

LETICIA LOPES QUIRINO PANTOJA

**Doenças Articulares Degenerativas da Articulação
Temporomandibular: uma revisão sistemática**

BRASÍLIA, 2018

**UNIVERSIDADE DE BRASÍLIA
FACULDADE DE CIÊNCIAS DA SAÚDE
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS DA SAÚDE**

LETICIA LOPES QUIRINO PANTOJA

**Doenças Articulares Degenerativas da Articulação
Temporomandibular: uma revisão sistemática**

Dissertação apresentada como requisito parcial para a obtenção do título de Mestre em Saúde Bucal pelo programa de Pós-Graduação em Ciências da Saúde da Universidade de Brasília.

Orientadora: Prof^a. Dr^a. Eliete Neves da Silva Guerra

BRASÍLIA, 2018

LETICIA LOPES QUIRINO PANTOJA

**Doenças Articulares Degenerativas da Articulação
Temporomandibular: uma revisão sistemática**

Dissertação apresentada como requisito parcial para a obtenção do título de Mestre em Saúde Bucal pelo programa de Pós-Graduação em Ciências da Saúde da Universidade de Brasília.

Aprovado em 22 de fevereiro de 2018.

BANCA EXAMINADORA

Prof^a Eliete Neves Silva Guerra – presidente
Universidade de Brasília

Prof. André Ferreira Leite
Universidade de Brasília

Prof^a Graziela de Luca Canto
Universidade Federal de Santa Catarina

AGRADECIMENTOS

Agradeço à Deus pelas oportunidades que Ele me tem dado durante a vida.

Ao meu esposo Humberto, agradeço pelo amor, suporte diário e paciência. E aos meus queridos filhos Gabriel, Luisa e Davi, pela torcida animada e pela compreensão ingênua e sincera.

Aos meus pais, agradeço por terem sempre orientado, dado o exemplo e apoiado incondicionalmente.

Agradeço à minha orientadora Prof^a Eliete Neves Silva Guerra pela oportunidade de ser sua aluna, pela confiança em mim depositada, pela orientação e paciência constantes. Deixo também minha grande admiração pela sua força e determinação em fazer uma ciência excelente, projetando tantos alunos, independente dos obstáculos.

Agradeço à amiga e Prof^a Heliana Mestrinho, pelo carinho de sempre e por ter me incentivado a voltar para a área acadêmica.

Agradeço à Prof^a Liete Zwir, pela disponibilidade e por compartilhar tanto conhecimento comigo.

Agradeço à Prof^a Graziela de Luca Canto por me apresentar o mundo apaixonante da revisão sistemática.

Agradeço à colega de mestrado e revisora Isabela Porto de Toledo, agradeço pelas inúmeras dicas de informática e metanálise. Aos colegas Yasmine Mendes e André Porporatti por também participarem prontamente da revisão sistemática.

Agradeço aos membros da banca pelas contribuições ao trabalho.

Agradeço à Universidade de Brasília por ter sido o berço da minha formação e ao Programa de Pós Graduação em Ciências da Saúde (PPGCS), pela continuação com excelência.

Agradeço por fim à CAPES pela bolsa concedida que permitiu a dedicação durante este período.

RESUMO

A doença articular degenerativa (DAD) é caracterizada por degeneração de tecidos duros e moles em torno de uma articulação levando à dor e alterações funcionais. A DAD da articulação temporomandibular (ATM) pode ser uma condição local ou ser secundária a uma doença sistêmica. O objetivo deste trabalho foi avaliar a evidência científica disponível sobre a prevalência da DAD da ATM por meio da revisão sistemática. Para isso, foram selecionados estudos que relatam dados de prevalência sobre DAD da ATM. A DAD foi avaliada utilizando diagnóstico clínico e por imagens. Uma estratégia de busca foi desenvolvida para os bancos de dados (LILACS, LIVIVO, PubMed, Science Direct, SCOPUS, Web of Science), bem como pesquisa adicional na literatura cinzenta. O risco de viés dos estudos individuais foi avaliado por meio do Joanna Briggs Critical Appraisal Checklist for Studies Reporting Prevalence Data. Uma metanálise de proporção combinando os dados de prevalência foi realizada usando o MedCalc Statistical Software. Como resultado, de 1082 estudos, 32 foram incluídos e agrupados em dois grupos: o primeiro com estudos que relataram a prevalência de DAD da ATM secundária a doenças sistêmicas, como artrite idiopática juvenil (AIJ) e artrite reumatóide (AR); e o segundo grupo com estudos que relataram a prevalência de DAD em pacientes com disfunção temporomandibular (DTM). A prevalência de DAD em pacientes com AIJ foi de 66,7% (IC: 54,31-78,01; n=292) e em pacientes com AR foi de 78,85% (CI: 61,63-91,94; n=140). Entre os pacientes com DTM, a prevalência de DAD foi de 62,77% dos pacientes (IC: 33,6-87,6; n=1472) ou de 44,23% das articulações (IC: 31,48-57,4; n=2199). Esta revisão sistemática mostrou uma alta prevalência de DAD em pacientes com doença reumática sistêmica e uma ocorrência menos prevalente, mas ainda alta, em pacientes com DTM sem envolvimento sistêmico.

ABSTRACT

Degenerative joint disease (DJD) is characterized by degeneration of hard and soft tissues around a joint leading to pain functional disability. DJD of the temporomandibular joint (TMJ) may be a local condition or part of a systemic disease. The objective of this study was to evaluate the available scientific evidence about the prevalence of DJD of the TMJ through a systematic review. A search on electronic databases and grey literature from their inception to January 2018 was performed. Studies reporting prevalence data of DJD of the TMJ were included. DJD was assessed through clinical and imaging diagnosis. Studies risk of bias was evaluated using the Critical Appraisal Checklist for Studies Reporting Prevalence Data. A proportion meta-analysis was conducted using the MedCalc Statistical Software. From 1082 studies, 32 were identified, and the sample size included 3435 subjects. They were clustered into two groups: the first comprised studies that reported prevalence of DJD in TMJ secondary to rheumatic systemic diseases such as Juvenile Idiopathic Arthritis (JIA) and Rheumatoid Arthritis (RA); and the second group comprised studies that reported prevalence of DJD on Temporomandibular disorders patients. The overall prevalence of DJD on JIA patients was 66.7% (CI: 54.31-78.01; n=292) and on RA patients was 78.85% (CI: 61.64-91.94; n=140). Among TMD patients, the prevalence of DJD reported by patients was 62.77% (CI: 33.6-87.6; n=1472) and reported by joints was 44.23% (CI: 31.48-57.4; n=2199). This review attempts to high prevalence of DJD in patients with systemic rheumatic disease and a less prevalent, but still high, occurrence in patients with TMD without systemic involvement.

