UNIVERSIDADE ESTADUAL DE CAMPINAS
FACULDADE DE ODONTOLOGIA DE PIRACICABA

ANDERSON MAURICIO PAIVA E COSTA

A LOCALIZAÇÃO DA EFUSÃO EM UMA ARTICULAÇÃO TEMPOROMANDIBULAR (ATM) QUE APRESENTA DESLOCAMENTO DE DISCO SEM REDUÇÃO É INFLUENCIADA PELA POSIÇÃO DO DISCO ARTICULAR DA ATM CONTRALATERAL

THE LOCATION OF EFFUSION IN A TEMPOROMANDIBULAR JOINT (TMJ) EXHIBITING DISC DISPLACEMENT WITHOUT REDUCTION IS INFLUENCED BY THE POSITION OF THE ARTICULAR DISC OF THE CONTRALATERAL TMJ

Piracicaba
2024

ANDERSON MAURICIO PAIVA E COSTA

A LOCALIZAÇÃO DA EFUSÃO EM UMA ARTICULAÇÃO TEMPOROMANDIBULAR (ATM) QUE APRESENTA DESLOCAMENTO DE DISCO SEM REDUÇÃO É INFLUENCIADA PELA POSIÇÃO DO DISCO ARTICULAR DA ATM CONTRALATERAL

THE LOCATION OF EFFUSION IN A TEMPOROMANDIBULAR JOINT (TMJ) EXHIBITING DISC DISPLACEMENT WITHOUT REDUCTION IS INFLUENCED BY THE POSITION OF THE ARTICULAR DISC OF THE CONTRALATERAL TMJ

Tese apresentada à Faculdade de Odontologia de Piracicaba da Universidade Estadual de Campinas como parte dos requisitos exigidos para a obtenção do título de Doutor em Estomatopatologia, na Área de Estomatologia.

Theses presented to the Piracicaba Dental School of the University of Campinas in partial fulfillment of the requirements for the degree of Doctor in Stomatopathology, in Stomatology area.

ORIENTADOR: PROF. DR. HÉLDER ANTÔNIO REBELO PONTES

ESTE EXEMPLAR CORRESPONDE À VERSÃO FINAL DA TESE DEFENDIDA PELO ALUNO ANDERSON MAURICIO PAIVA E COSTA ORIENTADO PELO PROF. DR. HÉLDER ANTÔNIO REBELO PONTES.

Piracicaba

2024

Ficha catalográfica
Universidade Estadual de Campinas (UNICAMP)
Biblioteca da Faculdade de Odontologia de Piracicaba
Marilene Girello - CRB 8/6159

C823L

Costa, Anderson Mauricio Paiva e, 1989-
A localização da efusão em uma articulação temporomandibular (ATM) que apresenta deslocamento de disco sem redução é influenciada pela posição do disco articular da ATM contralateral / Anderson Mauricio Paiva e Costa. – Piracicaba, SP : [s.n.], 2024.

Orientador: Helder Antonio Rebêlo Pontes.
Tese (doutorado) – Universidade Estadual de Campinas (UNICAMP), Faculdade de Odontologia de Piracicaba.

1. Articulação temporomandibular. 2. Disco da articulação temporomandibular. 3. Transtornos da articulação temporomandibular. 4. Imagem de ressonância magnética. I. Pontes, Helder Antonio Rebêlo, 1966-. II. Universidade Estadual de Campinas (UNICAMP). Faculdade de Odontologia de Piracicaba. III. Título.

Informações Complementares

Título em outro idioma: The location of effusion in a temporomandibular joint (TMJ) exhibiting disc displacement without reduction is influenced by the position of the articular disc of the contralateral TMJ
Palavras-chave em inglês:
Temporomandibular joint
Temporomandibular joint disc
Temporomandibular joint disorders
Magnetic resonance imaging
Área de concentração: Estomatologia
Titulação: Doutor em Estomatopatologia
Banca examinadora:
Helder Antonio Rebêlo Pontes [Orientador]
Felipe Paiva Fonseca
Nicolau Conte Neto
Paulo Sergio da Silva Santos
Ricardo de Souza Tesch
Data de defesa: 13-08-2024
Programa de Pós-Graduação: Estomatopatologia

Identificação e informações acadêmicas do(a) aluno(a)
- ORCID do autor: https://orcid.org/0000-0001-8953-4065
- Currículo Lattes do autor: https://lattes.cnpq.br/3955490148793360

UNIVERSIDADE ESTADUAL DE CAMPINAS
Faculdade de Odontologia de Piracicaba

A Comissão Julgadora dos trabalhos de Defesa de Tese de Doutorado, em sessão pública realizada em 13 de agosto de 2024, considerou o candidato ANDERSON MAURICIO PAIVA E COSTA aprovado.

PROF. DR. HELDER ANTONIO REBÊLO PONTES

PROF. DR. NICOLAU CONTE NETO

PROF. DR. PAULO SERGIO DA SILVA SANTOS

PROF. DR. FELIPE PAIVA FONSECA

PROF. DR. RICARDO DE SOUZA TESCH

A Ata da defesa, assinada pelos membros da Comissão Examinadora, consta no SIGA/Sistema de Fluxo de Dissertação/Tese e na Secretaria do Programa da Unidade.

DEDICATÓRIA

Dedico esta tese ao Prof. Dr. Hélder Antônio Rebelo Pontes, cuja incansável dedicação aos pacientes e exemplo de honestidade norteiam sua trajetória. Sua paixão pela Odontologia e seu compromisso com a excelência inspiram todos ao seu redor. Agradeço profundamente por toda orientação e apoio que me foram oferecidos ao longo desta jornada.

AGRADECIMENTOS

Agradeço a Deus pela saúde e por ter colocado pessoas importantissimas na minha vida, para me fortalecer e orientar em todos os momentos. Sou muito grato por dar esse orgulho à minha família, ter a oportunidade de ser o primeiro membro da minha família a ter um título de doutor.

Ao Prof. Dr. Hélder Antônio Rebelo Pontes, pela orientação e estar presente em todas as etapas do meu crescimento profissional, além de ser um exemplo para minhas decisões pessoais.

À Universidade Estadual de Campinas (UNICAMP), na pessoa dos professores da Faculdade de Odontologia de Piracicaba (FOP) Dr. Oslei Paes de Almeida, Dr. Pablo Vargas, Dr. Márcio Ajudarte Lopes, Dr. Alan Roger.

Aos meus familiares, em especial aos meus avós Euclides Costa, Zenaide Costa, minha mãe Andreia Costa e minha tia Elizabeth Costa.

A Joyce Rego, minha companheira de vida, minha motivadora incansável em todos os momentos.

A todos os colaboradores e colegas de pós-graduação e residentes que atuam e atuaram no Hospital João de Barros Barreto.

Agradeço a todos que ajudaram de forma direta e indireta para meu crescimento profissional, fazendo parte dessa conquista.

O presente trabalho foi realizado com apoio da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Código de Financiamento 001.

RESUMO

A articulação temporomandibular (ATM) faz parte do sistema estomatognático, com a Disfunção Temporomandibular (DTM) afetando cerca de 25% da população mundial, sendo mais comum em mulheres, e pode causar dor orofacial significativa, impactando a qualidade de vida. A Efusão articular (EA) na ATM, visível na Ressonância Magnética (RM), está relacionada à inflamação e pode indicar distúrbios internos dessa articulação. Este estudo visa avaliar se há relação entre o padrão da EA com o posicionamento do disco articular contralateral. Foi realizado um estudo observacional, retrospectivo, foram analisadas 1.202 ATMs através de exames de RM. A análise de correspondência e o teste qui-quadrado, foram utilizados para avaliar essa relação. Nossos resultados mostraram que, a efusão estava presente em 55,07% das ATMs analisadas, o espaço supra discal foi o mais afetado. Quando a ATM do lado analisado se encontra com disco articular (DA) em posição normal ou com redução, o padrão de efusão deste lado não sofre influência do tipo de deslocamento do disco articular (DDA) do lado oposto ($p>0,05$). Entretanto, quando o disco articular do lado analisado está com deslocamento sem redução, o lado contralateral pode influenciar no padrão de efusão do lado analisando ($p<0,05$). Em conclusão, em ATMs com DDA sem redução, a articulação contralateral pode modular o padrão de efusão no lado analisado. Enquanto as articulações com discos em posição normal ou com deslocamentos com redução o padrão de EA não é influenciado pela posição do DA na articulação contralateral.

Palavras-chave: Articulação Temporomandibular, Disco da articulação Temporomandibular, Transtornos da Articulação Temporomandibular, Imagem de Ressonância Magnética.

ABSTRACT

The temporomandibular joint (TMJ) is part of the stomatognathic system. The temporomandibular disorder (TMD) affects about 25% of the global population, being more common in women, and can cause significant orofacial pain, impacting quality of life. Joint effusion (JE) in the TMJ, visible on magnetic resonance imaging (MRI), is related to inflammation and can indicate internal disorders of this joint. This study aims to evaluate whether there is a relationship between the pattern of joint effusion (JE) and the positioning of the contralateral articular disc. An observational, retrospective study was conducted, analyzing 1,202 TMJs using magnetic resonance imaging (MRI). Correspondence analysis and the chi-square test were used to assess this relationship. Our results demonstrated that, effusion was present in 55.07% of the analyzed TMJs, with the supra discal space being the most affected. When the TMJ on the analyzed side has the articular disc (AD) in a normal position or with reduction, the effusion pattern on this side is not influenced by the type of disc displacement (DD) on the opposite side ($p>0.05$). However, when the articular disc on the analyzed side is displaced without reduction, the contralateral side can influence the effusion pattern on the analyzed side ($p<0.05$). In conclusion, in TMJs with DD without reduction, the contralateral joint can modulate the effusion pattern on the analyzed side. In joints with discs in a normal position or with reduction displacements, the JE pattern is not influenced by the AD position in the contralateral joint.

