains and thus find a cost effective way of diagnosing and differentiating low grade malignancies from benign lesions. Here in this study we used Periodic acid Schiff (PAS) to demonstrate neutral mucins and Alcian blue and Mucicarmine to demonstrate acidic mucins.

Materials and methods

100 prostatic biopsies received in the department of pathology in a tertiary care hospital over a course of 18 months (November 2016 to May 2018) were studied. All the paraffin embedded sections were subjected to PAS, Alcian blue and Mucicarmine along with routine H&E sections. On H&E sections histological diagnosis, Gleason's scoring, grade grouping and categorization of malignant cases were done.

Results

Out of 100 cases studied, majority (75%) of the cases were of BPH including pure BPH and BPH associated with other lesions. 15 cases were diagnosed to be malignant, among which 9 (60%) cases were well differentiated, 2 (13.3%) were moderately differentiated and 4 (26.7%) were poorly differentiated. To detect neutral mucin, all the cases were stained with Periodic acid schiff. Among benign cases 68/75 (90.7%) were found to be positive, 8/10 (80%) cases of pre malignant were positive and 8/15 (53.3%) cases of malignant were positive with p value 0.001(Table 1).

All the sections were subjected to Alcian blue stain to detect presence of acidic mucins. It was positive in 10/15 (66.7%) cases of malignancy, 2/10 (20%) pre malignant cases and 1/75(1.3%) benign case with with p value <0.01 (Table 2). The sections were also subjected to Mucicarmine to detect presence of acid mucins. It was positive in 8/15 (53.3%) malignant cases, 2/10 (20%) pre malignant cases and 1/75 (1.3%) benign case with p value <0.001 (Table 3)

Table. 1. Association between diagnosis and PAS staining.

Sl. No.	PAS	Diagnosis			p value#
		Benign n(%)	Premalignant n(%)	Malignant n (%)	
1	Negative	7 (9.3)	2 (20)	7 (46.7)	0.001*
2	Positive	68 (90.7)	8 (80)	8 (53.3)	

Note: # p value based on Chi-square test,* statistically significant (p<0.05)

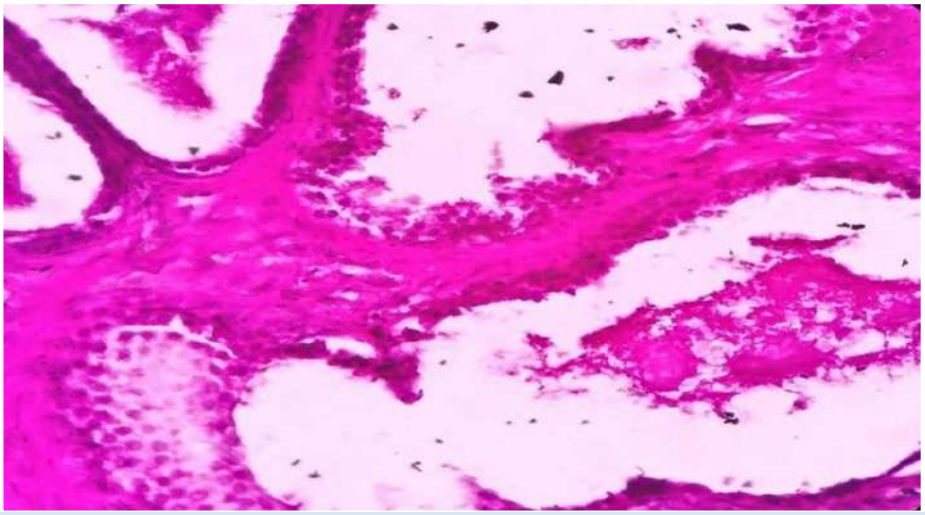


Figure. 1 Microscopic picture showing positive PAS staining in a case of BPH (40x).

Table. 2. Association between diagnosis and Alcian blue staining.

Sl. No.	Alcian blue	Diagnosis			p value#
		Benign n(%)	Premalignant n(%)	Malignant n (%)	
1	Negative	74 (98.7)	8 (80)	5 (33.3)	<0.001*
2	Positive	1 (1.3)	2 (20)	10 (66.7)	

Note: # p value based on Chi-square test,* statistically significant (p<0.05).

Discussion

Differentiating well differentiated carcinoma from benign lesions is always a challenge for the pathologists. Hence, there is a need for a useful tool which is cost effective, especially at the resource poor settings. Mucins are present in the glandular tissue and can be stained by various stains such as periodic acid Schiff (PAS), Alcian blue and Mucicarmine. According to

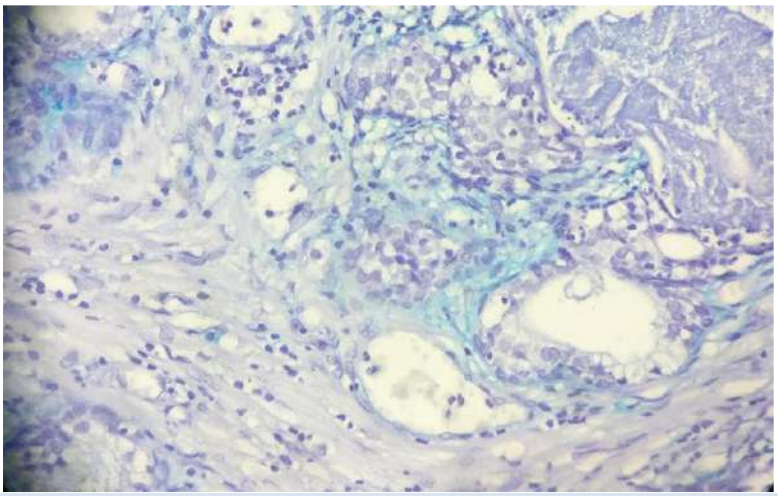


Figure. 2 Microscopic picture showing positive Alcian blue staining in a case of malignancy (40x).

Table. 3. Association between diagnosis and Mucicarmine staining.

Sl. No.	Mucicarmine	Diagnosis			p value#
		Benign n(%)	Premalignant n(%)	Malignant n (%)	
1	Negative	74 (98.7)	8 (80)	7 (46.7)	<0.001*
2	Positive	1 (1.3)	2 (20)	8 (53.3)	

Note: # p value based on Chi-square test,* statistically significant (p<0.05).