LISTA DE FIGURAS

Figuras da Dissertação

Figura 1:	Processo de degradação da cartilagem articular por alteração na homeostasia de remodelação articular	13
Figura 2:	Diferentes fases da DAD na ATM	15
Figura 3:	Nova pirâmide da evidência científica	18

Figuras do Artigo Científico

Figura 1:	Flow Diagram of Literature Search and Selection Criteria.....	37
Figura 2:	Frequency of DJD of the TMJ in rheumatic patients. Results from meta-analysis	38
Figura 3:	Frequency of DJD of the TMJ in TMD patients. Results from meta-analysis	39

LISTA DE TABELAS

Tabelas do Artigo Científico

Tabela 1:	Summary of descriptive characteristics of studies that reported prevalence of DJD of the TMJ in patients with rheumatic diseases	40
Tabela 2:	Summary of descriptive characteristics of studies that reported prevalence of DJD of the TMJ in patients with TMD	42
Tabela 3	Results from Joanna Briggs Institute critical appraisal checklist for studies reporting prevalence data	45

LISTA DE ABREVIATURAS E SIGLAS

AIJ	Artrite Idiopática Juvenil
AR	Artrite Reumatóide
ATM	Articulação Temporomandibular
DAD	Doença Articular Degenerativa
DC	Diagnostic Criteria for Temporomandibular Disorders
DTM	Disfunção Temporomandibular
GRADE	Grading of Recommendations Assessment, Development and Evaluation
IRM	Imagem de Ressonância Magnética
LILACS	Literatura Latino-americana e do Caribe em Ciências da Saúde
MASTAR	Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument
OA	Osteoartrite
RDC	Research Diagnostic Criteria for Temporomandibular Disorder
RS	Revisão Sistemática
TC	Tomografia Computadorizada
TCBCT	Tomografia Computadorizada tipo Cone-Beam

SUMÁRIO

1	INTRODUÇÃO.....	9
2	REVISÃO DA LITERATURA	11
	2.1 Doença Articular Degenerativa: Etiopatogênese	11
	2.2 Critérios de Diagnóstico da DAD na ATM	14
	2.3 Prevalência da DAD e suas variações segundo o critério diagnóstico	17
	2.4 Revisão Sistemática	18
3	PROBLEMAS E HIPÓTESES	21
4	OBJETIVO.....	22
	4.1 Objetivo Geral	22
	4.2 Objetivos Específicos	22
5	ARTIGO CIENTÍFICO	23
6	CONSIDERAÇÕES GERAIS	56
7	CONCLUSÕES.....	60
	REFERÊNCIAS BIBLIOGRÁFICAS	61

1 INTRODUÇÃO

As disfunções temporomandibulares (DTMs) englobam um grupo de condições musculoesqueléticas que envolvem a articulação temporomandibular (ATM), os músculos mastigatórios e estruturas associadas. A DTM é considerada a maior causa de dor não odontogênica na região orofacial e pode acarretar baixa qualidade de vida quando se torna crônica (1). Estima-se que 40% a 75% da população apresentem pelo menos um sinal de DTM e 33%, pelo menos um sintoma (1). Já a prevalência da disfunção é estimada entre 5 a 12 % da população geral (2).

Basicamente, as DTMs podem ser classificadas em desordens articulares e desordens musculares. As desordens musculares afetam a função dos músculos mastigatórios e produzem dor do tipo músculo-esquelética. As desordens articulares são aquelas que envolvem as estruturas da ATM tais como cápsula, ligamentos, superfícies ósseas e disco articular ou mesmo a movimentação do complexo cabeça da mandíbula-disco.

A doença articular degenerativa (DAD) é uma desordem que se caracteriza pela degeneração de tecidos duros e moles ao redor de uma articulação. Esse processo geralmente é acompanhado de inflamação intra-articular, resultando em alterações anatômicas e dor articular devido a alteração nos mecanismos periférico e central de processamento da dor. Afeta principalmente as articulações de rolamento em estresse físico como o joelho, o quadril, a coluna vertebral e os dedos, entretanto, outras articulações como os ombros e a articulação temporomandibular também podem ser acometidas (3).

Na ATM, a DAD pode ser uma condição local ou ser parte de uma alteração sistêmica. Em ambos os casos, afeta a cartilagem, o osso subcondral e a membrana sinovial, dentre outras estruturas, levando à remodelação da articulação e deterioração da cartilagem articular (4). Durante este processo, o paciente pode apresentar sintomas de dor, ruídos articulares e alterações da função, que podem até mesmo afetar a mastigação e limitar a abertura da boca. As doenças sistêmicas que mais frequentemente podem acometer a ATM incluem a artrite reumatóide (AR), a artrite idiopática juvenil (AIJ), as espondiloartropatias (por exemplo, espondilite anquilosante ou artrite psoriática) e as doenças induzidas por cristais (por exemplo, gota) (1). Quando a DAD não é secundária a uma doença sistêmica,

essa condição inflamatória e degenerativa local, acompanhada de sintomatologia dolorosa é chamada de osteoartrite (5). À medida que ocorre a remodelação óssea, essa condição geralmente torna-se estável mesmo que a morfologia óssea permaneça alterada, assim passa a se denominar osteoartrose. Interpreta-se como osteoartrose uma condição já não inflamatória com efeitos degenerativos semelhantes. A osteoartrose é considerada portanto uma adaptação mal sucedida de uma osteoartrite da ATM (6).

A prevalência relatada na literatura da DAD na ATM é inconclusiva. Os estudos epidemiológicos variam muito em função do critério diagnóstico utilizado, do tipo de população estudada e das formas de avaliação clínica ou por imagem da ATM (7). Além disso, o acometimento da ATM por doenças degenerativas sistêmicas nem sempre é considerado (8, 9).

Nesse contexto, esse trabalho foi desenvolvido para analisar a prevalência da DAD na ATM considerando todos os fatores etiopatológicos envolvidos nessa condição.

2 REVISÃO DA LITERATURA

2.1 Doença Articular Degenerativa: Etiopatogênese

A articulação temporomandibular (ATM) faz a conexão entre a mandíbula e o crânio e permite os movimentos mandibulares para as funções de mastigação e fala. É formada pela cabeça da mandíbula que se encaixa na fossa mandibular do osso temporal; separando esses ossos está o disco articular, uma estrutura formada por um tecido conjuntivo denso fibroso. A ATM é considerada uma das articulações sinoviais mais complexas do corpo e possui características únicas tanto do ponto de vista funcional quanto estrutural e histológico. Funcionalmente é classificada como uma articulação composta. Embora uma articulação composta seja formada por pelo menos três ossos, o disco articular funciona como um osso não calcificado que permite os movimentos complexos da ATM (10). Estruturalmente, ao contrário da maioria das articulações sinoviais, as superfícies articulares da ATM são recobertas com tecido conjuntivo denso fibroso e sem cartilagem hialina, o que significa maior capacidade de auto-reparação (1). Por outro lado, a zona de crescimento ósseo da cabeça da mandíbula está localizada logo abaixo dessa fibrocartilagem, tornando-a particularmente vulnerável à lesão inflamatória e um modelo valioso para estudar alterações ósseas (11).

A ATM é totalmente envolvida pelo ligamento capsular que se insere inferiormente na cabeça da mandíbula e na borda do osso temporal em sua parte superior. Internamente o disco articular está inserido no ligamento capsular e isso divide a articulação em duas cavidades distintas. As superfícies internas das cavidades são revestidas de células endoteliais especializadas que formam a membrana sinovial, responsável pela produção do líquido sinovial que preenche as cavidades articulares (10). O fluido sinovial, além de diminuir a fricção entre as superfícies articulares durante a função, também supre as necessidades metabólicas dos tecidos cartilagosos, uma vez que as superfícies articulares são avasculares.