Keywords: Temporomandibular Joint, Temporomandibular Joint Disc, Temporomandibular Joint Disorders, Magnetic Resonance Imaging.

SUMÁRIO

1 INTRODUÇÃO

A articulação temporomandibular (ATM) é uma estrutura anatômica e biomecanicamente de difícil compreensão, sendo uma das articulações mais complexas em humanos, ela faz parte do sistema estomatognático, é uma articulação bilateral formada pela cabeça da mandíbula e parte do osso temporal[1]. No espaço entre esses ossos, encontra-se o disco articular (DA), este possui alto teor de colágeno o que melhora sua durabilidade e rigidez, o DA participa dos movimentos de rotação e translação da mandíbula, além de funcionar como amortecedor para as forças oclusais [2]. Além dessas estruturas ósseas e do DA, músculos e ligamentos fazem parte dessa complexa articulação. Sendo assim, a ATM é constituída por estruturas ósseas, musculares e fibrocartilaginosas, tornando sua fisiologia complexa. Alterações em tais estruturas podem causar uma variedade de problemas funcionais, conhecidos como disfunção temporomandibular (DTM)[3,4].

As DTMs é um termo geral para um grupo de doenças que afetam a articulação temporomandibular e disfunção dos músculos mastigatórios e estruturas adjacentes[5,6,7]. A DTM não é uma patologia incomum, afetando as culturas em todos os continentes, com acometimento de aproximadamente 11% em crianças, chegando a afetar até 31% dos adultos[8],No geral, cerca de um quarto da população mundial é acometida por DTMs, com a frequência em mulheres sendo mais que o dobro daquela observada em homens[2,9.] Tal disfunção é a causa mais comum de dor não odontogênica na região orofacial tendo um importante impacto na qualidade de vida e produtividade dos indivíduos acometidos, além de estar associada a comorbidades como ansiedade, depressão e doenças crônicas[10,11,12]. Os sinais e sintomas clínicos podem incluir além da dor na face e região pré-auricular, sensibilidade muscular, limitação da amplitude de movimentos da mandíbula, ruídos[13]. O diagnóstico de DTM geralmente envolve exame clínico (anamnese e exame físico) e exames de imagem da ATM).

Dentre as patologias das ATM's a condição mais comum é o deslocamento do disco articular (DDA), ele pode se dividir em basicamente dois tipos: o deslocamento anterior do disco com redução (ADDWR) e o deslocamento de disco anterior sem redução (ADDWoR) sendo o ADDWoR, que geralmente apresentam sinais e sintomas mais significativos, como dor, limitação de abertura de boca, sendo um maior desafio seu tratamento [1, 14]. Apesar de existirem outros tipos de deslocamentos, esses são mais raros[15]. Qualquer tipo de deslocamentos anormais causam um desequilíbrio na interação das estruturas osseas e a cartilagem do disco articular, com sobrecargas que podem gerar alterações morfológicas e ou degenerativas na ATM[16]. O deslocamento anterior do disco com redução (ADDWR), a principal alteração intra articular, quando a boca está fechada, o disco articular fica deslocado em relação a cabeça da mandíbula, retornando para região correta ao abrir a boca, a qual pode occorer um som de clique durante a movimentação da mandíbula [5,17,18].

A ressonância magnética (RM) é baseada na física de ressonância magnética nuclear, que foi representada pela primeira vez por Bloch e Purcell em 1946[19]. A RM tem sido descrita como exame padrão ouro para avaliações das ATMs, principalmente para os DDA e presença de efusão articular, pois permite a avaliação de todas as estruturas articulares, ao contrário da tomografia computadorizada, utilizada para avaliação principalmente dos componentes ósseos[20,21,22,23,24,25]. Muitos estudos avaliaram a acurácia dos achados patológicos de RM em relação aos sintomas clínicos. Deslocamentos de disco, degeneração óssea condilar, edema ósseo medular e efusão articular são achados que apresentaram relações com sintomas clínicos de DTM na literatura[3,23,26].

A detecção de aumento na quantidade no líquido sinovial articular (derrame articular) aumenta nossa compreensão dos distúrbios internos que afetam a ATM[27]. O derrame articular (EJ) no espaço da ATM está relacionado a presença de inflamação, aparecendo como um sinal de alta intensidade na ressonância magnética ponderada em T2[25,28,29]. O derrame articular, pode

estar relacionado a dor na região da ATM[30,31], e tende a está relacionada a desarranjo internos mais graves da ATM[32].

No entanto, poucos são os estudos que avaliaram a relação entre o deslocamento do disco articular e a localização da efusão articular de forma compartimentalizada, uma vez que não são bem conhecidos os mecanismos envolvidos no desenvolvimento dessas patologias, assim como se há influência da posição do disco contralateral na localização da efusão. Este estudo visa avaliar, através de ressonância magnética, uma relação do padrão de efusão com o posicionamento do disco contralateral.

2 ARTIGO

Artigo submetido ao periódico: Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology (TRIPLE O).

The location of effusion in a temporomandibular joint (TMJ) exhibiting disc displacement without reduction is influenced by the position of the articular disc of the contralateral TMJ.

Anderson Mauricio Paiva e Costa - **DDS, MSc**[1], Diogo dos Santos da Mata Rezende - **DDS, MSc, PhD**[1], Gabriela Sapêda dos Santos - **DDS**[1], Gabrielle Bastos Machado Ferreira - **DDS**[1], Tatiana Foscaldo Ribeiro Abreu Ribeiro - **DDS, MSc**[1], Aléssio Silva de Souza - **DDS**[1], Sue Ann Lavareda Corrêa Uchoa - **DDS, MSc**[1], Suelen Castro Lavareda Corrêa **- DDS, MSc, PhD**[1], Anderson Kikuchi Moraes de Oliveira - **DDS, MSc, PhD**[1], Flávia Sirotheau Correa Pontes - **DDS, MSc, PhD**[1] and Hélder Antônio Rebelo Pontes – **DDS, MSc, PhD**[1].

[1]Service of Oral Pathology, João de Barros Barreto University Hospital, Federal University of Para, Belem, Para, Brazil

Corresponding Author:

Anderson Mauricio Paiva e Costa – DDS, MSc.

Department of Surgery and Oral Pathology

Adress: João de Barros Barreto University Hospital, Mundurucus Street, nº 4487, Zip Code 66073-000, Guamá

Belém, Pará, Brazil.

Telephone +55 91 32016786;

e-mail address: mpaivaecosta@gmail.com

The authors state that they have no potential conflict of interest that could bias the results obtained in the current study.

The authors state that they had no financial support to develop this research.

Ethics statement: All the authors complied with the ethical policies outlined on the journal's author guidelines page.

Clinical Relevance: Understanding the influence of the contralateral TMJ on JE location in cases of DD without reduction can improve diagnosis and treatment, leading to more effective and personalized interventions for TMJ dysfunctions.

Structured Abstract: 167 words; Manuscript: 2799 words; Figures: 4; Tables: 5.

References: 56.

Keywords: Temporomandibular Joint, Temporomandibular Joint Disc, Temporomandibular Joint Disorders, Magnetic Resonance Imaging, Joint effusion.

Structured Abstract

Objective: This study evaluates the relationship between joint effusion (JE) patterns and the position of the contralateral articular disc (AD).

Study Design: An observational, longitudinal, retrospective study analyzed 1,202 TMJs using MRI. Correspondence analysis and the chi-square test assessed this relationship.

Results: Effusion was present in 55.07% of the TMJs analyzed, the supra discal space was the most affected. When the TMJ on the analyzed side has the AD in a normal position or with reduction, the effusion pattern on this side is not influenced by the type of disc displacement (DD) on the opposite side ($p>0.05$). However, when the AD on the analyzed side is displaced without reduction, the contralateral side can influence the effusion pattern on the analyzed side ($p<0.05$).

Conclusion: In TMJs with DD without reduction, the contralateral joint can modulate the effusion pattern on the analyzed side. In joints with discs in a normal position or with reduction displacements, the JE pattern is not influenced by the AD position in the contralateral joint.

The location of effusion in a temporomandibular joint (TMJ) exhibiting disc displacement without reduction is influenced by the position of the articular disc of the contralateral TMJ.

Introduction

The temporomandibular joint (TMJ) is a component of the stomatognathic system, comprised of the mandibular condyle and a portion of the temporal bone[1]. Within the interposed space of these bones lies the articular disc (AD), characterized by a high collagen content, crucial for facilitating both rotational and translational movements of the mandible, while also serving as a cushion against occlusal forces[2]. Alongside these osseous components and the AD, the TMJ comprises muscles and ligaments, contributing to its complexity. Alterations within these structures can lead to various functional disturbances, recognized as temporomandibular disorders (TMD)[3,4].

TMD is a general term for temporomandibular joint diseases and masticatory muscle dysfunction[5,6]. TMD is not an uncommon pathology, affecting approximately 25% of the global population, with a prevalence in women more than double that observed in men[2,7]. Such dysfunction is the most common cause of non-odontogenic pain in the orofacial region, significantly impacting the quality of life and productivity of affected individuals, and is associated with comorbidities such as anxiety, depression, and chronic diseases[8,9,10]. Clinical signs and symptoms may include not only pain in the face and pre-auricular region but also muscle tenderness, limited range of jaw motion and joint noises[11]. The diagnosis of TMD generally involves clinical examination (history taking and physical examination) and imaging tests of the TMJ.