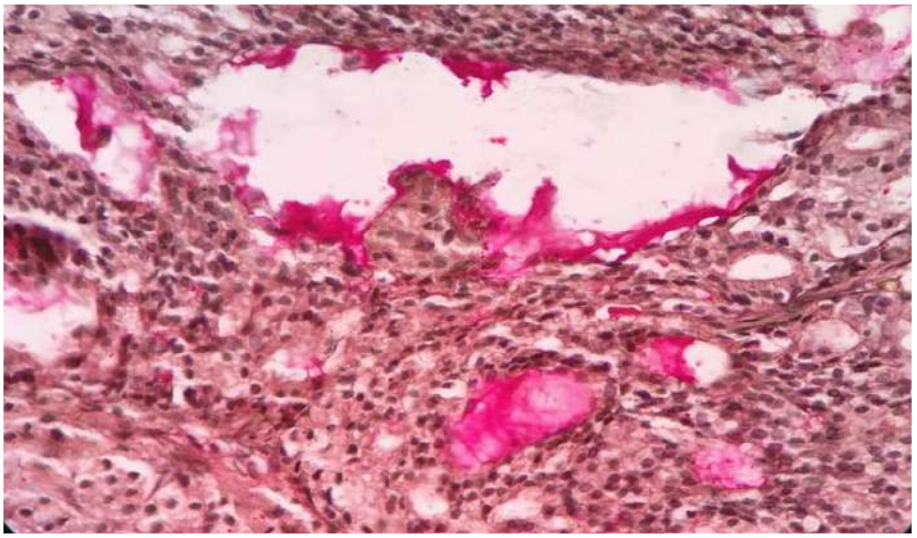


Figure. 3 Microscopic picture showing positive Mucicarmine staining in a case of malignancy (40x)

many studies, acidic stains are present in malignant lesions, but not in benign ones. And neutral mucins are seen more frequently in benign lesions than in malignant lesions.2

The findings of positivity with acidic mucins (alcian blue and mucicarmine) in benign cases in our study (1.3%) are comparable with the study conducted by Agarwal et al2 (0%), Pinder et al3 (0%) and McMahon et al4 (5%).

Among malignant lesions, alcian blue positivity was seen in 66.7% cases, results in concordance with Arora et al.5 (60%). Mucicarmine positivity was seen in 53.3% cases. All the well differentiated carcinomas were positive for acidic mucins.

All the cases positive for alcian blue and mucicarmine were of well differentiated carcinoma, implicating that low grade or well differentiated carcinoma secrete acidic mucin which is usually not seen in high grade or poorly differentiated carcinomas.

Acidic mucins are usually positive in well differentiated carcinomas and usually negative in case of benign lesions. Hence we conclude that alcian blue and mucicarmine stains can be of immense help to pathologists in differentiating carcinomas from benign lesions.

In conclusion, Mucin stains such as Alcian blue and Mucicarmine can detect the presence of acidic mucins secreted by the malignant glands of the well differentiated carcinomas and therefore these stains can be used as an adjunct in easily differentiating few well differentiated carcinoma and benign cases.

Conflict of interest

None to declare.

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References

1. Juan R. Rosai and ackerman's surgical pathology. 10th ed. London: Mosby Elsevier; 2011. p.1295.
2. Agarwal DN, Zawar MP, Deshpande NM, Sudhamani S. The study of mucin histochemistry in benign and malignant lesions of prostate. J Sci Soc. 2014 Jan 1; 41:38. [Google Scholar]
3. Pinder SE, McMahon RF. Mucins in prostatic carcinoma. Histopathology. 1990; 16:43-6. [PubMed] [Google Scholar]
4. McMahon RF, McWilliam LJ, Mosley S. Evaluation of three techniques for differential diagnosis of prostatic needle core biopsy specimens. J Clin Pathol. 1992; 45: 1094-8. [Google Scholar]
5. Arora HL. Histochemistry of mucins in various human prostatic diseases. IJPM. 1979; 22: 353-8. [PubMed] [Google Scholar]

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Apendicitis del muñón apendicular

(Stump appendicitis)

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Resumen(español)

La apendicectomía es uno de los procedimientos quirúrgicos más frecuentes a nivel mundial, aunque es considerado generalmente sencillo. No obstante, pueden surgir complicaciones, entre ellas la apendicitis del muñón apendicular, que ocurre cuando se deja un remanente apendicular que se infla. La incidencia es baja, aproximadamente 1 en 50,000 casos, y su diagnóstico suele ser complicado debido a la rareza de la condición, lo que puede resultar en retrasos en el tratamiento y aumentos en la morbilidad. Se presenta un caso de apendicitis del muñón apendicular en una paciente femenina de 66 años que acudió a emergencias con dolor abdominal agudo en la fosa ilíaca derecha, acompañado de fiebre y antecedentes de apendicectomía abierta siete años atrás. A pesar del tratamiento conservador con antibióticos, la paciente no mostró mejoría, lo que llevó a realizar una tomografía computarizada que evidenció un muñón apendicular inflamado y perforado. Esto resultó en la decisión de realizar una laparotomía exploratoria y la extirpación del muñón. La apendicitis del muñón apendicular, aunque rara, es una complicación seria que requiere un diagnóstico temprano y tratamiento adecuado.

Palabras clave(español)

Apendicitis del muñón apendicular; Apendicectomía; Complicación.

Abstract(english)

Appendectomy is one of the most common surgical procedures worldwide, generally considered straightforward. However, complications can arise, including stump appendicitis, which occurs when a remnant of the appendix becomes inflamed. The incidence is low, approximately 1 in 50,000 cases, and its diagnosis is often complicated due to the rarity of the condition, leading to delays in treatment and increased morbidity. We present a case of stump appendicitis of a 66-year-old female patient who presented to the emergency department with acute abdominal pain in the right iliac fossa, accompanied by fever and a history of open appendectomy seven years prior. Despite conservative treatment with antibiotics, the patient showed no improvement, leading to a CT scan that revealed an inflamed and perforated appendiceal stump. This resulted in the decision to perform an exploratory laparotomy and resection of the stump. Stump appendicitis, although rare, is a serious complication that requires timely diagnosis and appropriate treatment.

Keywords(english)

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Stump Appendicitis; Appendectomy; Complication.

Introducción

La apendicectomía, ya sea abierta o laparoscópica, es uno de los procedimientos quirúrgicos más frecuentemente realizados en todo el mundo. Aunque generalmente es un procedimiento simple, pueden surgir complicaciones a corto plazo, como dolor, sangrado e infección del sitio quirúrgico, así como complicaciones tardías, que incluyen adherencias, hernias y obstrucción intestinal (1).

La apendicitis del muñón apendicular es una complicación rara que ocurre cuando el apéndice vermiforme no se extirpa completamente, dejando un remanente que puede inflamarse. Esta condición, con una incidencia de aproximadamente 1 en 50,000 casos, puede presentarse desde unos pocos días hasta varios años después de la apendicectomía inicial (2). Su diagnóstico es difícil debido a su rareza y a la baja sospecha clínica, lo que puede llevar a retrasos en el tratamiento y aumentar la morbilidad (3). La tomografía computarizada es la herramienta diagnóstica más utilizada, y completar la apendicectomía es el tratamiento de elección (4). Se presenta un caso de apendicitis del muñón apendicular.