As desordens articulares que mais comumente afetam a ATM são as que alteram o posicionamento do disco articular e a DAD da ATM. A degeneração dos tecidos moles e duros na ATM constitui uma condição osteoartrítica que pode ter origem local ou ser consequência de uma doença sistêmica (1).

A etiopatogênese da DAD envolve um processo inflamatório degenerativo contínuo em que fatores mecânicos ou metabólicos superam a capacidade adaptativa da articulação e contribuem para o dano inicial da cartilagem e/ou tecidos sinoviais (3). Na osteoartrite (AO), uma degeneração articular de origem local, o processo patológico inicia-se com excesso de carga na articulação que leva à abrasão e deterioração da fibrocartilagem articular seguido de um espessamento e remodelação do osso subjacente (6). O remodelamento ósseo envolve maior síntese de matrizes extracelulares e, a princípio, constitui uma resposta biológica essencial às demandas funcionais normais que assegura a homeostase da forma da articulação bem como a manutenção das relações entre forma e função. As alterações degenerativas locais ocorrem como resultado da remodelação articular disfuncional devido tanto a uma diminuição da capacidade de adaptação das estruturas articulares quanto ao excesso de estresse físico sobre as estruturas articulares que excede a capacidade adaptativa normal (4). A sobrecarga altera o metabolismo dos condrócitos da superfície articular que entram em apoptose e iniciam o processo destrutivo. Além disso, desencadeiam a degradação do ácido hialurônico, principal componente do fluido sinovial, promovendo alteração da lubrificação articular (6). A regulação do ácido hialurônico nas articulações é feita por citocinas pró inflamatórias. A presença dessas citocinas nas articulações está ligada ao progresso e aceleração da degradação da cartilagem e à promoção da reabsorção do osso adjacente, por meio da diferenciação e ativação dos osteoclastos (12). Além disso, a alteração dos condrócitos também ativa as vias sinalizadoras responsáveis pelas alterações no osso subcondral tais como edema medular e formação de cistos, comumente vistos na OA. Essa cascata de alterações produz uma resposta inflamatória local denominada sinovite, que constitui uma resposta secundária induzida pela ativação imunológica e que pode ser observada desde os estágios iniciais. Essa inflamação crônica e de baixa intensidade é uma das responsáveis pela perpetuação cíclica da degeneração articular (4, 13). A figura 1 resume o processo de degeneração articular local devido a sobrecarga da ATM.

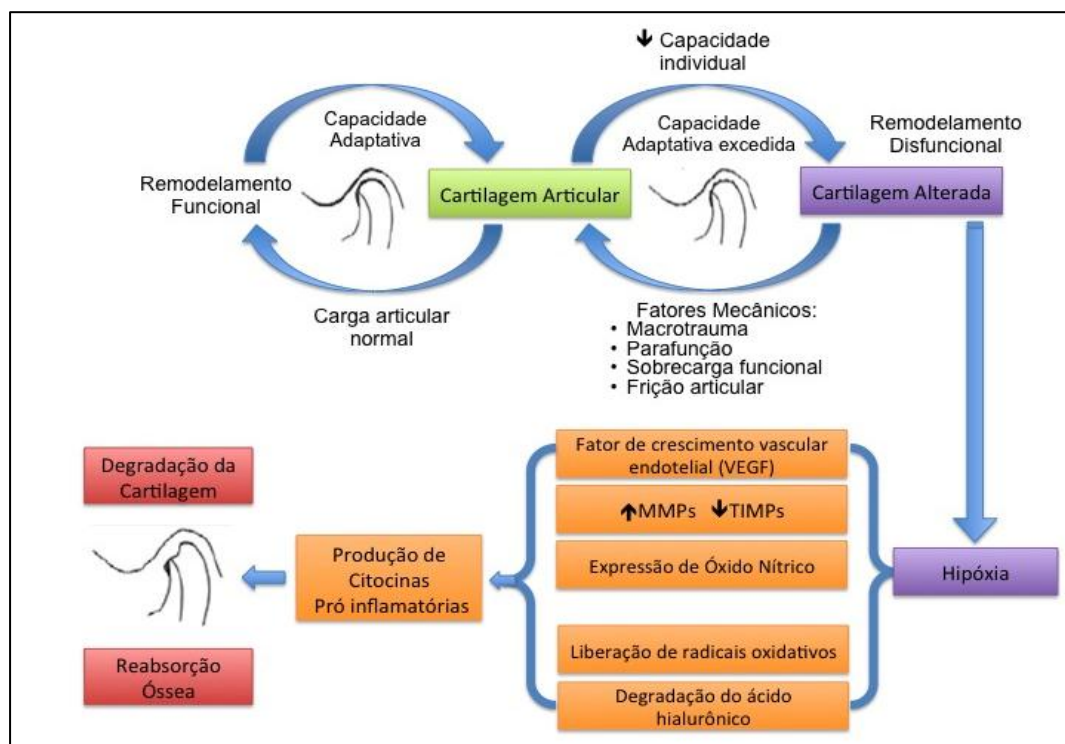


Figura 1: Processo de degradação da cartilagem articular por alteração na homeostasia de remodelação articular. Adaptada de Tanaka et al, 2008.

Diferentemente da DAD de origem local, a degeneração articular secundária a doenças sistêmicas envolve uma resposta imunológica adaptativa mais robusta e de papel central na patogênese da degeneração (13). Embora várias artropatias inflamatórias reumáticas possam afetar a ATM, as mais frequentemente relatadas na literatura são a artrite reumatoide (AR), a artrite idiopática juvenil (AIJ), as espondiloartropatias (espondilite anquilosante e artrite psoriática) e a gota (1). O acometimento da ATM chega ser relatado em 86% dos casos na AR, que afeta adultos, (14) e na AIJ, que ocorre em crianças até 16 anos, em 87% dos casos (15).

Embora o início da doença sistêmica dependa do envolvimento de vários fatores tanto genéticos como ambientais, o desenvolvimento da artrite (fase articular da artrite reumatoide) depende da resposta imunológica do indivíduo. O processo patológico da degeneração articular na AR é caracterizado por inflamação autoimune e proliferação do tecido sinovial, fonte de liberação de citocinas pró-inflamatórias e proteases que, em conjunto com osteoclastos e condrócitos, promove a destruição articular (16). Nesse processo, a hiperplasia sinovial altera bioquimicamente as características protetivas do líquido sinovial, promovendo a apoptose de condrócitos que iniciam a quebra da cartilagem e consequente

destruição óssea. As citocinas sinoviais promovem a diferenciação e invasão de osteoclastos na região subcondral, sendo as principais consequências a reabsorção óssea associada ao aumento da inflamação.

O processo patológico da degeneração articular na AIJ é semelhante ao da AR. Essa também se refere a uma desordem inflamatória que afeta articulações sinoviais, entretanto envolve indivíduos com menos de 16 anos pelo período de pelo menos 6 semanas (17).

2.2 Critérios de Diagnóstico da DAD na ATM

Independente da etiopatogênese da DAD ser de origem local ou sistêmica, o curso natural da doença na ATM pode ser dividido em três fases de progressão lenta. A fase inicial é a mais lenta e, embora já ocorram danos teciduais microscópicos, apresenta sintomas brandos que são comuns a outras alterações internas da ATM (3). Nas fases intermediária e tardia ocorrem alterações ósseas significantes e o agravamento dos sintomas. A figura 2 demonstra a transição entre o remodelamento fisiológico e adaptativo e as fases da DAD. Tanto na DAD de origem local como secundária a doenças sistêmicas, o que leva o paciente a procurar atendimento para uma alteração na ATM é a presença de dor ou ruído articular além de alterações na função como dificuldade para abrir a boca ou mastigar (1). Estes sintomas geralmente se manifestam na fase intermediária ou tardia da DAD.