Among TMJ pathologies, the most common condition is articular disc displacement (ADD), with anterior disc displacement with reduction (ADDWR) being the main intra-articular change, which may be accompanied by a clicking sound during jaw movement[12].

Magnetic resonance imaging (MRI) is based on the physicals principles of nuclear magnetic resonance, initially elucidated by Bloch and Purcell in 1946[13]. MRI has been established as the gold standard examination for TMJ evaluation, particularly in cases of ADD and those with joint effusion, as it enables comprehensive assessment of all joint structures, unlike computed tomography, which primarily evaluates bone components[14,15,16,17,18,19].

The increase in joint synovial fluid volume (joint effusion) enhances our comprehension of internal disorders affecting the TMJ[20]. Joint effusion (JE) within the TMJ space is correlated with inflammation and presents as a high-intensity signal on T2-weighted MRI[19,21,22]. JE may be associated with TMJ region pain[23,24], and more severe internal disorders in this area [25].

However, few studies have assessed the relationship between articular disc displacement and the location of joint effusion in a compartmentalized manner, as the mechanisms involved in the development of these pathologies are not well understood, nor is it known if there is an influence of the contralateral disc position on effusion location. This study aims to evaluate, through magnetic resonance imaging, the relationship between effusion pattern and contralateral disc positioning.

Material and Methods

Sample selection

An observational, retrospective study was conducted at a private diagnostic imaging clinic located in Belém, Pará, Brazil. MRI scans of patients of both genders were analyzed from January 2017 to December 2022, presenting clinical signs and symptoms indicative of intra-articular temporomandibular joint dysfunction. Exclusion criteria included incomplete exams, patient movement during imaging, congenital deformities (such as bifid condyle, hyperplasia, and hypoplasia), joint ankylosis, condylar prostheses, exams with imaging artifacts (such as screws or metal plates in the region), and severe degenerative changes impeding disc analysis.

Magnetic resonance imaging and image analysis

MRIs of the TMJs were conducted using a 1.5-T Tesla SIGNATM Explorer device (GE Healthcare, Milwaukee, WI, USA). Images were acquired employing the fast spin-echo technique, encompassing sagittal oblique and coronal sections weighted in T1, T2, STIR, and DP sequences, with patients in both open and closed mouth positions. All images were acquired by a trained and calibrated radiologist who was blinded to patient information. Subsequently, the images were analyzed by two dental surgeons specialized in radiology and experienced in TMJ MRI analysis. In instances of disagreement, the two reviewers convened to achieve consensus; if consensus was not reached, the image was discarded. Analyzed exam characteristics included the position of the articular disc and the presence of effusion within the joint spaces.

Effusion analysis

To analyze joint effusions in the TMJ, T2-weighted images were assessed. Effusion was considered present when more than one line of hypersignal was evident in at least two consecutive sections[26]. When present, effusions were classified according to their location (Figure 1) as follows: supra-disc effusion, retro-disc effusion, infra-disc effusion, supra and infra-disc effusion, supra and retro-disc effusion, retro and infra-disc effusion, and supra/retro/infra-disc effusion. In the absence of effusion, the classification was recorded as: without effusion.

Analysis of the articular disc position

To analyze the disc position relative to the condyle, the following parameters were utilized[27,28,29]:

Superior (normal) position of the disc: The posterior band of the articular disc was situated above the apex of the condyle (between the 11 o'clock and 12 o'clock positions) in the

intercuspal position and the intermediate thin zone between the condyle and the eminence during maximum mouth opening.

Displacement of the disc with reduction: The posterior band of the disc was situated anterior to the condyle in the closed-mouth position; however, the normal relationship between the condyle and the disc was restored in the maximum opening position.

Disc displacement without reduction: The posterior band was positioned anterior to the condyle either in the closed or maximum mouth opening position.

Statistical analysis

The data collected in the study were tabulated in a digital spreadsheet (Microsoft Excel - Windows 2010) and subsequently analyzed using RStudio software (version 4.2.2). To assess associations among categorical variables in a multivariate manner, correspondence analysis technique was employed, and chi-square test (X^2) was conducted to analyze the dependence between variables: disc displacement and effusion, with a significance level set at 0.05 ($p < 0.05$). Residue analysis indicated the probability of associations between categorical variables in the study. A probability greater than or equal to 70% was considered significant for determining associations between variable categories. Graph analysis involved examination of geometric proximity relationships and projections in dimensions identifiable from points on the graph.

Ethical considerations

This study adhered to the Guidelines and Regulatory Norms for Research Involving Human Subjects, in accordance with Resolution 466/2012[30] of the National Health Council. Additionally, it considered the Universal Declaration of Human Rights from 1948[31], ensuring respect for autonomy, human dignity, protection of life, freedom, and culture.

The present study was initiated after approval from ethics committee, and it was governed by the determinations of the Guidelines and Regulatory Norms for Research Involving Human Beings, in accordance with Resolution 466/2012[30] of the National Health Council. Also considering the Universal Declaration of Human Rights from 1948[31], the research will be conducted with respect for autonomy, human dignity, protection of life, freedom, and culture.

Having been approved by the ethics committee (CAAE 31975720.4.0000.0018)

Results

Global analysis

A total of 673 exams were analyzed, with 72 exams excluded for the following reasons: incomplete scans or movement artifacts (09), congenital deformities (17), joint ankylosis or condylar prostheses (02), image artifacts (03), severe degenerative changes (34), and lack of consent to participate in the research (07). Thus, 601 exams were included in the analysis, totaling 1,202 temporomandibular joints (TMJ). Females were predominantly affected, with a ratio of 4.5:1. The mean age across all participants was 39.8 years (range: 9 to 83 years). The average age among females was 40 years, whereas among males, it was 38.6 years. Among all TMJs analyzed, disc location was preserved in 234 (19.47%), while disc displacement with reduction was observed in 672 (55.90%), and displacement without reduction was found in 296 (24.63%). Of the 1,202 TMJs, 540 (44.93%) showed no effusion, while 662 (55.07%) exhibited effusion in at least one joint space. Among the TMJs that presented effusions in a single joint compartment or in more than 1 compartment, 77.34% had effusion present in the supradiscal space, being the most affected overall, followed by the retrodiscal space (47.43%) and infradiscal space (31.27%). When considering only the TMJs with disc displacements with reduction and infradiscal effusions represented 114 (32.6%), while for displacements without

reduction, there were 67 (29%). Taking into account only the condyles with hypomobility, the percentage of presence of infradiscal effusions drops to 17.43%.

Correlation between the effusion location on the analyzed side and the position of the contralateral articular disc

When the TMJ on the analyzed side is found with the articular disc in a normal position (Table I) or with reduction (Table II), the effusion pattern on this side is not influenced by the type of displacement of the contralateral articular disc ($p>0.05$). Therefore, the pattern of joint effusion in TMJs with the articular disc in a normal position on the analyzed side, without considering the TMJ on the opposite side, tends not to present effusion in the joint spaces with 100% confidence values (Table III) (Figure 2). While in patients with disc displacement with reduction without considering the TMJ on the opposite side, it was observed with 73.04% confidence a tendency not to present any type of intra-articular effusion. However, when effusion is present, it tends to occur in the supra and infradiscal spaces simultaneously, with 75.39% confidence in the statistical tests (Table III) (Figure 2).

However, when the articular disc on the analyzed side is displaced without reduction (Table IV), the contralateral side influences the effusion pattern on the analyzing side ($p<0.05$). In this regard, when the contralateral articular disc is in a normal position, the analyzed side may present with 92.41% confidence a pattern of effusion that involves all three spaces simultaneously: supra, retro, and infradiscal. However, when the contralateral articular disc presents displacement with reduction, the analyzed side tends, with 90.28% confidence, to present only the supradiscal effusion pattern. However, when the contralateral articular disc is displaced without reduction, there is a strong tendency with 93.97% confidence for the analyzed side not to present effusion (Table V) (Figure 3) (Figure 4).

Discussion

Magnetic resonance imaging (MRI), by revealing details of both soft and hard tissues, is the main tool for evaluating changes in the temporomandibular joints[14, 15, 16,1718,19]. In this regard, MRI is considered the gold standard examination for describing alterations in the articular disc, as well as identifying areas with joint effusion[32].

Joint effusion, identified on MRI as a hyperintense signal on T2-weighted sequences[19,22,33,34] corresponds to an inflammatory process, with several studies showing increased concentrations of pro-inflammatory factors such as interleukin-6 (IL-6) and IL-8 in joint tissues and synovial fluid[35,36]. There is no consensus in the literature whether such effusion areas are present at the onset of observed changes in the TMJ [21] or represent a late event associated with more pronounced joint[37].

Our results showed that TMDs have a predilection for females, with a ratio of 4.5:1, corroborating with most studies reported in the literature[16,38,39,40,41,42,43]. Female hormonal influences may partially explain the higher number of women affected by TMDs, determining a greater laxity of ligaments[44,45,46]. Additionally, it has been described that women present a higher amount of type III collagen in the retrodiscal[47]. The average age of the patients was 39.8 years, like those found by Pinto et al., 2019, and Muraoka et al., 2017[40,48].