Caso clínico

Se trata de una paciente femenina de 66 años que acudió a emergencias por presentar dolor abdominal de moderada intensidad, que inicialmente era difuso y luego se volvió agudo y localizado en la fosa ilíaca derecha desde hacía 48 horas. Este dolor se acompañaba de un aumento de la temperatura, sin escalofríos ni temblores, y se aliviaba con ibuprofeno. Además, refería 3 a 4 episodios de evacuaciones líquidas no fétidas, sin sangre ni moco. La paciente tenía antecedentes de hipertensión arterial crónica tratada con enalapril, y negaba antecedentes de hábito tabáquico, consumo de alcohol o uso de drogas ilícitas. También refería haber sido sometida a una apendicectomía abierta hace siete años.

Al examen físico de ingreso, la paciente presentaba regulares condiciones generales, facies dolorosa, febril (temperatura de 38.2 °C), taquicárdica (110 latidos por minuto) e hipotensa (100/60 mm de Hg). El resto de sus signos vitales eran normales. En la inspección del abdomen se reveló una distensión abdominal leve, sensibilidad generalizada y una cicatriz visible en el punto de McBurney en la fosa ilíaca derecha. Esta zona era sensible, presentaba defensa muscular y rigidez, con signo de Rovsing positivo y sensibilidad de rebote a la palpación. Los signos del psoas y del obturador fueron negativos. La auscultación mostró ruidos intestinales normales, sin soplos ni otros sonidos anormales. La percusión del abdomen evidenció timpanismo generalizado, sin matidez desplazable. No se apreciaron masas ni organomegalias. El examen rectal fue normal, sin masas ni dolor a la palpación. El examen de los sistemas cardiovascular, respiratorio y neurológico no reveló hallazgos anormales.

Los resultados de laboratorio iniciales mostraron un recuento total de leucocitos elevado (15.7 × 10^9/L, rango normal 4.8 – 11.3 × 10^9/L) con un aumento en el porcentaje de neutrófilos (88.4%, rango normal 4.9 – 76.2%). El resto de las pruebas de laboratorio resultó normal. La radiografía abdominal simple mostró asas intestinales dilatadas localizadas centralmente y múltiples niveles de aire-líquido también localizados centralmente.

La paciente fue ingresada para manejo conservador con antibióticos de amplio espectro, hidratación endovenosa y antieméticos, manteniéndola en ayunas. A pesar de este manejo, no presentó mejoría de la sintomatología. En vista de lo anterior, se decidió realizar una tomografía computarizada abdominal, la cual mostró hallazgos sugestivos de apendicitis. La imagen reveló un muñón apendicular pequeño y dilatado, con paredes engrosadas, estrías de gas asociadas y aire libre intraluminal (figura 1). Basado en estos hallazgos, se diagnosticó apendicitis del muñón apendicular. Estos hallazgos llevaron a la decisión de realizar una laparotomía exploratoria.

Durante la cirugía, se accedió al abdomen a través de una incisión media inferior. Se encontraron asas intestinales dilatadas y secreción purulenta en el cuadrante inferior derecho del

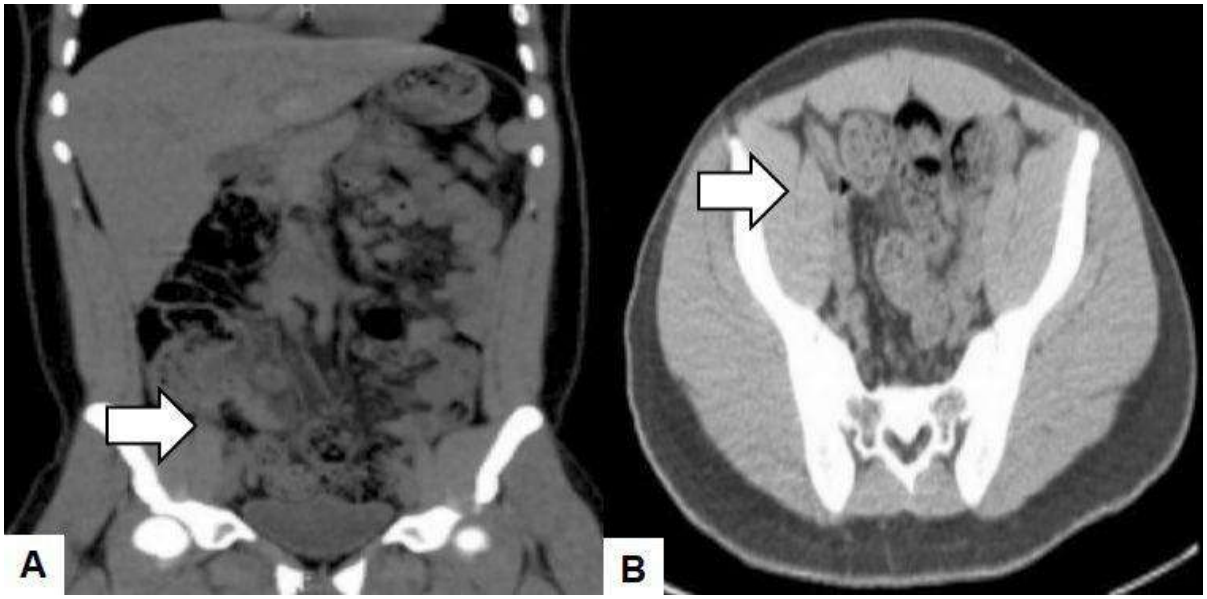


Figura 1. Imagen de tomografía axial computarizada A) coronal y B) axial. La fleca señala la apendicitis del muñón dilatada con paredes engrosadas y cambios inflamatorios.

abdomen. Se llevó a cabo una exploración meticulosa de la cavidad abdominal, movilizando tanto el ciego como el colon ascendente para visualizar mejor el área. Se identificó el muñón apendicular, localizado en la base del ciego, con aproximadamente 5 centímetros de longitud, el cual estaba inflamado y perforado, con paredes engrosadas y áreas de necrosis. Se procedió a ligar y extirpar el muñón apendicular desde su base utilizando suturas absorbibles. A continuación, se realizó un lavado peritoneal exhaustivo con solución salina para eliminar los restos de pus y material inflamatorio. Se colocaron drenajes para evitar la acumulación residual de líquido. La incisión abdominal fue cerrada en capas, utilizando suturas absorbibles para la fascia y suturas no absorbibles para la piel. Se aplicó un apósito estéril sobre la herida quirúrgica.

La evaluación anatomopatológica mostró que el muñón del apéndice vermiforme estaba engrosado, con un tamaño de 5 x 1 centímetro. Las secciones mostraron congestión con infiltrados inflamatorios mixtos transmurales, con infiltración de neutrófilos, linfocitos y células plasmáticas en todas las capas de la pared apendicular. La mucosa estaba ulcerada en varias zonas, con pérdida de la arquitectura normal. La submucosa y la muscular propia mostraban edema y congestión vascular significativa. La serosa presentaba depósitos de fibrina y exudado purulento. No se encontraron parásitos ni neoplasias. Estas características eran consistentes con apendicitis del muñón apendicular.