De acordo com o *Diagnostic Criteria for Temporomandibular Disorders* (DC), o diagnóstico da DAD depende da observação de sintomas expressivos e confirmação por meio de imagem com a presença de alterações ósseas (18). Portanto, o diagnóstico só pode ser confirmado na fase intermediária ou tardia da DAD, onde já ocorreram alterações estruturais maiores que podem comprometer a função articular. O DC é atualmente o critério diagnóstico de referência para DTM e corresponde a um conjunto de parâmetros confiáveis do ponto de vista científico e ao mesmo tempo viáveis para uso na prática clínica (18). Este critério foi desenvolvido por um consórcio internacional de pesquisadores e clínicos a partir da constatação de que o antigo padrão de diagnóstico (19), o *Research Diagnostic Criteria for Temporomandibular Disorders* (18), não possuía sensibilidade e

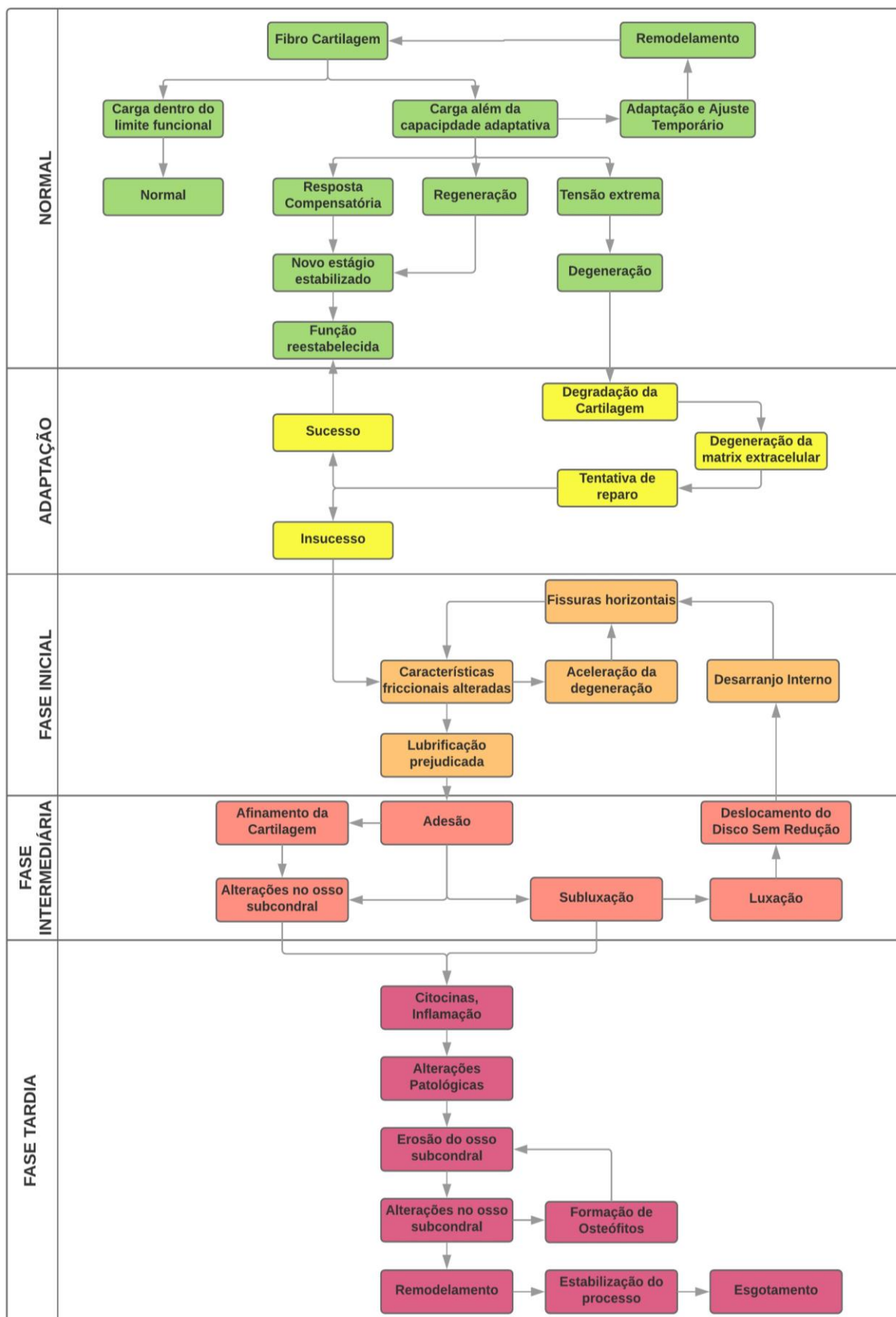


Figura 2: Diferentes fases da DAD na ATM. Adaptado de Kalldka et al, 2014.

especificidade adequadas para diagnóstico das DTMs (20). A revisão de todos os parâmetros de anamnese e avaliação clínica demonstrou que para o diagnóstico da DAD a sensibilidade era de 55% e a especificidade de 61% e, portanto, o uso de imagem seria necessário para a confirmação desse diagnóstico (18). No antigo RDC o diagnóstico de DAD era unicamente clínico (19). Se por um lado a necessidade de confirmação por imagem aumenta a acurácia, por outro faz com que o diagnóstico necessariamente ocorra na fase tardia.

Outra inovação do DC foi a ampliação da classificação das DTMs para incluir desordens menos comuns porém clinicamente importantes que já possuísem critério diagnóstico estabelecido (21). Nesta etapa foram incluídas, dentre as doenças articulares, as artrites sistêmicas tais como a AR, AIJ e as espondiloartropatias. Nesses casos, o diagnóstico da manifestação dessas patologias na ATM passa primeiramente pelo diagnóstico da doença sistêmica por profissional da área médica, seguida pela verificação das manifestações clínicas da DAD da ATM e detecção das alterações ósseas em imagem (21).

Em relação a detecção de imagens, a tomografia é a imagem padrão para a observação das alterações ósseas especialmente para a DAD de origem local (22). Pelo menos um desses parâmetros deve ser observado: cisto subcondral, erosão, osteófitos e esclerose generalizada (18). A tomografia computadorizada (TC) e a tomografia computadorizada tipo cone beam (TCBCT) são as mais indicadas para avaliação da ATM pois possibilitam a aquisição de imagens que permitem uma descrição mais precisa da morfologia articular (23). Para avaliação das alterações em DAD de origem sistêmica, a imagem por ressonância magnética (IRM) também pode ser considerada e é bastante utilizada por ser o padrão de referência para o diagnóstico da doença sistêmica em outras articulações (7, 21). No entanto, embora esse tipo de imagem permita a observação de outros parâmetros como a presença de edema ósseo trabecular ou derrame articular (24), os critérios de diagnóstico para DAD da ATM permanecem restritos às alterações ósseas descritas para a tomografia (21).