In our analysis, the main alteration in the positioning of the articular disc was anterior displacement with reduction. In this regard, the frequency of anterior disc displacement with reduction (ADDWR) represented 69.4%, while anterior disc displacements without reduction (ADDWOR) represented 30.6%. This result was corroborated by numerous authors [12,21,29,49,50]. This finding indicates that anterior disc displacement without reduction is a later event in this process of joint disease.

Effusion was present in at least one joint compartment in just over half (55.07%) of the analyzed exams. Other authors have reported similar data, where effusion appears in

approximately half of the cases analyzed by MRI in patients with TMD[51,52]. On the other hand, a recent study by Li et al., 2024[53] shows that the presence of effusion is a less frequent event, affecting only 20% of the analyzed exams. An explanation for this difference could be the criterion for considering effusion; these authors consider effusion present when the fluid signal appears in 4 consecutive cuts in MRI, while most studies, including this one, consider effusion present in two consecutive T2 cuts.

This study aimed to assess whether the observed disc position in both joints interferes with the location of effusion observed in joints presenting disc displacements.

Our results showed that when have displacement without reduction, we should consider the contralateral side to better define the location of the effusion. Thus, when the contralateral disc is in a normal position, the side with displacement without reduction tends to have an effusion pattern involving all three spaces simultaneously (supra, retro, and infradiscal). This more intense effusion pattern can be explained by the fact that the temporomandibular joint is an articulation with symmetrical and coordinated movements[54,55]. Thus, in this TMJ model, the side of the joint showing displacement without reduction would present greater mechanical/inflammatory damage due to the asymmetry caused by the difference in the position of the articular discs.

In the cases that the analyzed side presents the disc with displacement without reduction and the contralateral side exhibits displacement with reduction, there is a tendency to observe effusion only in the supradiscal compartment. Such a condition, in our analysis, may be attributed to the imbalance being less intense, occurring only during a part of the mandibular movement, following the disc recapture.

When the analyzed joint has the articular disc without reduction and the contralateral TMJ also presents the disc with displacement without reduction, there is a strong tendency for there to be no effusion. We believe that disc displacements without reduction occurring

bilaterally, with no correlation with joint effusion, may be justified by some pattern of adaptation of TMD or because the disease is at a more advanced stage.

On the other hand, according to our results, when the analyzed TMJ has the articular disc in a normal position or with reduction, the contralateral side will not influence the effusion pattern of the analyzed side.

Therefore, regardless of the position of the disc of the contralateral TMJ, when the analyzed side is in a normal position, there is a strong tendency for no effusion to occur in the joint spaces in line with Hosgor, 2019[23]. However, when the analyzed joint is displaced with reduction, regardless of the opposite side, we will find the possibilities: no effusion or effusion present with a tendency to affect the supra and infra discal spaces simultaneously. There is strong consensus in the literature that reductions are unlikely to be related to joint effusions[23,56]. However, these authors did not analyze the location of effusions in the joint spaces individually and in detail.

Conclusion

In conclusion, we observed that when the joint presents disc displacement without reduction, it is important to consider the contralateral joint, because it modulates the effusion pattern on the analyzed side. However, when analyze joints with discs in a normal position or with reduction displacements, the effusion pattern is not influenced by the disc position in the contralateral joint.

References

1. Okeson, J. P. (2019) Management of temporomandibular disorders and occlusion -E-book. St. Louis, MO: Elsevier Health Sciences.
2. Lee, Y. H., Won, J. H., Kim, S., Auh, Q. S., & Noh, Y. K. (2022). Advantages of deep learning with convolutional neural network in detecting disc displacement of the temporomandibular joint in magnetic resonance imaging. Scientific Reports, 12(1), 11352.
3. Poluha, R. L., Canales, G. D. L. T., Costa, Y. M., Grossmann, E., Bonjardim, L. R., & Conti, P. C. R. (2019). Temporomandibular joint disc displacement with reduction: a review of mechanisms and clinical presentation. Journal of applied oral science, 27.
4. De Stefano, A. A., Guercio-Monaco, E., Hernández-Andara, A., & Galluccio, G. (2020). Association between temporomandibular joint disc position evaluated by magnetic resonance imaging and mandibular condyle inclination evaluated by computed tomography. Journal of Oral Rehabilitation, 47(6), 743-749.
5. List, T., & Jensen, R. H. (2017). Temporomandibular disorders: old ideas and new concepts. Cephalalgia, 37(7), 692-704.
6. Manfredini, D., Guarda-Nardini, L., Winocur, E., Piccotti, F., Ahlberg, J., & Lobbezoo, F. (2011). Research diagnostic criteria for temporomandibular disorders: a systematic review of axis I epidemiologic findings. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 112(4), 453-462.
7. Wilentz, J. B., & Cowley Jr, A. W. (2017). How can precision medicine be applied to temporomandibular disorders and its comorbidities?.
8. Johansson, A., Unell, L., Carlsson, G. E., Söderfeldt, B., & Halling, A. (2003). Gender difference in symptoms related to temporomandibular disorders in a population of 50-year-old subjects. Journal of orofacial pain, 17(1).

9. Rodrigues, C. A., Magri, L. V., Melchior, M. D. O., & Mazzetto, M. O. (2015). Evaluation of the impact on quality of life of patients with temporomandibular disorders. Revista Dor, 16, 181-185.
10. Conti, P. C. R., Pinto-Fiamengui, L. M. S., Cunha, C. O., & Conti, A. C. D. C. F. (2012). Orofacial pain and temporomandibular disorders: the impact on oral health and quality of life. Brazilian oral research, 26, 120-123.
11. Ito, S., Mine, Y., Yoshimi, Y., Takeda, S., Tanaka, A., Onishi, A., ... & Tanimoto, K. (2022). Automated segmentation of articular disc of the temporomandibular joint on magnetic resonance images using deep learning. Scientific Reports, 12(1), 221.
12. Miernik, M., & Więckiewicz, W. (2015). The Basic Conservative Treatment of Temporomandibular Joint Anterior Disc Displacement Without Reduction--Review. management, 13, 15.
13. Purcell, E. M., Torrey, H. C., & Pound, R. V. (1946). Resonance absorption by nuclear magnetic moments in a solid. Physical review, 69(1-2), 37
14. Vervaeke, K., Verhelst, P. J., Orhan, K., Lund, B., Benchimol, D., Van der Cruyssen, F., ... & Politis, C. (2022). Correlation of MRI and arthroscopic findings with clinical outcome in temporomandibular joint disorders: a retrospective cohort study. Head & Face Medicine, 18(1), 2.
15. Johnson, M., Sreela, L. S., Mathew, P., & Prasad, T. S. (2022). Actual applications of magnetic resonance imaging in dentomaxillofacial region. Oral Radiology, 38(1), 17-28
16. Matsubara, R., Yanagi, Y., Oki, K., Hisatomi, M., Santos, K. C., Bamgbose, B. O., ... & Asaumi, J. (2018). Assessment of MRI findings and clinical symptoms in patients with temporomandibular joint disorders. Dentomaxillofacial Radiology, 47(4), 20170412.

17. Higuchi, K., Chiba, M., Sai, Y., Yamaguchi, Y., Nogami, S., Yamauchi, K., & Takahashi, T. (2020). Relationship between temporomandibular joint pain and magnetic resonance imaging findings in patients with temporomandibular joint disorders. International Journal of Oral and Maxillofacial Surgery, 49(2), 230-236.
18. Litko, M., Berger, M., Szkutnik, J., & Różyło-Kalinowska, I. (2017). Correlation between direction and severity of temporomandibular joint disc displacement and reduction ability during mouth opening. Journal of Oral Rehabilitation, 44(12), 957-963.
19. Ferreira, L. A., Grossmann, E., Januzzi, E., Paula, M. V. Q. D., & Carvalho, A. C. P. (2016). Diagnosis of temporomandibular joint disorders: indication of imaging exams. Brazilian journal of otorhinolaryngology, 82, 341-352.
20. Gynther, G. W., Holmlund, A. B., & Reinholt, F. P. (1994). Synovitis in internal derangement of the temporomandibular joint: correlation between arthroscopic and histologic findings. Journal of oral and maxillofacial surgery, 52(9), 913-917
21. Reverand, S. D., Guerra, M. M., Campo, J. R., Escorial, V., & Cordero, J. (2020). Correlation between joint effusion and clinical symptoms, magnetic resonance imaging and arthroscopic findings in patients with temporomandibular joint disease. Journal of Cranio-Maxillofacial Surgery, 48(12), 1146-1151.
22. Harms, S. E., Wilk, R. M., Wolford, L. M., Chiles, D. G., & Milam, S. B. (1985). The temporomandibular joint: magnetic resonance imaging using surface coils. Radiology, 157(1), 133-136.
23. Hosgor, H. (2019). The relationship between temporomandibular joint effusion and pain in patients with internal derangement. Journal of Cranio-Maxillofacial Surgery, 47(6), 940-944.