El postoperatorio transcurrió sin incidentes. La paciente fue dada de alta seis días después de la admisión, con antibióticos de amplio espectro y analgésicos orales hasta completar un total de 10 días. Durante la visita de seguimiento a las dos semanas, la paciente informó que se sentía mejor, sin dolor ni signos de infección en el sitio de la incisión. En una evaluación de seguimiento a los tres meses, la paciente había recuperado su funcionalidad previa a la cirugía.

Discusión

El apéndice surge de la pared posteromedial del ciego, aproximadamente a 3 centímetros por debajo de la válvula ileocecal. Su posición variable y longitud subserosa, combinadas con la inflamación aguda, pueden resultar en la identificación errónea de la unión apendico-cecal. Disecar la rama recurrente de la arteria apendicular y seguir la tenia coli en el ciego ayuda a identificar la verdadera base apendicular (1).

La apendicitis aguda es la emergencia quirúrgica abdominal más común encontrada en la práctica clínica. Este es un diagnóstico clínico, y el paciente generalmente se presenta con dolor periumbilical que irradia al abdomen inferior derecho. Sin embargo, siempre surgen dudas cuando un paciente con antecedentes de apendicectomía se presenta con dolor abdominal en el cuadrante inferior derecho (5).

La apendicitis del muñón apendicular es la reactivación del tejido apendicular residual después de la apendicectomía. Es una complicación rara y tardía que es desconocida por la mayoría de los clínicos (6). El diagnóstico precoz es necesario y debe considerarse al evaluar a cualquier paciente con dolor abdominal recurrente en el cuadrante inferior derecho y antecedentes de apendicectomía. Su frecuencia está subestimada y subreportada. La edad de aparición varía entre 11 y 72 años, y el tiempo de aparición puede variar desde 2 semanas hasta décadas después de la apendicectomía. La relación hombre-mujer es de 1.1 a 1 (5).

Los factores de riesgo se dividen en anatómicos y relacionados con la cirugía. La identificación inapropiada de la base apendicular o de la unión apendico-cecal es un denominador común para ambos. El apéndice retrocecal o subseroso, un apéndice duplicado o un divertículo en la base del apéndice son algunos de los factores anatómicos contribuyentes. Los factores relacionados con la cirugía incluyen la identificación inadecuada de la base apendicular debido a una inflamación local severa, dejar un muñón largo (mayor de 5 milímetros, ya que podría permitir la impactación de un fecalito) por temor a una lesión cecal, o una disección difícil y ulceraciones locales debido a la presencia de un fecalito (7). Ambas técnicas quirúrgicas para tratar el muñón, es decir, la inversión del muñón o la simple ligadura del muñón, no previenen la posibilidad de apendicitis del muñón apendicular (8,9).

Algunas teorías han intentado vincular la apendicectomía laparoscópica en evolución con la apendicitis del muñón apendicular, ya que su visión restringida, la falta de tridimensionalidad, las limitaciones en la palpación y la preparación cuidadosa de la base del ciego con los instrumentos de diatermia podrían posiblemente jugar un papel en la identificación errónea de la base, aumentando así las posibilidades de desarrollo de apendicitis del muñón apendicular. Sin embargo, muchas otras series posteriores sostienen que la apendicectomía abierta también tiene una incidencia similar a la del abordaje laparoscópico (10).

El diagnóstico de apendicitis del muñón apendicular es un desafío debido a su rareza y a la similitud de sus síntomas con los de la apendicitis aguda. Algunos diagnósticos diferenciales también imitan clínicamente la apendicitis del muñón apendicular, incluyendo la enfermedad de Crohn, el tracto de drenaje quirúrgico residual y la apendicitis epiploica (2). Es necesario considerar que la obstrucción intestinal puede aparecer en un 1% a 5% de los casos. La inflamación y la infección del muñón apendicular pueden irritar el intestino adyacente, lo que lleva a la aparición de íleo paralítico. Por otra parte, la alta tasa de perforación asociada subraya la necesidad de un diagnóstico y tratamientos oportunos (11).

El diagnóstico preoperatorio correcto de la apendicitis del muñón apendicular puede realizarse mediante ecografía y tomografía computarizada. La radiografía simple de abdomen puede ser útil para identificar la perforación del muñón, con presencia de líquido y/o aire libre en la cavidad abdominal. La ecografía puede revelar un muñón apendicular engrosado, líquido en la fosa ilíaca derecha y edema del ciego (1). Los hallazgos de la tomografía computarizada pueden ser similares a los de la apendicitis aguda, mostrando una estructura tubular con realce de contraste que surge del ciego, con estriación de grasa adyacente, así como engrosamiento de la pared cecal con material de contraste oral en la ubicación del origen apendicular, conocido como el "signo de la punta de flecha". La tomografía computarizada excluye otras etiologías del abdomen agudo y es capaz de identificar cambios inflamatorios pericecales, formación de abscesos, líquido en el canal paracólico derecho, engrosamiento de la pared cecal, masa ileocecal y, en algunos casos, el muñón apendicular (12). La colonoscopia y el enema de bario son otras

modalidades de diagnóstico descritas en la literatura, aunque son menos útiles (13).

El tratamiento de elección para la apendicitis del muñón apendicular es la apendicectomía de finalización, con o sin inversión del muñón, realizada ya sea como cirugía abierta (72% de los casos) o mediante abordaje laparoscópico, dependiendo de la condición clínica del paciente y de la experiencia y recursos hospitalarios (6,14). Diferentes estudios reportan que la laparoscopia es superior a la cirugía abierta porque proporciona un mejor ángulo de visión, lo que conduce a un diagnóstico diferencial más preciso; sin embargo, no existe un enfoque quirúrgico estandarizado para el tratamiento de la apendicitis del muñón apendicular. Además, en casos de inflamación significativa alrededor de la región ileocecal con presencia de abscesos, podría ser necesario realizar una ileocectomía o incluso hemicolectomía derecha (15).

También se han descrito tratamientos no quirúrgicos para la apendicitis del muñón apendicular, que incluyen la extirpación colonoscópica del apendicolito y el tratamiento médico con antibióticos, analgésicos y dieta líquida (16). Estos pacientes pueden someterse a una apendicectomía del muñón a intervalos de 6 semanas, tras la resolución de la inflamación. Algunos investigadores han propuesto que esto disminuye la morbilidad potencial de las infecciones de la herida y del sitio quirúrgico, y elimina recurrencias futuras (10).