2.3 Prevalência da DAD e suas variações segundo o critério diagnóstico

A prevalência de DTM em nível populacional é uma questão antiga de debate, devido à falta de homogeneidade em relação aos critérios diagnósticos adotados nos diferentes estudos já publicados (25). Há evidências de que a prevalência de sinais e sintomas de DTM na população em geral é alta. As investigações iniciais sugerem que 75% das populações apresentam pelo menos um sinal objetivo de DTM e que 33% relatam sintomas subjetivos (1). O estabelecimento de protocolos como o RDC e o DC tiveram como objetivo uma maior consistência entre os estudos pela padronização dos critérios de diagnóstico. Entretanto a revisão e evolução constante desses critérios ainda permite uma variabilidade grande nos dados de prevalência (26).

As diferenças da prevalência relatada da DAD da ATM podem variar não só conforme a variabilidade dos critérios de diagnóstico utilizados mas também se o critério adotado é apenas clínico ou associado com imagem. A prevalência por diagnóstico clínico de DAD da ATM é relatada em 2 a 16% da população (3, 6, 26), enquanto a comprovação por imagem do envolvimento das estruturas da ATM é relatado em 35 a 94% dos pacientes com pelo menos um sintoma de DAD (9, 27, 28). Como princípio geral, a prevalência de qualquer doença aumenta com a capacidade do observador de detectar as anormalidades associadas à doença. No caso da imagem diagnóstica, a capacidade de detectar uma anormalidade anatômica está intimamente relacionada ao tamanho da anormalidade. Assim, à medida que os avanços tecnológicos possibilitam que o equipamento de imagem detecte anormalidades menores, a prevalência da doença associada também aumenta (29). A prevalência da DAD da ATM com diagnóstico apenas clínico é mais baixa pois a sensibilidade e especificidade é baixa também (25).

Em 2011 foi realizada uma revisão sistemática com a finalidade de estabelecer a prevalência das DTMs, incluindo as DADs, segundo o critério diagnóstico RDC (26). Entretanto este protocolo é apenas clínico e não considera a DAD de origem sistêmica. As orientações mais atuais recomendam estudos de prevalência e revisões sistemáticas sobre o tema, considerando o uso do DC como critério diagnóstico, não só pela confirmação por imagem diagnóstica, mas também por incluir a DAD da ATM com origem nas artrites sistêmicas (30).

2.4 Revisão Sistemática

A revisão sistemática da literatura (RS) é planejada para responder a uma pergunta específica e que utiliza métodos explícitos e sistemáticos para identificar, selecionar e avaliar criticamente os estudos publicados na literatura científica, evitando o viés em cada uma de suas etapas. A grande disponibilidade de pesquisas exige uma avaliação criteriosa da qualidade de sua evidência científica (31). Com o intuito de contribuir para a análise da qualidade dos trabalhos publicados, foram classificados os níveis de evidência, baseados de acordo com o desenho e características dos estudos. A partir dessa classificação, podemos aplicar a metodologia da revisão sistemática como uma ferramenta ou uma lente para avaliação crítica da evidência disponível (Figura 3) (32).

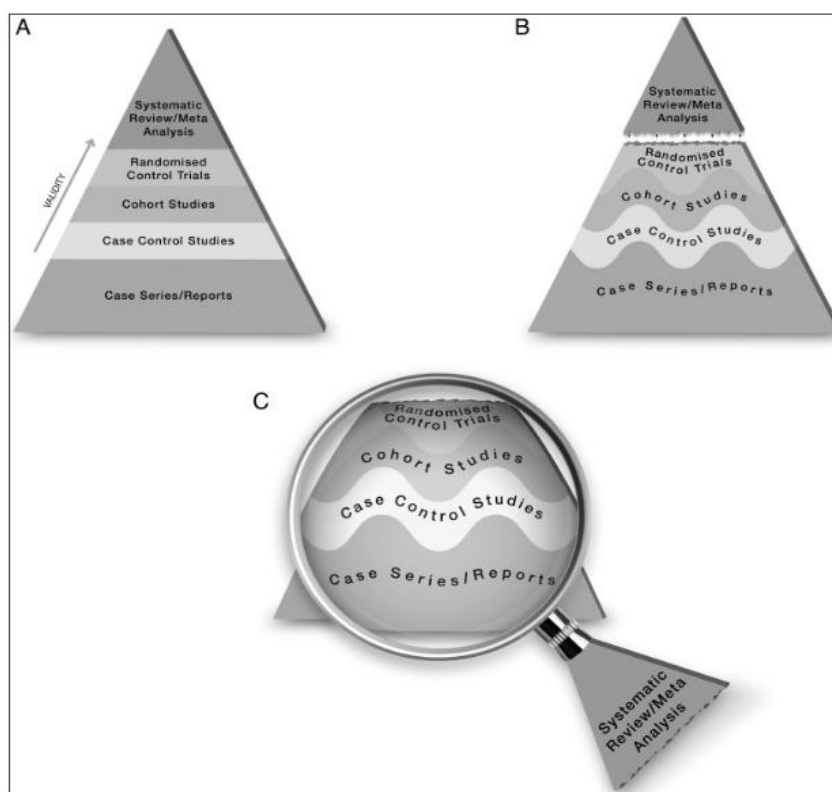


Figura 3 - Nova pirâmide da evidência científica. Extraída de Murad et al., 2016.

As RSs são produzidas por meio de um processo de busca da literatura abrangente, imparcial e reproduzível, que localiza, avalia e sintetiza o conjunto de evidências dos estudos científicos para obter uma visão geral acerca de um assunto. A metodologia utilizada está descrita nas Diretrizes Metodológicas para elaboração de RS do Ministério da Saúde (33) e nos guias da Cochrane (34). As

RSs são reportadas sob a forma de artigos científicos conforme preconizado no *Preferred Reporting Items for Systematic Reviews and Metanalysis – PRISMA* (35).

Resumidamente, a produção de cada RS compreende as seguintes fases:

1. Definição da Pergunta de Pesquisa: elaborada a partir da estratégica PICO considerando a especificação da população (P) incluída nos estudos, a definição da intervenção (I) ou exposição investigadas, o estabelecimento de um fator para comparação (C) e a definição dos desfechos (O) investigados.

2. Definição dos Critérios de Elegibilidade: são definidos critérios de exclusão e inclusão dos estudos primários que compõem a RS.

3. Documentação da Metodologia: a estrutura da RS é descrita em protocolo que deve ser registrado no banco internacional de registros de RS PROSPERO (*International Prospective Register of Ongoing Systematic Reviews* – disponível em <http://144.32.150.25/PROSPERO/prospero.asp>)

4. Busca de Estudos Elegíveis: a identificação de estudos deve ser realizada em bases de dados bibliográficas tais como PubMed, LILACS, Web of Science, Cochrane Library, Science Direct, SCOPUS, dentre outras. Para cada base de dados é desenvolvida uma estratégia de busca específica que possibilite a inclusão mais ampla de estudos. As referências identificadas são gerenciadas com o auxílio de um programa gerenciador de referências.