24. Milam, S. B., & Schmitz, J. P. (1995). Molecular biology of temporomandibular joint disorders: proposed mechanisms of disease. Journal of oral and maxillofacial surgery, 53(12), 1448-1454.
25. Costa, A. L., D'Abreu, A., & Cendes, F. (2008). Temporomandibular joint internal derangement: association with headache, joint effusion, bruxism, and joint pain. J Contemp Dent Pract, 9(6), 9-16.
26. Emshoff, R., Brandlmaier, I., Bertram, S., & Rudisch, A. (2003). Relative odds of temporomandibular joint pain as a function of magnetic resonance imaging findings of internal derangement, osteoarthrosis, effusion, and bone marrow edema. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 95(4), 437-445
27. Koca, C. G., Gümrükçü, Z., & Bilgir, E. (2020). Does clinical findings correlate with magnetic resonance imaging (MRI) findings in patients with temporomandibular joint (TMJ) pain? A cross sectional study. Medicina Oral, Patología Oral y Cirugía Bucal, 25(4), e495.
28. Kumar, R., Pallagatti, S., Sheikh, S., Mittal, A., Gupta, D., & Gupta, S. (2015). Suppl 2: M4: Correlation Between Clinical Findings of Temporomandibular Disorders and MRI Characteristics of Disc Displacement. The open dentistry journal, 9, 273.
29. Vogl, T. J., Lauer, H. C., Lehnert, T., Naguib, N. N., Ottl, P., Filmann, N., ... & Nour-Eldin, N. E. A. (2016). The value of MRI in patients with temporomandibular joint dysfunction: Correlation of MRI and clinical findings. European journal of radiology, 85(4), 714-719.
30. Resolution No. 466 of December 12, 2012: guidelines and regulatory standards for research involving human beings. Brasília (DF): MS; 2012.
31. United Nations General Assembly. The Universal Declaration of Human Rights (UDHR). New York: United Nations General Assembly, 1948.

32. Ahmad, M., Hollender, L., Anderson, Q., Kartha, K., Ohrbach, R., Truelove, E. L., & Schiffman, E. L. (2009). Research diagnostic criteria for temporomandibular disorders (RDC/TMD): development of image analysis criteria and examiner reliability for image analysis. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 107(6), 844-860.
33. Sano, T., & Westesson, P. L. (1995). Magnetic resonance imaging of the temporomandibular joint: increased T2 signal in the retrodiskal tissue of painful joints. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 79(4), 511-516.
34. Suenaga, S., Nagayama, K., Nagasawa, T., Indo, H., & Majima, H. J. (2016). The usefulness of diagnostic imaging for the assessment of pain symptoms in temporomandibular disorders. Japanese Dental Science Review, 52(4), 93-106.
35. Kaneyama, K., Segami, N., Sun, W., Sato, J., & Fujimura, K. (2005). Levels of soluble cytokine factors in temporomandibular joint effusions seen on magnetic resonance images. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 99(4), 411-418.
36. Segami N, Nishimura M, Kaneyama K, Miyamaru M, Sato J, Murakami KI. Does joint effusion on T2 magnetic resonance images reflect synovitis? Comparison of arthroscopic findings in internal derangements of the temporomandibular joint. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001 Sep;92(3):341-5. doi: 10.1067/moe.2001.117808. PMID: 11552156.
37. Pasqual, P. G. V., Poluha, R. L., Setogutti, Ê. T., & Grossmann, E. (2020). Evaluation of effusion and articular disc positioning after two different arthrocentesis techniques in patients with temporomandibular joint disc displacement without reduction. CRANIO, 38(4), 256-263.

38. Yasan, G. T., Adiloglu, S., Tuz, H. H., & Sahar, D. (2023). Evaluation of clinical signs and magnetic resonance imaging findings in patients with temporomandibular disorders. Journal of Cranio-Maxillofacial Surgery, 51(7-8), 441-447.
39. Li, C., & Zhang, Q. (2023). Comparison of imaging findings of 714 symptomatic and asymptomatic temporomandibular joints: a retrospective study. BMC Oral Health, 23(1), 79.
40. de Souza Pinto, G. N., Grossmann, E., Iwaki Filho, L., Groppo, F. C., Poluha, R. L., Muntean, S. A., & Iwaki, L. C. V. (2019). Correlation between joint effusion and morphology of the articular disc within the temporomandibular joint as viewed in the sagittal plane in patients with chronic disc displacement with reduction: A retrospective analytical study from magnetic resonance imaging. CRANIO.
41. Grossmann, E., Poluha, R. L., Iwaki, L. C. V., Santana, R. G., & Iwaki Filho, L. (2018). Predictors of arthrocentesis outcome on joint effusion in patients with disk displacement without reduction. Oral surgery, oral medicine, oral pathology and oral radiology, 125(4), 382-388.
42. Li, L., Shi, H., Xie, H., & Wang, L. (2018). MRI assessment and histopathologic evaluation of subchondral bone remodeling in temporomandibular joint osteoarthritis: a retrospective study. Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology, 126(4), 355-362.
43. Guarda-Nardini, L., Rossi, A., Ramonda, R., Punzi, L., Ferronato, G., & Manfredini, D. (2014). Effectiveness of treatment with viscosupplementation in temporomandibular joints with or without effusion. International journal of oral and maxillofacial surgery, 43(10), 1218-1223.
44. Lazarin, R. D., Previdelli, I. T. S., Iwaki, L. C. V., & Grossmann, E. (2016). Correlation of gender and age with magnetic resonance imaging findings in patients with

arthrogenic temporomandibular disorders: a cross-sectional study. International journal of oral and maxillofacial surgery, 45(10), 1222-1228.

45. Poveda Roda, R., Bagán, J. V., Díaz Fernández, J. M., Hernández Bazán, S., & Jiménez Soriano, Y. (2007). Review of temporomandibular joint pathology: Part I: Classification, epidemiology and risk factors. Medicina Oral, Patología Oral y Cirugía Bucal (Internet), 12(4), 292-298.
46. Shaefer, J. R., Holland, N., Whelan, J. S., & Velly, A. M. (2013). Pain and temporomandibular disorders: A pharmaco-gender dilemma. Dental Clinics, 57(2), 233-262.
47. Dias, I. M., Coelho, P. R., Assis, N. M. S. P., Leite, F. P. P., & Devito, K. L. (2012). Evaluation of the correlation between disc displacements and degenerative bone changes of the temporomandibular joint by means of magnetic resonance images. International journal of oral and maxillofacial surgery, 41(9), 1051-1057.
48. Muraoka, H., Kaneda, T., Kawashima, Y., Hirahara, N., Fukuda, T., Muramatsu, T., & Ito, K. (2017). Parotid lymphadenopathy is associated with joint effusion in non-neoplastic temporomandibular disorders. Journal of Oral and Maxillofacial Surgery, 75(3), 491-497.
49. Giozet, A. F., Iwaki, L. C. V., Grossmann, E., Previdelli, I. T. S., Pinto, G. N. D. S., & Iwaki Filho, L. (2019). Correlation between clinical variables and magnetic resonance imaging findings in symptomatic patients with chronic temporomandibular articular disc displacement with reduction: A retrospective analytical study. CRANIO, 37(6), 374-382.
50. LeResche, L., & Von Korff, M. (1992). Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J craniomandib Disord, 6(4), 301-355.

51. Eriksen, E. S., Hellem, S., Skartveit, L., Brun, J. G., Bøe, O. E., Moen, K., & Geitung, J. T. (2020). Temporomandibular joint pain and associated magnetic resonance findings: a retrospective study with a control group. Acta Radiologica Open, 9(9), 2058460120938738.
52. Thomas, N., Harper, D. E., & Aronovich, S. (2018). Do signs of an effusion of the temporomandibular joint on magnetic resonance imaging correlate with signs and symptoms of temporomandibular joint disease?. British Journal of Oral and Maxillofacial Surgery, 56(2), 96-100.
53. Li, C., Chen, B., Zhang, R., & Zhang, Q. (2024). Comparative study of clinical and MRI features of TMD patients with or without joint effusion: a retrospective study. BMC Oral Health, 24(1), 314.
54. Kubein-Meesenburg, D., Nägerl, H., Fialka-Fricke, J., Hahn, W., Weber, S., Hönig, J., ... & Ihlow, D. (2012). Functional states of mandibular movements and synovial pumps of the temporomandibular joint. Is it possible to provide a biomechanically correct replacement for the TMJ?. Annals of Anatomy-Anatomischer Anzeiger, 194(2), 200-207.
55. Brown, T. (1975). Mandibular movements. Monographs in Oral Science, 4, 126-150.
56. Manfredini, D., Basso, D., Arboretti, R., & Guarda-Nardini, L. (2009). Association between magnetic resonance signs of temporomandibular joint effusion and disk displacement. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 107(2), 266-271.

FIGURE LEGENDS:

Figure 1: Images of ATMs in oblique sagittal cuts, T2-weighted, showing the locations of effusions (arrow): A - no effusion, B - supra discal effusion, C - retro discal effusion, D - infra discal effusion, E - supra and retro discal effusion, F - supra and infra discal effusion, G - infra and retro discal effusion, H - supra/retro/infra discal effusion.

Figure 2: Correspondence map with the categories of variables: effusion location and articular disc position, without considering the position of the contralateral TMJ articular disc.

Figure 3: Correspondence map with the categories of variables: Effusion Location on the Analyzed Side and the Position of the Articular Disc in the Contralateral TMJ.

Figure 4: Illustrative drawing of the trends of effusion locations in TMJs with articular disc displacement (ADD) WITHOUT REDUCTION being influenced by the type of displacement of the contralateral disc.

TABLE LEGENDS:

Table I: Test Result Based on the Chi-Square Value, Descriptive Level (p), to Verify the Dependence of the Variables Effusion on the Analyzed Side (disc in normal position) and Position of the Contralateral Disc.

Table II: Test Result Based on the Chi-Square Value, Descriptive Level (p), to Verify the Dependency of the Variables Effusion on the Analyzed Side (disc with displacement with reduction) and Position of the Contralateral Disc.