En conclusión, la apendicitis del muñón apendicular es una complicación rara pero significativa de la apendicectomía. La identificación temprana y la prevención mediante técnicas quirúrgicas adecuadas son esenciales para reducir el riesgo de esta condición. La educación continua y la conciencia entre los clínicos sobre esta complicación pueden mejorar los resultados para los pacientes.

Conflictos de interés

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Referencias

1. Alemayehu A, Woyesa E, Fekadu D. Stump appendicitis: challenging diagnosis with serious complication: a case report. J Surg Case Rep. 2023; 2023: rjad043. [PubMed]
2. Mohammed NA, Dukandar M. Stumped by appendicitis: A rare cause of acute abdominal pain. Cureus. 2023; 15: e50557. [PubMed] [Google scholar]
3. Nashidengo PR, Quayson FW, Abebrese JT, Tjipetekera R, Seibes SS. Twice perforated stump appendicitis: a case report. Pan Afr Med J. 2022; 43: 43. [PubMed] [Google scholar]
4. Mejri A, Arfaoui K, Aloui B. Stump appendicitis: a myth that can become reality. Pan Afr Med J. 2020; 36: 274. [PubMed] [Google scholar]
5. Almas T, Nagarajan VR, Ahmed D, Ullah M, Ashary MA, Oruk M, Khan A, Amin K, Malik U, Ramjohn J, Huang H, Rifai A, Alzahrani A, Alqallaf N, Alsairefi S, Hur YS, Bhullar A, Abdulkarim K, Alwheibi E, Kadom M, Alshabibi A, Shafi A, Murad F, Mansoor E. Recurrent appendicitis of vermiform appendix after a prior appendectomy: A case report and review of the literature. Ann Med Surg (Lond). 2022; 77: 103603. [PubMed] [Google scholar]
6. Yuen AT, Suessman A. Stumped by a case of appendicitis after appendectomy. Ochsner J. 2024; 24: 147-50. [PubMed] [Google scholar]
7. Soh CL, Shetty S, Abdalla S, Soggiu F. 'Stumped' by stump appendicitis-a case report and literature review. J Surg Case Rep. 2024; 2024: rjae573. [PubMed] [Google scholar]
8. Parthsarathi R, Jankar SV, Chittawadgi B, Sabnis SC, Kumar SS, Rajapandian S, Senthilnathan P, Raj PP, Palanivelu C. Laparoscopic management of symptomatic residual appendicular tip: A rare case report. J Minim Access Surg. 2017; 13: 154-6. [PubMed] [Google scholar]
9. Hendahewa R, Shekhar A, Ratnayake S. The dilemma of stump appendicitis - A case report and literature review. Int J Surg Case Rep. 2015; 14: 101-3. [PubMed] [Google scholar]
10. Basukala S, Pathak BD, Pahari S, Gurung S, Basukala B, Rayamajhi BB, Thapa N. An unusual case of perforated stump appendicitis: A case report. Ann Med Surg (Lond). 2022; 76: 103447. [PubMed] [Google scholar]
11. Ahmed F, Asad S, Salim S, Soomar SM. Appendicitis after appendectomy: A rare presentation of acute appendicitis as stump appendicitis. Case Rep Gastroenterol. 2022; 16: 441-5. [PubMed] [Google scholar]
12. Casas MA, Dreifuss NH, Schlottmann F. High-volume center analysis and systematic review of stump appendicitis: solving the pending issue. Eur J Trauma Emerg Surg. 2022; 48: 1663-72. [PubMed] [Google scholar]
13. Enzerra MD, Ranieri DM, Pickhardt PJ. Stump appendicitis: Clinical and CT findings. AJR Am J Roentgenol. 2020; 215: 1363-9. [PubMed] [Google scholar]
14. Choi H, Choi YJ, Lee TG, Kim DH, Choi JW, Ryu DH. Laparoscopic management for stump appendicitis: A case series with literature review. Medicine (Baltimore).

2019; 98: e18072. [PubMed] [Google scholar]

15. Bastakoti A, Khatiwada A, Luitel P, Panthi B, Kc S, Kc S. Classic yet challenging case of stump appendicitis: a case report. Ann Med Surg (Lond). 2024; 86: 7427-30. [PubMed] [Google scholar]
16. Qunibi H, Thalji M, Ahmad MS, Fakhouri S. A rare case of tip appendicitis treated successfully with conservative management. J Surg Case Rep. 2024; 2024: rjae685. [PubMed]

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Role of dental examination in identifying internal carotid artery dissection presenting with Horner's syndrome: A case report

(Papel del examen dental en la identificación de la disección de la arteria carótida interna que se presenta con el síndrome de Horner: Informe de un caso)

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Abstract(english)

Headache, localized cerebral ischemia, and oculosympathetic paresis are hallmark features of Horner's syndrome, which may arise secondary to internal carotid artery dissection (ICAD)—a rare but potentially life-threatening condition. Prompt and accurate diagnosis is critical to alleviate symptoms and prevent serious neurological sequelae such as ischemic stroke. Dentists, often being the first professionals consulted for orofacial pain, play an important role in recognizing atypical presentations that may mimic common dental pathologies. We present the case of a patient with painful partial Horner's syndrome secondary to ICAD, in whom timely dental referral facilitated early detection and intervention, ultimately averting a potentially fatal ischemic event. This case underscores the importance of vigilance among dental practitioners in identifying red flag symptoms, emphasizing their role in early diagnosis and prevention of life-threatening complications.

Keywords(english)

carotid artery dissection, Horner's syndrome, dentist.

Resumen(español)

El dolor de cabeza, la isquemia cerebral localizada y la paresia oculosimpática son características distintivas del síndrome de Horner, que puede surgir como consecuencia de una disección de la arteria carótida interna (DACI), una afección poco frecuente pero potencialmente mortal. Un diagnóstico rápido y preciso es fundamental para aliviar los síntomas y prevenir secuelas neurológicas graves, como el accidente cerebrovascular isquémico. Los odontólogos, que suelen ser los primeros profesionales consultados por dolor orofacial, desempeñan un papel importante en el reconocimiento de presentaciones atípicas que pueden simular patologías dentales comunes. Presentamos el caso de un paciente con síndrome de Horner parcial doloroso secundario a DACI, en quien la derivación oportuna al odontólogo facilitó la detección e intervención tempranas, evitando así un evento isquémico potencialmente fatal. Este caso subraya la importancia de la vigilancia por parte

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de los odontólogos para identificar los síntomas de alarma, enfatizando su papel en el diagnóstico precoz y la prevención de complicaciones potencialmente mortales.

Palabras clave(español)

disección de la arteria carótida, síndrome de Horner, odontólogo.