5. Seleção de Estudos e Coleta de Dados: essa etapa geralmente é desenvolvida em duas fases. Na primeira fase, dois revisores avaliam independentemente títulos e resumos de todas as referências identificadas, excluindo as não pertinentes conforme os critérios de inclusão e exclusão previamente estabelecidos. Na segunda fase, os critérios de elegibilidade são novamente aplicados de forma independente pelos mesmos dois revisores, considerando leitura do texto completo das referências resultantes da fase 1. Desacordos entre os autores são resolvidos por consenso ou com o auxílio de um terceiro revisor. Em seguida, procede-se à coleta de dados nos estudos selecionados na fase 2, também realizada de forma independente pelos dois revisores e depois confrontadas para confirmação.

6. Avaliação da Qualidade dos Estudos Incluídos: o risco de viés e a aplicabilidade dos estudos na RS são analisados com o auxílio de ferramentas

específicas e validadas na literatura, tais como o *Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data* (5) ou o *Grading of Recommendations Assessment, Development and Evaluation* (GRADE) (36).

7. Síntese dos resultados: os resultados são descritos qualitativamente e, caso os estudos sejam minimamente homogêneos, pode ser realizado um estudo de metanálise para compilação quantitativa dos dados encontrados.

3 PROBLEMAS E HIPÓTESES

Diante do panorama exposto levantam-se dois problemas principais:

Problema 1: Os dados de prevalência da DAD da ATM são heterogêneos e podem variar devido a alguns fatores: tipos de estudo, populações estudadas, critérios utilizados para o diagnóstico, incluindo o uso ou não de imagem no diagnóstico. Dessa forma, não temos um dado concreto e compilado na literatura científica sobre a prevalência da DAD na população, considerando-se todas as faixas etárias e diferentes populações e que considere as principais origens etiológicas da doença.

Pergunta 1: Qual a prevalência geral da DAD da ATM na população?

Pergunta 2: Se considerarmos a etiopatogenia envolvida na DAD, a prevalência de degeneração secundária a uma doença sistêmica é menor do que a prevalência de DAD de origem local?

Hipóteses: A prevalência da DAD na ATM na população é elevada, sendo a prevalência de DAD de origem local maior do que a prevalência de DAD secundária a doenças sistêmicas.

Problema 2: A prevalência de DAD pode variar conforme o critério diagnóstico. A utilização de exames de imagem para confirmação do diagnóstico clínico aumenta a acurácia do diagnóstico.

Pergunta: O uso de imagem para confirmação do diagnóstico aumenta a prevalência da DAD?

Hipótese: A prevalência de DAD confirmada pelo diagnóstico por imagem é mais elevada quando comparada à prevalência aferida apenas por diagnóstico clínico.

Para responder os problemas apresentados e testar as hipóteses formuladas, foi desenvolvida uma revisão sistemática da literatura.

4 OBJETIVO

4.1 Objetivo Geral

O objetivo deste trabalho foi avaliar e sintetizar a melhor evidência científica disponível sobre a prevalência da DAD da ATM em conformidade com o diagnóstico padrão de referência atual.

4.2 Objetivos específicos

- Verificar a prevalência de DAD da ATM na população;
- Verificar se a prevalência de degeneração secundária a uma doença sistêmica na ATM é menor do que a prevalência de DAD de origem local;
- Avaliar se o uso de imagem para confirmação do diagnóstico aumenta a prevalência da DAD.

5 ARTIGO

O seguinte artigo que reporta a revisão sistemática conduzida e seus resultados foi enviado para publicação na Revista *Clinical Oral Investigations*, ISSN 1432-6981 (versão impressa), classificada como periódico B1 na Qualis-Capes Medicina II. O envio está registrado sob o número CLOI-D-18-00101 e pode ser acessado no endereço eletrônico <https://cloi.editorialmanager.com/>. Esta revista foi escolhida por apresentar um escopo multidisciplinar e internacional para a publicação de pesquisas de todos os campos da medicina bucal.

Prevalence of degenerative joint disease of the temporomandibular joint: a systematic review and meta-analysis

INTRODUCTION

Degenerative joint disease (DJD) is characterized by degeneration of the hard and soft tissues around a joint, leading to pain and disability [1]. Although the load-bearing joints of the body such as the knee, hips, and spine are most commonly affected, other joints like shoulder and temporomandibular joint (TMJ) can also be affected [2]. In the TMJ, DJD may be a local condition, also called osteoarthritis (OA), or a part of a systemic disease. The most frequently generalized systemic inflammatory diseases that can lead to degenerative changes in the TMJ include rheumatoid arthritis (RA), juvenile idiopathic arthritis (JIA), spondyloarthropathies (e.g., ankylosing spondylitis or psoriatic arthritis), and crystal-induced diseases (e.g., gout) [3]. In both cases, despite the differences in pathogenesis, DJD affects the cartilage, subchondral bone, synovial membrane, and other structures, leading to joint remodeling, abrasion, and deterioration of the articular cartilage [4].

The prevalence of DJD of the TMJ varies greatly, depending on the diagnostic criteria, population studied, and means of assessment of the TMJ [5]. Clinical evidence of the disease is observed in 2 to 16% of the population [6,4,2] and structural involvement of the TMJ can be found in 35 to 94% of the patients with at least one symptom [7-9]. Inconsistencies in patient selection, diagnostic criteria, and techniques for TMJ assessment may result in this disparity [10]. Moreover, TMJ involvement in rheumatic diseases is not often assessed because other joints are generally involved first [8,11].

According to the Research Diagnostic Criteria for temporomandibular disorders (RDC/TMD) [12], OA involves the presence of reported symptoms and clinical signs (mandibular range of motion, joint pain or tenderness, and joint sounds). While validating and revising the criteria, the international RDC/TMD consortium observed a lack of adequate

validity of the clinical diagnostic criteria for this articular disorder [12]. So imaging should be used to confirm diagnosis by the presence on computed tomography (CT) of specific osseous changes: subchondral cyst, erosion, generalized sclerosis, or osteophyte [13]. The new criteria was called Diagnostic Criteria for TMD (DC/TMD) and considered the terms OA and osteoarthritis to denote subclasses of DJD [12]. Moreover, the current TMD classification was expanded to include less common, but clinically important disorders like the systemic arthritides that included RA and JIA on TMJ [14].

In 2011, Manfredini *et al.* [6] published a systematic review of findings from epidemiologic studies adopting the RDC/TMD. The authors observed that only in a minority of the studies considered imaging examination on diagnoses. Studies using a combination of clinical and radiological diagnosis report a higher prevalence in the inflammatory-degenerative disorders group compared to the diagnoses based on clinical criteria alone [13]. In 2016, the workgroup of the International Consortium suggested that studies about inflammation on TMJ should observe its local and systemic genesis and also consider rheumatological and orthopaedic expertise [15].

In view of these considerations, the purpose of this systematic review was to comprehensively evaluate the prevalence of DJD of the TMJ using clinical and imaging diagnosis and to discuss how the diagnostic criteria according to pathogenesis could influence this data.

METHODS

Study design

A systematic review was undertaken using a two-phase selection process according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses [16] guidelines. The systematic review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO) under the number CRD42017060281[17].

Eligibility criteria

- Inclusion criteria

This review included observational studies that reported the prevalence of DJD of the TMJ, assessed by clinical examination and imaging. Concerning clinical diagnosis, we considered studies that at least evaluated mandibular range of motion, joint pain or tenderness, and joint sounds [12]. For imaging diagnosis, we considered studies using cone beam computed tomography (CBCT), CT, tomography, or magnetic resonance imaging (MRI) [14]. No time restrictions were applied.