Table III: Residue and Confidence Level Obtained from the Correspondence Analysis of the Variables effusion location and disc position, without considering the contralateral TMJ.

Table IV: Test Result from the Chi-Square Value, Descriptive Level (p), to Verify the Dependency of Variables: Effusion on the Analyzed Side (disc with displacement without reduction) and Contralateral Disc Position.

Table V: Residual and Confidence Level Obtained from the Correspondence Analysis of the Variables: Effusion Location on the Analyzed Side and Articular Disc Position in the Contralateral TMJ.

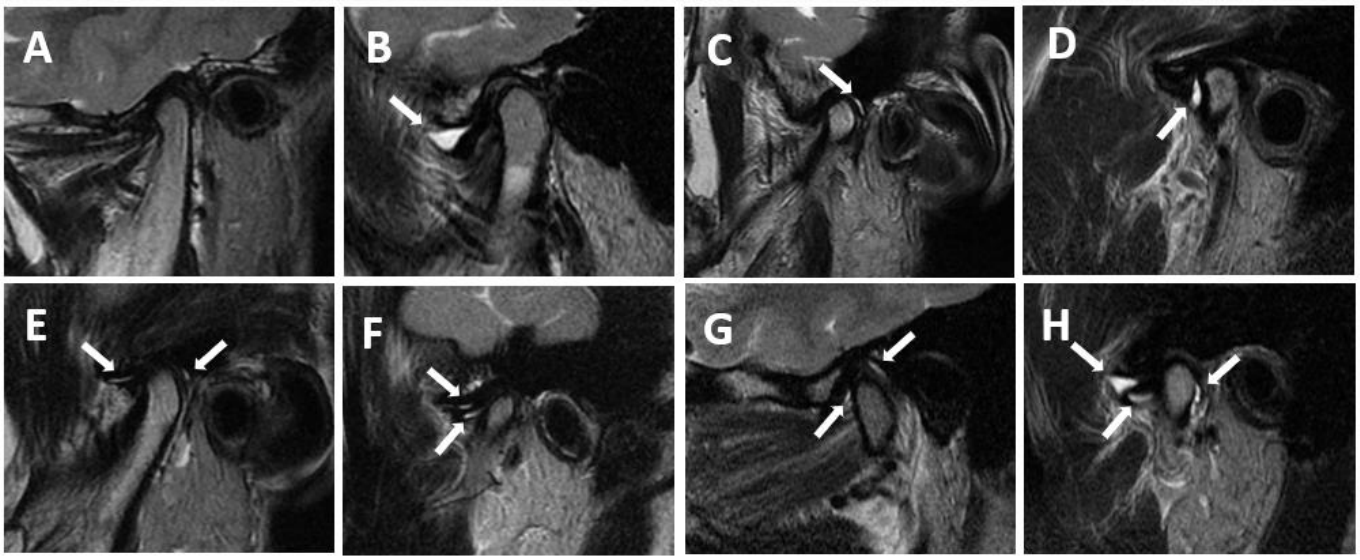


FIGURE 1

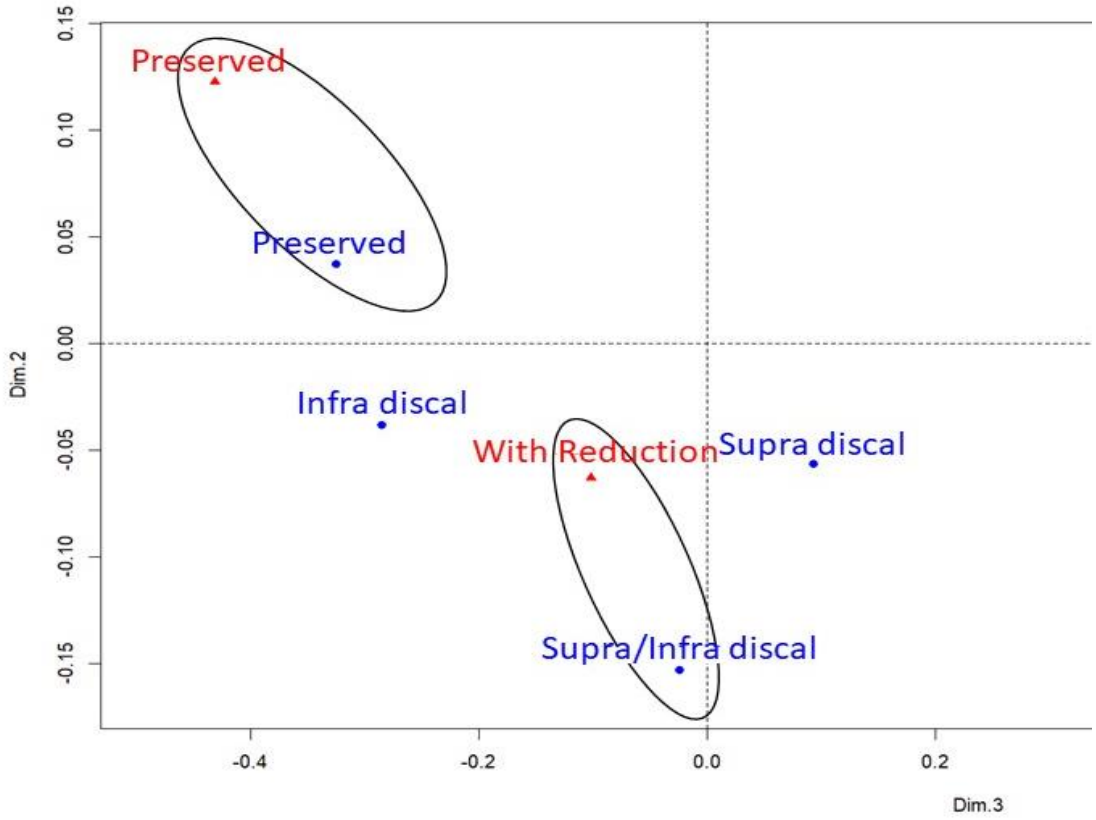
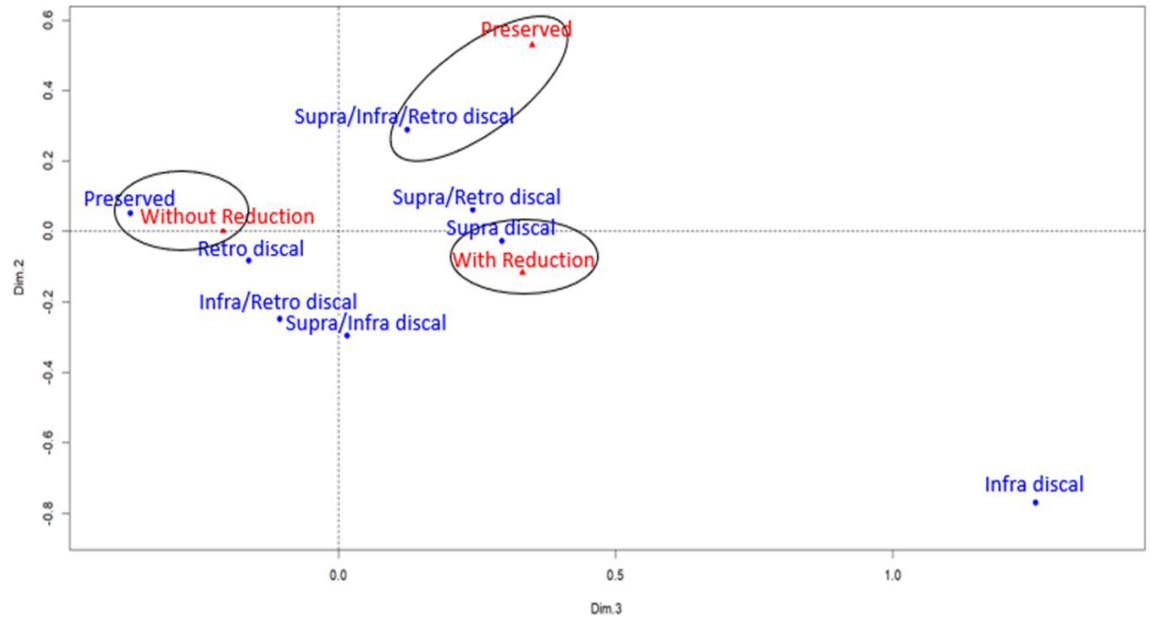


FIGURE 2



FIFURE 3

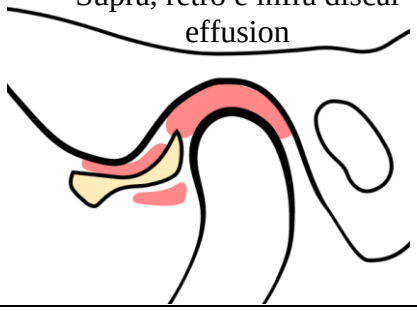
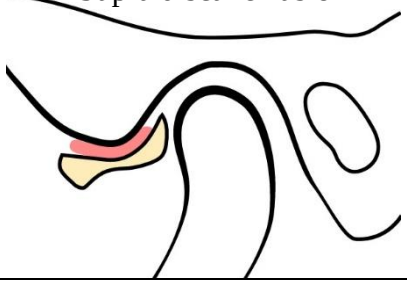
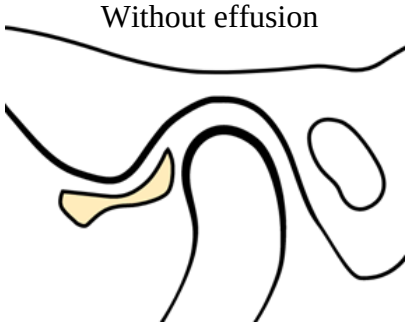
Effusion pattern on the analyzed side (ADD without reduction)	Contralateral articular disc position
Supra, retro e infra discal effusion 	Normal position
Supra discal effusion 	ADD with
Without effusion 	ADD without