Introduction

Horner's syndrome (HS) was first described by François Pourfour du Petit in 1727 and later named after the Swiss ophthalmologist Johann Friedrich Horner in 1869 [1,2]. It results from disruption of the oculosympathetic pathway, producing a characteristic constellation of clinical features, including unilateral ptosis, ipsilateral miosis with normal pupillary light reactivity, and, in some cases, ipsilateral facial anhidrosis [3]. Since general practitioners are often the first point of contact, and because the condition may mimic pain associated with dental abscesses in the mandibular region, dentists frequently play a pivotal role in its early recognition. Given that the orofacial region falls within the primary domain of dental practice, dentists with specialized training in orofacial pathoses are well-positioned to apply their clinical skills in history-taking and diagnosis. This expertise enables them to manage straightforward orofacial pain cases and appropriately refer complex cases to medical specialists when necessary [4].

Although Horner's syndrome is an uncommon manifestation of internal carotid artery dissection (ICAD), early recognition is critical, as timely initiation of treatment can prevent devastating neurological complications such as embolic stroke, aneurysmal rupture, or even death. Therefore, it is imperative that dental practitioners remain vigilant to the signs and symptoms of HS, as they may be instrumental in facilitating early diagnosis. The present case highlights how a timely dental examination identified a patient with ICAD on the verge of ischemic stroke, thereby averting a potentially fatal outcome. This underscores the importance of dental evaluation in systemic disease recognition and reinforces the crucial role of dentists in safeguarding patient health and saving lives.

Case report

A male patient presented to the hospital with a chief complaint of headache and pain localized to the right side of the face and neck, radiating posterior to the right eye. He was employed in heavy construction work and reported daily consumption of approximately five units of alcohol, though he denied smoking. His medical history was significant for hypertension secondary to polycystic kidney disease, for which he was receiving ramipril (2.5 mg) and dual antiplatelet therapy.

On clinical examination, the patient reported persistent right-sided facial and cervical pain radiating to the periorbital region. There was no clinical evidence of connective tissue disorder. To exclude odontogenic pathology as a possible source of pain, he was referred to the dental unit. Intraoral examination revealed intact dentition with multiple restorative fillings in the upper and lower posterior teeth, minimal attrition of the mandibular posterior teeth, and mild gingivitis. No signs of dental abscess or other intraoral pathology were observed. Intraoral periapical radiographs further confirmed the absence of periapical pathology or dental sepsis (Figure 1). Temporomandibular joint examination was unremarkable.

However, additional examination revealed right-sided partial ptosis, ipsilateral miosis, mild enophthalmos, and facial anhidrosis—clinical features consistent with oculosympathetic palsy (Horner's syndrome) (Figure 2).

Magnetic Resonance Imaging (MRI) of the brain was performed to evaluate the cause of the patient's right-sided neck and facial pain. The MRI revealed no evidence of acute ischemic stroke or intracranial pathology, and no abnormalities were detected in the right carotid artery. However, Magnetic Resonance Angiography (MRA) of the carotid vessels demonstrated a focal dissection of the right internal carotid artery, characterized by luminal irregularity and narrowing, which correlated with the patient's presenting symptoms of pain and oculosympathetic palsy.



Figure 1. Intraoral radiographs demonstrated the presence of restorative fillings in the teeth with no radiographic evidence of dental sepsis.

The patient and his spouse were counseled regarding the findings, with emphasis on the typically self-limiting nature of carotid artery dissection. They were advised to continue the dual antiplatelet therapy already prescribed for his underlying hypertension and polycystic kidney disease. The patient was placed under close clinical surveillance with scheduled follow-up imaging. At the three-month review, the patient reported significant improvement in pain and partial resolution of oculosympathetic symptoms. Follow-up MRA demonstrated interval healing of the arterial wall with improved luminal patency. At six months, the patient remained asymptomatic, with no new neurological deficits, and was advised to maintain long-term secondary prevention measures.

Discussion

Horner's syndrome, or oculosympathetic paresis, is characterized by the clinical triad of ipsilateral ptosis, miosis, and anhidrosis. It results from disruption of the sympathetic pathway, which extends from the hypothalamus to the eye through three orders of neurons. Lesions at any level of this pathway may produce the syndrome [5]. While various etiologies have been described—including neoplasms, vascular malformations, trauma, and iatrogenic causes—internal carotid artery dissection (ICAD) represents one of the most serious and potentially life-threatening underlying conditions.

Recent studies emphasize that painful Horner's syndrome should be regarded as a red flag for ICAD until proven otherwise. Headache and neck pain are among the most common presenting symptoms of ICAD, reported in 68–92% of cases, and often radiate to the orofacial region [5]. These pain patterns can mimic odontogenic or temporomandibular disorders, leading patients to first consult dental practitioners. This overlap highlights the unique role of dentists in detecting ICAD at an early stage. Dentists are specifically trained in orofacial anatomy, pain mechanisms, and differential diagnosis of orofacial pain,

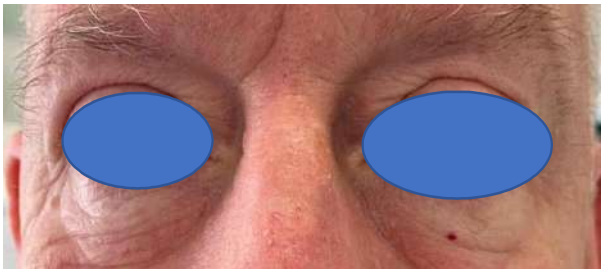


Figure 2. Clinical view.

enabling them to distinguish between common odontogenic causes and atypical presentations that may indicate vascular pathology [6].

In the present case, referral for suspected dental sepsis ultimately led to the recognition of Horner's syndrome during dental evaluation. This underscores the importance of thorough extraoral examination, particularly when pain is disproportionate to dental findings or associated with autonomic or neurological signs. Incorporating red-flag training into dental curricula and continuing education programs could strengthen early recognition of ICAD and related conditions in routine practice.

Patient history also plays a crucial role in ICAD risk assessment. Our patient had hypertension secondary to autosomal dominant polycystic kidney disease (ADPKD) and consumed alcohol daily. ADPKD is associated not only with renal cyst formation but also with vascular abnormalities due to impaired vessel wall integrity, predisposing patients to aneurysms, hypertension, and potentially arterial dissections [7]. Hypertension is an established risk factor for ICAD, as it increases shear stress on already vulnerable vessels [CCJM, 2017]. While the relationship between alcohol consumption and ICAD is less well established, chronic intake may indirectly contribute by exacerbating hypertension and vascular stress.

Prognosis in ICAD depends on early recognition and treatment. MRI combined with MR angiography (MRA) is the imaging modality of choice, offering high sensitivity for vessel wall abnormalities and luminal changes. Antithrombotic therapy for 3–6 months remains the standard of care, with most patients showing substantial or complete recovery within this period. Studies indicate that up to 85–90% of patients experience resolution of symptoms, and mortality is <5% when ischemic complications are avoided [5].