- Exclusion criteria

In phase one of assessment of titles and abstracts, studies that matched the following criteria were excluded: 1-reviews, letters, conference abstracts, editorials, and case reports; 2- studies that did not match intervention criteria from the PICOS (population, intervention, comparison, and outcomes) strategy; i.e., studies in which only imaging was used to confirm DJD, studies in which imaging was not used to confirm DJD, or studies in which detailed clinical examination was not performed; 3- studies in which frequency (or data to calculate them) was not reported due to different target conditions. In phase two of the full- text reading, the following exclusion criteria were added: 4- unavailability of full paper copy and 5- studies not written in Roman alphabet.

Information sources & search

Appropriate search strategies, including truncation and word combinations, were developed for each of the following databases: LILACS, LIVIVO, PubMed (including MEDLINE), Science Direct, SCOPUS, and Web of Science. A partial grey literature search was performed using Google Scholar, OpenGrey, and ProQuest. The Google Scholar search was limited to the first 60 most relevant articles published in the last 10 years. All databases were searched on October 10th, 2016; an update search was performed on January 10th, 2018. The references cited in the selected articles were also checked for any incremental references that could have been inadvertently omitted during the electronic database searches.

All references were managed by the reference managing software EndNote X7.4 (Thomson Reuters, New York, NY, USA), and duplicate hits were removed with the help of Rayyan (Qatar Computing Research Institute, Doha, Qatar) [18], a mobile app for systematic reviews. More information on the search strategies is provided in Appendix 1.

Study selection

The selection process was carried out in two phases. In phase one, two reviewers (L.Q.P, and I.P.T.) independently examined the titles and abstracts of all identified references. Any studies that did not meet the inclusion criteria were excluded. This blind process was ensured and registered as it was conducted using the Rayyan app [18]. In phase 2, the same two reviewers independently applied the exclusion criteria to the remaining studies based on full text readings. Disagreement in either phase was resolved by discussion and mutual decision with a third reviewer (Y.M.P.). The final selection was always based on the full-text of the publication.

Data collection process

The same two reviewers (L.Q.P, and I.P.T.) extracted the required data from the selected articles. A third author (Y.M.P) crosschecked all the collect information and confirmed its

accuracy.

Data items

For all the included studies, the descriptive characteristics were recorded following the PICOS principles: population characteristics (type of studied population, sample size, age, and gender); intervention (type of clinical and imaging assessment); outcomes (prevalence findings); and studies (authors, year of publication, country, study type). Comparison could not be performed due to the cross-sectional design of this study. If required, the authors calculated some of the required data.

Data synthesis

Quantitative analyses of the included studies were performed by combining the prevalence data through a meta-analysis. Forest plots were elaborated with the aid of MedCalc Statistical Software version 14.8.1 (Ostend, Belgium). Heterogeneity was calculated by inconsistency index (I^2), and values greater than 50% were considered indicative of substantial heterogeneity between the studies, applying a random effect.

Risk of bias in individual studies

The risk of bias of selected studies was assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data (2014) [19]. This checklist addresses critical issues of internal and external validity that must be considered when assessing the validity of prevalence data. Two reviewers (L.Q.P, and I.P.T.) independently scored the risk of bias as “low risk,” “moderate risk,” or “high risk.” Disagreements were resolved by a consensus involving a third author (Y.M.P). Risk of bias was categorized by the authors as high when up to 49% of the studies scored “yes,” moderate when 50% to 69% of the studies scored “yes,” and low when more than 70% of the studies scored “yes”.

Analysis of subgroups

Subgroups analysis was performed by grouping studies according to pathogenesis: prevalence of DJD of the TMJ in patients with rheumatic diseases formed group 1, and prevalence of DJD of the TMJ in patients with TMD formed group 2.

RESULTS

Study selection

In phase one, 1,331 different citations were identified across the six electronic databases. Moreover, 60 citations from Google Scholar, 14 from OpenGrey, and 10 from ProQuest were also considered. After removing duplicates, 1,082 citations remained. After a comprehensive evaluation of the abstracts, 987 articles were excluded. Therefore, 95 articles were retrieved for full-text reading. Six more studies were included to phase two: one from a hand-screening on the reference lists, one suggested by the expert of the team, three from the first update search

on April, 28th 2017 and another one from the second update on January 10th 2018. From these 101 remaining studies, 69 articles were subsequently excluded (Appendix 2). Thus, 32 [20,11,21,22,8,23- 40,10,41-48] studies were included in the final qualitative synthesis (Table 1 and 2). Of these, 28 [20,11,21,8,24-40,10,41-43,46- 48] presented useful data for quantitative synthesis. A flowchart of the identification process, inclusion, and exclusion of the studies is shown in Figure 1.

Qualitative results of studies

Studies included in the qualitative analysis were conducted in 16 different countries: Austria [49,29-33], Germany [22,28,23,44], United States [20,47,43], Brazil [34,27,26] Sweden [36,48], Switzerland [37,38], Turkey [8,25], Bulgaria [45], Denmark [21], Egypt [42], Finland [35], India [41], Japan [39], Norway [11], Slovenia [40], and Taiwan [10]. Sample sizes ranged from 15 [34,8] to 1,038 participants [38], and the total sample size included 3,435 subjects.

Two studies [23,44] had samples selected from general population. All others had convenience samples and investigated two specific populations of patients, so they were clustered into two groups according to pathogenesis of DJD. Group 1 comprised of 13 studies that reported the prevalence of DJD in TMJ secondary to rheumatic systemic diseases (JIA, RA, Marfan's Syndrome, ankylosing spondylitis, spondyloarthropathy, and mixed connective tissue diseases). Group 2 comprised of 19 studies that investigated the prevalence of DJD among patients with TMD in different populations: children, youths, adults, and seniors.

DJD diagnoses in all studies were done by clinical assessment and imaging exam confirmation. Concerning the type of clinical assessment, some studies have used published protocols such as RDC/TMD [50] or DC/TMD [12]; however, in order to reduce heterogeneity between included studies reviewers assured that all of them evaluated at least the mandibular range of motion, joint pain or tenderness, and perception of joint sounds by appropriate clinical tests. For imaging diagnosis, CBCT, CT, tomography, or MRI was used. Despite imaging technic used, reviewers considered only data from specific osseous changes [13,14] to analyze prevalence data. Tables 1 and 2 provide more information about included studies characteristics.

Synthesis of results

In principle, population-based studies would be required to achieve the purpose of this review, which was to evaluate the prevalence of degenerative diseases in the temporomandibular joint. However, the only two studies [23,44] that matched the inclusion criteria had age related samples extracted from epidemiological studies and did not really represent the general population, so they could not be considered for quantitative data synthesis. Thus, this review evaluated the prevalence of DJD of the TMJ in population of

patients.

The study on patients with Marfan's syndrome [22] was excluded from this analysis because it was the only study that reported DJD of the TMJ. Another study [45] did not have enough data to be included in the quantitative analysis. Finally, a majority of the studies had convenience samples formed by subjects who were referred to specialized treatment centers and so proportion meta-analysis was conducted within 28 studies from the 32 selected in phase 2.