FIGURE 4

Variable	χ^2	p	Result
Effusion / Displacement	18.695	0.09616	Independent

Table I:

Variable	χ^2	p	Result
Effusion / Displacement	13.381	0.4967	Independent

Table II

Effusion	Position of the articular disc	
	Preserved	With reduction
Preserved	4.723 **(100.000%)**	1.104 **(73.041%)**
Retro disc effusion	-2.049 (0.000%)	-1.691 (0.000%)
Supra disc effusion	-1.310 (0.000%)	0.219 (17.335**%)**
Infra disc effusion	0.361 (28.190%)	0.243 (19.199%)
Infra and retro disc effusion	-0.984 (0.000%)	-0.480 (0.000%)
Supra and infra disc effusion	-1.105 (0.000%)	1.160 **(75.395%)**
Supra and retro disc effusion	-3.318 (0.000%)	-0.723 (0.000%)
Supra, retro and infra disc effusion	-2.313 (0.000%)	-1.826 (0.000%)

Table III

Variable	χ^2	p	Result
Effusion / Displacement	27.479	0.01667	Dependent

Table IV

Effusion of the Analyzed Side (ADD without reduction)	Contralateral displacement		
	Preserved	With reduction	Without reduction
Preserved	-0.670 (0.000%)	-2.318 (0.000%)	1.879 **(93.976%)**
Retro disc effusion	-1.000 (0.000%)	-0.603 (0.000%)	0.762 (55.394%)
Supra disc effusion	0.578 (43.674%)	1.659 **(90.288%)**	-1.377 (0.000%)
Infra and retro disc effusion	-0.451 (0.000%)	0.056 (4.466%)	0.110 (8.759%)
Supra and infra disc effusion	-1.378 (0.000%)	0.731 (53.522%)	-0.066 (0.000%)
Supra and retro disc effusion	0.968 (66.696%)	0.994 (67.978%)	-1.032 (0.000%)
Supra, retro and infra disc effusion	1.775 **(92.410%)**	-0.220 (0.000%)	-0.432 (0.000%)

Table V

3 CONCLUSÃO

Em conclusão, observamos que quando a articulação está com deslocamento de disco sem redução, é importante atentar para a articulação contralateral, pois esta modula o padrão de efusão no lado analisado. Já quando analisamos as articulações com discos em posição normal ou com deslocamentos com redução o padrão de efusão não é influenciado pela posição do disco na articulação contralateral.

REFERÊNCIAS

1- Okeson, J. P. (2007). Joint intracapsular disorders: diagnostic and nonsurgical management considerations. *Dental Clinics*, *51*(1), 85-103.

2- Lee, Y. H., Won, J. H., Kim, S., Auh, Q. S., & Noh, Y. K. (2022). Advantages of deep learning with convolutional neural network in detecting disc displacement of the temporomandibular joint in magnetic resonance imaging. Scientific Reports, 12(1), 11352.

3- Poluha, R. L., Canales, G. D. L. T., Costa, Y. M., Grossmann, E., Bonjardim, L. R., & Conti, P. C. R. (2019). Temporomandibular joint disc displacement with reduction: a review of mechanisms and clinical presentation. Journal of applied oral science, 27.

4- De Stefano, A. A., Guercio-Monaco, E., Hernández-Andara, A., & Galluccio, G. (2020). Association between temporomandibular joint disc position evaluated by magnetic resonance imaging and mandibular condyle inclination evaluated by computed tomography. Journal of Oral Rehabilitation, 47(6), 743-749.

5- Leeuw, R.; Klasser, G.D. (2018). *Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management*, 6th ed.; Quintessence: Chicago, IL, USA.

6- List, T., & Jensen, R. H. (2017). Temporomandibular disorders: old ideas and new concepts. Cephalalgia, 37(7), 692-704.

7- Manfredini, D., Guarda-Nardini, L., Winocur, E., Piccotti, F., Ahlberg, J., & Lobbezoo, F. (2011). Research diagnostic criteria for temporomandibular disorders: a systematic review of axis I epidemiologic findings. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 112(4), 453-462.

8- Valesan, L. F., Da-Cas, C. D., Réus, J. C., Denardin, A. C. S., Garanhani, R. R., Bonotto, D., ... & de Souza, B. D. M. (2021). Prevalence of temporomandibular joint disorders: a systematic review and meta-analysis. *Clinical oral investigations*, *25*, 441-453.

9- Wilentz, J. B., & Cowley Jr, A. W. (2017). How can precision medicine be applied to temporomandibular disorders and its comorbidities?.

10- Johansson, A., Unell, L., Carlsson, G. E., Söderfeldt, B., & Halling, A. (2003). Gender difference in symptoms related to temporomandibular disorders in a population of 50-year-old subjects. Journal of orofacial pain, 17(1).

11- Rodrigues, C. A., Magri, L. V., Melchior, M. D. O., & Mazzetto, M. O. (2015). Evaluation of the impact on quality of life of patients with temporomandibular disorders. Revista Dor, 16, 181-185.

12- Conti, P. C. R., Pinto-Fiamengui, L. M. S., Cunha, C. O., & Conti, A. C. D. C. F. (2012). Orofacial pain and temporomandibular disorders: the impact on oral health and quality of life. Brazilian oral research, 26, 120-123.

13- Ito, S., Mine, Y., Yoshimi, Y., Takeda, S., Tanaka, A., Onishi, A., ... & Tanimoto, K. (2022). Automated segmentation of articular disc of the temporomandibular joint on magnetic resonance images using deep learning. Scientific Reports, 12(1), 221.

14- Durham, J., Aggarwal, V., Davies, S. J., Harrison, S. D., Jagger, R. G., Leeson, R., & Renton, T. (2013). Temporomandibular Disorders (TMDs): an update and management guidance for primary care from the UK Specialist Interest Group in Orofacial Pain and TMDs (USOT).

15- Afroz, S., Naritani, M., Hosoki, H., Takechi, K., Okayama, Y., & Matsuka, Y. (2018). Prevalence of posterior disc displacement of the temporomandibular joint in patients with temporomandibular disorders: systematic review and meta-analyses. Journal of Oral & Facial Pain and Headache, 32(3), 277-286.

16- Bousnaki, M., Bakopoulou, A., & Koidis, P. (2018). Platelet-rich plasma for the therapeutic management of temporomandibular joint disorders: a systematic review. *International journal of oral and maxillofacial surgery*, *47*(2), 188-198.

17- Afroz, S., Naritani, M., Hosoki, H., & Matsuka, Y. (2020). Posterior disc displacement of the temporomandibular joint: A rare case report. CRANIO®, 38(4), 273-278.

18- Miernik, M., & Więckiewicz, W. (2015). The Basic Conservative Treatment of Temporomandibular Joint Anterior Disc Displacement Without Reduction--Review. management, 13, 15.

19- Purcell, E. M., Torrey, H. C., & Pound, R. V. (1946). Resonance absorption by nuclear magnetic moments in a solid. Physical review, 69(1-2), 37

20- Vervaeke, K., Verhelst, P. J., Orhan, K., Lund, B., Benchimol, D., Van der Cruyssen, F., ... & Politis, C. (2022). Correlation of MRI and arthroscopic findings with clinical outcome in temporomandibular joint disorders: a retrospective cohort study. Head & Face Medicine, 18(1), 2.

21- Johnson, M., Sreela, L. S., Mathew, P., & Prasad, T. S. (2022). Actual applications of magnetic resonance imaging in dentomaxillofacial region. Oral Radiology, 38(1), 17-28

22- Matsubara, R., Yanagi, Y., Oki, K., Hisatomi, M., Santos, K. C., Bamgbose, B. O., ... & Asaumi, J. (2018). Assessment of MRI findings and clinical symptoms in patients with temporomandibular joint disorders. Dentomaxillofacial Radiology, 47(4), 20170412.

23- Higuchi, K., Chiba, M., Sai, Y., Yamaguchi, Y., Nogami, S., Yamauchi, K., & Takahashi, T. (2020). Relationship between temporomandibular joint pain and magnetic resonance imaging findings in patients with temporomandibular joint disorders. International Journal of Oral and Maxillofacial Surgery, 49(2), 230-236.

24- Litko, M., Berger, M., Szkutnik, J., & Różyło-Kalinowska, I. (2017). Correlation between direction and severity of temporomandibular joint disc displacement and

reduction ability during mouth opening. Journal of Oral Rehabilitation, 44(12), 957-963.

25- Ferreira, L. A., Grossmann, E., Januzzi, E., Paula, M. V. Q. D., & Carvalho, A. C. P. (2016). Diagnosis of temporomandibular joint disorders: indication of imaging exams. Brazilian journal of otorhinolaryngology, 82, 341-352.

26- Junhasavasdikul, T., Abadeh, A., Tolend, M., & Doria, A. S. (2018). Developing a reference MRI database for temporomandibular joints in healthy children and adolescents. Pediatric Radiology, 48, 1113-1122.