This case highlights the importance of interdisciplinary collaboration in the management of atypical orofacial pain. Dentists, often the first point of contact for patients with facial pain, play a pivotal role in identifying systemic diseases with craniofacial manifestations. By recognizing the clinical features of painful Horner's syndrome and initiating timely referral, dental practitioners can directly contribute to stroke prevention and improved patient outcomes.

In conclusion, Dentists are often the first point of consultation for conditions affecting the oral and maxillofacial region. Consequently, they play a critical role in recognizing potentially serious pathologies that may initially present with orofacial symptoms. A meticulous evaluation of the patient's medical history, combined with careful attention to presenting complaints, is essential for early detection of such conditions. Internal carotid artery dissection (ICAD), if left untreated, carries a substantial risk of severe complications, including ischemic stroke. Therefore, maintaining a high index of suspicion, supported by a thorough ophthalmologic assessment, is imperative in suspected cases. Moreover, a sound understanding of the anatomical basis of Horner's syndrome is invaluable in localizing the lesion. Timely recognition facilitates early initiation of appropriate treatment, thereby significantly reducing the likelihood of life-threatening outcomes associated with carotid artery dissection.

Conflictos de interés

Los autores declaran no tener ningún conflicto.

Referencias

1. Lee VH, Brown RD Jr, Mandrekar JN, Mokri B. Incidence and outcome of cervical artery dissection: a population-based study. Neurology. 2006; 67: 1809-12. [PubMed] [Google Scholar]
2. English SW, Passe TJ, Lindell EP, Klaas JP. Multiple cranial neuropathies as a presentation of spontaneous internal carotid artery dissection: A case report and literature review. J Clin Neurosci. 2018; 50: 129-31. [PubMed] [Google Scholar]
3. Creavin ST, Rice CM, Pollentine A, Cowburn P. Carotid artery dissection presenting with isolated headache and Horner syndrome after minor head injury.

Am J Emerg Med. 2012; 30: 2103. e5-7. [PubMed] [Google Scholar]

4. Furlan JC, Sundaram AN. Sudden-onset anisocoria in a patient with upper respiratory tract infection. CMAJ. 2014; 186: 57-61. [PubMed] [Google Scholar]
5. Porporatti AL, Schroder ÂGD, Lebel A, Moreau N, Guillouet C, Stechman-Neto J, Boucher Y. Prevalence of orofacial and head pain: an umbrella review of systematic reviews. J Oral Facial Pain Headache. 2024 Sep 12; 38:1. [PubMed] [Google Scholar]
6. Peng KP, Oppermann T. Orofacial pain disorders: an overview and diagnostic approach. Cephalalgia Reports. 2022 Apr 26;5:25158163221097349. [Google Scholar]
7. Dennis MR, Pires PW, Banek CT. Vascular dysfunction in polycystic kidney disease: a mini-review. Journal of vascular research. 2023; 60: 125-36. [PubMed] [Google Scholar]
8. Millstein R, Lawler HM. Hypoglycemia after gastric bypass: An emerging complication. Cleve Clin J Med. 2017; 84: 319-28. [PubMed] [Google Scholar]

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A rare case of Sister Joseph's nodule in carcinoma of colon diagnosed by fine needle aspiration cytology

(Un caso raro de nódulo de "Sister Joseph's" en carcinoma de colon diagnosticado mediante citología por aspiración con aguja fina)

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Abstract(english)

Umbilical skin metastasis is also known as sister joseph nodules. Its occurrence in carcinoma of the colon is considered to be rare. The finding of umbilical metastasis indicates a poorer prognosis for the patient and a less survival rate. The Sister Mary Joseph nodule can be mistaken for a number of cutaneous tumors that grow on the umbilicus. Histological/cytological assessments of all umbilical sores are obligatory, to decide its inclination and furthermore for the possible primary source.

Keywords(english)

Carcinoma, colon, cytology, nodule, umbilicus, sister joseph.

Resumen(español)

La metástasis cutánea umbilical también se conoce como nódulos de la hermana José. Su aparición en el carcinoma de colon se considera poco frecuente. El hallazgo de metástasis umbilical indica un peor pronóstico para el paciente y una menor tasa de supervivencia. El nódulo de la Hermana María José puede confundirse con diversos tumores cutáneos que crecen en el ombligo. Es fundamental realizar evaluaciones histológicas/citológicas de todas las úlceras umbilicales para determinar su inclinación y, además, determinar su posible origen primario.

Palabras clave(español)

Carcinoma, colon, citología, nódulo, ombligo, hermana José..

Introduction

Umbilical skin metastasis is also known as sister joseph nodules. Sister Mary Joseph Dempsey, a surgical assistant, published the first article on this metastatic nodule in 1928 [1]. These nodules usually occur in carcinoma of the stomach and ovary. Its occurrence in carcinoma of the colon is considered to

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be rare. Umbilical metastasis in colon cancer has been first described by Walshe in 1846[2]. A finding of umbilical metastasis indicates a poorer prognosis for the patient and a less survival rate. The present case report is about a rare finding of umbilical metastasis in a treated case of colon carcinoma.

Case report

A 61-year-old male, known case of Mucinous carcinoma of colon-PT4N2bMx treated with left hemicolectomy followed by transverse colectomy along with 12 cycles of adjuvant chemotherapy in 2019 and reversal of transverse colostomy with end-to-end anastomosis in the year 2020. Now in 2021 patient presented with complaints of bilateral leg swelling for 25 days which was insidious in onset and non-progressive in nature. On examination of the patient vitals were stable with per abdominal examination showing mild tenderness over the right hypochondrium. Midline laparotomy and colostomy scars were noted along with a solid swelling over the anterior abdominal wall.

Investigation: USG imaging of abdomen was done for the patient and did not reveal any significant abnormality. PET CT scan was done which showed mildly hypermetabolic circumferential mural thickening with maximum thickness measuring 10mm extending for a length of 2.5cm with luminal narrowing near the colorectal anastomosis site. Also, another segment of hypermetabolic circumferential mural thickening with maximum thickness measuring

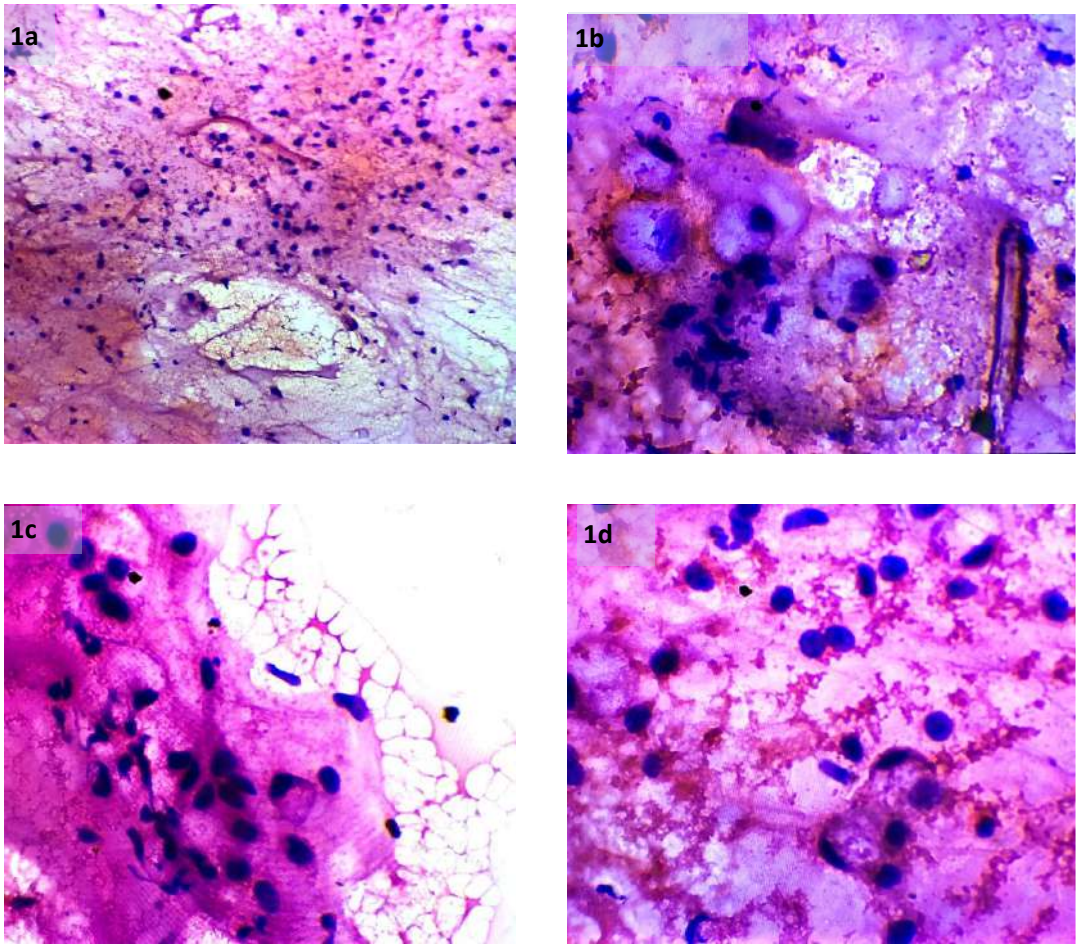


Figure 1. 1a: Cytology smears showing 4x view of atypical cells in a mucinous background**, 1b:**40x magnification view showing cells with signet ring cell features**, 1c&1d:** 10x magnification view showing atypical cells with hyperchromatic nuclei and few with signet ring like features.

10mm extending for a length of 5cm with luminal narrowing approximately 5cm proximal to the lesion noted in the anastomosis site.

Moderately hypermetabolic subaortic node measuring 11x9mm and faintly hypermetabolic left supraclavicular node measuring 12x6mm-Suspicious for Metastasis.

Faintly hypermetabolic stranding in the left lower anterior abdominal wall-? Inflammatory post-surgical changes, faintly hypermetabolic and enlarged bilateral inguinal lymph nodes-likely reactive, faintly hypermetabolic peritoneal stranding with soft tissue measuring 54x23mm in the left iliac region-? post-surgical change.

Fine-needle aspiration cytology of the patient's solid swelling over the anterior abdominal wall was ordered. A 5x3cm swelling on the anterior abdominal wall, just below the umbilicus, as well as midline laparotomy and colostomy scars were discovered on the abdomen.

FNAC findings. A fine needle aspiration cytology was done from the swelling over the anterior abdominal wall just below the umbilicus.

Aspirated Smears showed atypical cells, some cells with signet ring cells feature hyperchromatic nuclei in a mucinous background. Impression was given as Features are that of Malignancy possibly from the metastatic deposit of colon.

Discussion

The malignant metastatic umbilical nodule, more commonly referred to as the "Sister Joseph Nodule," accounts for only 1% to 3% of all abdominal and pelvic carcinomas.[3] The umbilicus is an easy target for metastasis due to its variations in vascularity and developmental anomalies. A carcinoma can spread to the umbilicus in a number of ways, including through the umbilical vein's portal venous system, lymph nodes, dermal lymphatics, and embolization through the arterial system.[4] Histological/cytological assessments of all umbilical sores are obligatory, to decide its inclination and furthermore for the possible primary source, on the off chance that it's analyzed to be a metastatic one [5] .Umbilical nodules are intriguing and can be benign or malignant and these malignant growths can be primary or metastatic. Benign causes like endometriosis, melanocytic nevi, fibroepithelial papillomas, keloid, myxoma, abscess, umbilical hernia, dermatofibroma, seborrheic keratosis, pilonidal sinus.[6][7]

In conclusion the Sister Mary Joseph nodule can be mistaken for a number of cutaneous tumors that grow on the umbilicus. The differences found in the clinical and cytological examinations in this study aid in diagnosis. For further treatment, the patient was taken to a palliative care center.

Conflict of interest

None to declare.

References

1. İşcan Y, Karip B, Onur E, Özbay N, Tezer S, Memişoğlu K. Sister Mary Joseph nodule in colorectal cancer. Ulus Cerrahi Derg. 2014; 32: 295-7. [PubMed] [Google Scholar]
2. Wu YY, Xing CG, Jiang JX, Lu XD, Feng YZ, Wu HR. Carcinoma of the right side colon accompanied by Sister Mary Joseph's nodule and inguinal nodal metastases: a case report and literature review. Chin J Cancer. 2010; 29: 239-41. [PubMed] [Google Scholar]
3. Akhtar K, Zaheer S, Ahmad S, Sherwani RK. Sister Mary Joseph's nodule: a rare cytologic presentation. Clin Pract. 2011; 1: e6. [PubMed] [Google Scholar]
4. Hunis M, Hunis AP. The Sister Joseph's Nodule Historical Perspective Presentation of a Clinical (Own) Case Discussion and Review of the Literature. J Health Care and Research. 2020; 1: 166-71. [Google Scholar]
5. Wronski M, Klucinski A, Krasnodebski IW. Sister Mary Joseph nodule: a tip of an iceberg. J Ultrasound Med. 2014; 33: 531-4. [PubMed] [Google Scholar]
6. Powell FC, Cooper AJ, Massa MC, Goellner JR, Su WP. Sister Mary Joseph's nodule: a clinical and histologic study. J Am Acad Dermatol. 1984; 10: 610-5. [PubMed] [Google Scholar]
7. Al-Mashat F, Sibiany AM. Sister Mary Joseph's nodule of the umbilicus: is it always of gastric origin? A review of eight cases at different sites of origin. Indian J Cancer. 2010; 47: 65-9. [PubMed] [Google Scholar]

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