27- Gynther, G. W., Holmlund, A. B., & Reinholt, F. P. (1994). Synovitis in internal derangement of the temporomandibular joint: correlation between arthroscopic and histologic findings. Journal of oral and maxillofacial surgery, 52(9), 913-917

28- Reverand, S. D., Guerra, M. M., Campo, J. R., Escorial, V., & Cordero, J. (2020). Correlation between joint effusion and clinical symptoms, magnetic resonance imaging and arthroscopic findings in patients with temporomandibular joint disease. Journal of Cranio-Maxillofacial Surgery, 48(12), 1146-1151.

29- Harms, S. E., Wilk, R. M., Wolford, L. M., Chiles, D. G., & Milam, S. B. (1985). The temporomandibular joint: magnetic resonance imaging using surface coils. Radiology, 157(1), 133-136.

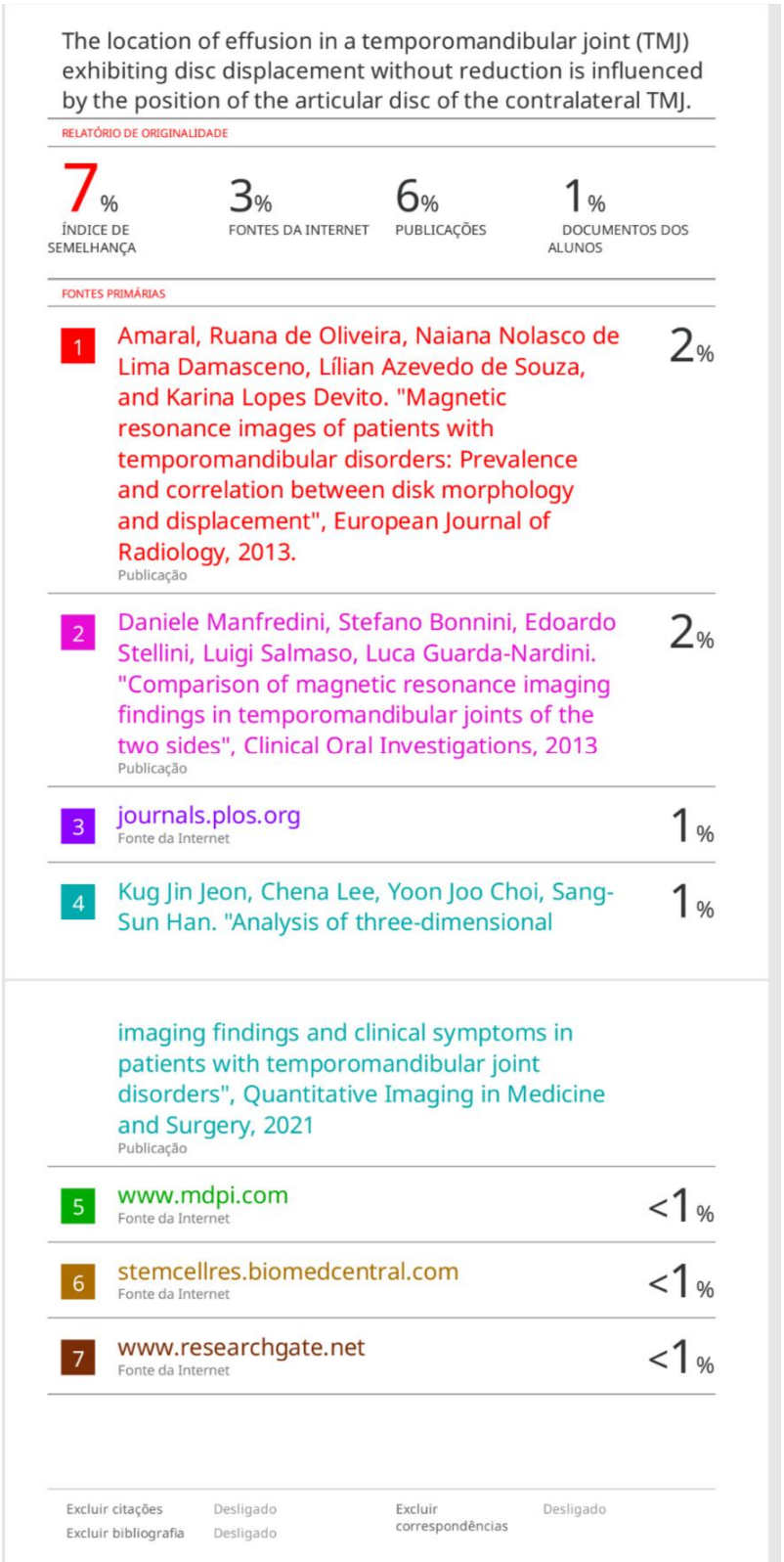
30- Hosgor, H. (2019). The relationship between temporomandibular joint effusion and pain in patients with internal derangement. Journal of Cranio-Maxillofacial Surgery, 47(6), 940-944.

31- Milam, S. B., & Schmitz, J. P. (1995). Molecular biology of temporomandibular joint disorders: proposed mechanisms of disease. Journal of oral and maxillofacial surgery, 53(12), 1448-1454.

32- Costa, A. L., D'Abreu, A., & Cendes, F. (2008). Temporomandibular joint internal derangement: association with headache, joint effusion, bruxism, and joint pain. J Contemp Dent Pract, 9(6), 9-16

ANEXOS

Anexo 1 – Verificação de originalidade e prevenção de plágio



The location of effusion in a temporomandibular joint (TMJ) exhibiting disc displacement without reduction is influenced by the position of the articular disc of the contralateral TMJ.

RELATÓRIO DE ORIGINALIDADE

7%	3%	6%	1%
ÍNDICE DE SEMELHANÇA	FONTES DA INTERNET	PUBLICAÇÕES	DOCUMENTOS DOS ALUNOS

FONTES PRIMÁRIAS

1	Amaral, Ruana de Oliveira, Naiana Nolasco de Lima Damasceno, Lílian Azevedo de Souza, and Karina Lopes Devito. "Magnetic resonance images of patients with temporomandibular disorders: Prevalence and correlation between disk morphology and displacement", European Journal of Radiology, 2013. Publicação	2%
2	Daniele Manfredini, Stefano Bonnini, Edoardo Stellini, Luigi Salmaso, Luca Guarda-Nardini. "Comparison of magnetic resonance imaging findings in temporomandibular joints of the two sides", Clinical Oral Investigations, 2013 Publicação	2%
3	journals.plos.org Fonte da Internet	1%
4	Kug Jin Jeon, Chena Lee, Yoon Joo Choi, Sang-Sun Han. "Analysis of three-dimensional imaging findings and clinical symptoms in patients with temporomandibular joint disorders", Quantitative Imaging in Medicine and Surgery, 2021 Publicação	1%
5	www.mdpi.com Fonte da Internet	<1%
6	stemcellres.biomedcentral.com Fonte da Internet	<1%
7	www.researchgate.net Fonte da Internet	<1%

Excluir citações	Desligado	Excluir correspondências	Desligado
Excluir bibliografia	Desligado		

Anexo 2 - Certificado do Comitê De Ética em Pesquisa

UFPA - INSTITUTO DE CIÊNCIAS DA SAÚDE DA UNIVERSIDADE FEDERAL DO PARÁ

PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: Avaliação das características morfológicas e dimensionais encontradas em exames de ressonância magnética em pacientes com disfunção temporomandibular.

Pesquisador: HÉLDER ANTÔNIO REBELO PONTES
Área Temática:
Versão: 4
CAAE: 31975720.4.0000.0018
Instituição Proponente: Faculdade de Odontologia da Universidade Federal do Pará
Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 6.630.795

UFPA - INSTITUTO DE CIÊNCIAS DA SAÚDE DA UNIVERSIDADE FEDERAL DO PARÁ

Continuação do Parecer: 6.630.795

Folha de Rosto	Folha_de_rosto.pdf	22:30:55	REBELO PONTES	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

BELEM, 31 de Janeiro de 2024

Assinado por:
Wallace Raimundo Araujo dos Santos
(Coordenador(a))

Anexo 3 - Documento de submissão do artigo

Gmail mauricio costa <mpaivaecosta@gmail.com>

TRIPLEO-D-24-00795 - Confirming your submission to Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology

1 mensagem

OOOO (Triple O) journal <em@editorialmanager.com> 13 de junho de 2024 às 22:37
Responder a: "OOOO (Triple O) journal" <tripleojournal@gmail.com>
Para: Anderson Mauricio Paiva e Costa <mpaivaecosta@gmail.com>

Dear Dr. Paiva e Costa,

Your submission entitled "The location of effusion in a temporomandibular joint (TMJ) exhibiting disc displacement without reduction is influenced by the position of the articular disc of the contralateral TMJ." has been received by Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology. It has been assigned the following manuscript number: **TRIPLEO-D-24-00795**.

You may check on the progress of your paper by logging on to the Editorial Manager as an author. The URL is https://www.editorialmanager.com/tripleo/
Your username is: mpaivaecosta

If you need to retrieve password details, please go to: http://ees.elsevier.com/tripleo/automail_query.asp

Your manuscript will be given a reference number when an Editor has been assigned.

Thank you for submitting your work to this journal.

Sincerely,

Editorial Manager
Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology

This journal uses the Elsevier Article Transfer Service. This means that if an editor feels your manuscript is more suitable for an alternative journal, then you might be asked to consider transferring the manuscript to such a journal. The recommendation might be provided by a Journal Editor, a dedicated Scientific Managing Editor, a tool assisted recommendation, or a combination. For more details see the journal guide for authors.
http://www.oooojournal.net/

E-mail: tripleOjournal@gmail.com