For the meta-analysis, group 1 was divided as following: 1.1) only studies evaluating patients with JIA (n= 7) and 1.2) studies evaluating patients with RA (n=5). In group 2, the studies that reported the prevalence of DJD of the TMD patients were also divided: 2.1) only studies with positive cases reported by patients (n= 7) and 2.2) with positive cases reported by joint (n=9). Detailed information about the groups may be found in

According to the meta-analysis, the prevalence of DJD in patients with JIA was 66.70% (CI: 54.31-78.01, n=292) and that in patients with RA was 78.85% (CI: 61.64-91.94, n=140). Forest plots of group 1 are shown in Figure 2.

In group 2, the prevalence of DJD in patients with TMD was 62.77% (CI: 33.61-87.58, n=1,472) when reported according to patients and that reported according to the joints was 44.23% (CI: 31.48-57.39, n=2,199). Forest plots of group 2 are shown in Figure 3.

The heterogeneity between the studies found in the meta-analysis was high, possibly due to the differences in the samples and the methods of assessing the disease; therefore, a random model was chosen. In group 1, an inconsistency (I^2) of 78.63% (CI: 55.91 to 89.64, $p = 0.0001$) was found between studies in patients with JIA and I^2 of 79.80% (CI: 52.29 to 91.45, $p = 0.0005$) was found between those in patients with RA. In group 2, for positive cases reported according to patients, an I^2 of 98.69% (CI: 98.20 to 99.04, $p < 0.0001$) was found; and for positive cases reported according to the joint, I^2 was 97.27% (CI: 96.14 to 98.07, $p < 0.0001$).

Risk of bias within studies

The selected studies were mostly heterogeneous. Only six studies [20,11,47] [37,38,46] were classified at low risk of bias; four of these were on patients with JIA (group 1) and two were on patients with TMD (group 2). The study with the biggest sample size [38] had low risk and was conducted on patients with TMD. The majority [21,24,27-33,35,39,10,42,48] was classified as moderate risk. The other nine studies [34,43,8,25,22,51,40,41,26] presented high risk of bias; six of these were on patients with systemic rheumatic disease (from group 1). The high risk of bias was assigned by a negative or unclear response to questions 4, 5, 7, and 9 in all studies; these items corresponded to subject's description, sample coverage, measurement

reliability, and confounding factor identification, respectively. Table 3 provides the results for the risk of bias within the studies and Appendix 3 provides detailed information about assessment of critical issues.

Level of Evidence

The GRADE system for evaluating quality of evidence was applied to both the groups. The systemic patient outcomes were categorized as low (group 1) and moderate for patients with TMD (group 2). GRADE table of findings is shown in Appendix 5.

DISCUSSION

This systematic review investigated the available literature reporting the prevalence of DJD of the TMJ, including 3,435 subjects. The results could not determine the prevalence in general population, instead indicated high prevalence in patients with systemic rheumatic diseases and a relatively less, but still high, prevalence in patients with TMD without systemic involvement. These findings have clinical significance because degenerative changes may lead to pain and functional impairment that can affect chewing and range of mouth opening. In patients with rheumatic disease, DJD of the TMJ is a concern, particularly in those who are growing due to it can causes growth disorders of the jaw as well as facial deformities [47].

The pathogenesis of degeneration involves an inflammatory process that has different sources depending on its origin from a systemic disease or a local condition. In patients with rheumatic diseases, due to immunological activation, articular surfaces of the condyles are covered by an inflamed granulation tissue (pannus), which causes destruction of the joint tissue osseous structures [52]. In local conditions, the pathological process is initiated by deterioration and abrasion of the articular cartilage due to overloading stress that exceeded functional adaptive remodeling, with subsequent release of degraded proteoglycans and proteolytic enzymes into the synovial fluid. This could lead to a secondary inflammatory response with further degradation of the joint components [2]. However, an early study (5) demonstrated that inflammation is present in OA joints well before the development of osseous changes and suggested that, even in its earliest stages, before visible cartilage degeneration has occurred, local OA is already an inflammatory disease [53].

Despite these differences in pathogenesis, the diagnosis of degenerative changes of the TMJ is usually the same: generally made at a late stage by clinical detection of same signs and symptoms, and confirmation with imaging exam. However, appropriate treatment differs according the pathogenesis so correct differential diagnosis is crucial.

Reported prevalence of DJD is controversial, ranging from 2 to 94% [20,25,35,8] and also varies depending on the diagnostic methods used. From a methodological viewpoint, it should be noted that inclusion in the present review was necessarily based on clinical and imaging diagnosis. Although the clinical diagnosis of DJD present in the subgroups IIIb and IIIc of the RDC/TMD matches the criteria used for the selection of studies (evaluation of mandibular range of motion, joint pain, and joint sounds), they were not restricted to the use of RDC/TMD in this systematic review. This strategy allowed the inclusion of studies that addressed systemic DJD and had not used this specific diagnostic tool, although had evaluated the same clinical parameters. The inclusion of these studies is important because early symptoms of rheumatic diseases may occasionally occur first in the TMJ [8,11]. Also, considering gathered diagnostic data from TMJ arthritis of local or systemic genesis is a recommendation of the RDC/TMD International Consortium [15]. In these cases, interaction between dental and medical professionals is important for correct differential diagnosis and appropriate multidisciplinary treatment.

The validity of clinical diagnosis for DJD without imaging has a sensitivity of 55% and specificity of 61%; therefore, imaging should be used to confirm the diagnosis [12]. Although we found some studies that used conventional radiographic TMJ projections like transpharyngeal, transcranial, and panoramic radiograph to confirm diagnoses, we restricted the inclusion to tomographic or MRI studies. Radiographs of the TMJ may be low inexpensive and adequate in a number of clinical situations; however, bony alterations such as erosions, osteophytes, flattening, sclerosis, pseudocysts, and pneumatizing of articular eminence are difficult to detect on conventional radiographs, as overlapping of the anatomic structures occur in these disorders [54]. The advantage of using CBCT or CT is the possibility of acquiring images that enable an accurate description of TMJ morphology [55]. MRI is being increasingly recognized as a useful method for early detection of destructive as well as inflammatory lesions, especially on TMJ [5] because, despite not showing bony abnormalities distinctly, it is the most sensitive technique for detecting acute synovitis and the only one able to demonstrate bone marrow edema [56]. It is specially significant on DJD secondary to rheumatic diseases in which inflammatory response and proliferation of synovial tissues usually occurs before osseous changes [57]. However, in order to reduce heterogeneity between imaging results from different imaging techniques, only assessment of osseous components according to Ahmad *et al* [13] were considered in this review.

Some studies included in this review reported both the clinical and imaging prevalence of DJD and demonstrated that the use of imaging increases the prevalence rate. On studies with patients with rheumatic diseases, only 4 studies didn't report both data. Weiss *et al.*, 2008 [47]

found that 64% of the patients with JIA clinically presented DJD of the TMJ; this prevalence was 69% when MRI was used to confirm the diagnosis. Mohammed *et al.*, 2012 [42] found the clinical prevalence to be 35% and that with MRI to be 80%. Resnick *et al.* 2016 [43], found the clinical prevalence in patients with JIA to be 24% and that using CBCT to be 67%. Ferraz Junior *et al.*, 2012 [34] found a bigger difference: 40% prevalence clinically and 93.3% prevalence on imaging. The same occurred in patients with RA. Bayar *et al.*, 2002 [8] found 40% of the patients with clinical DJD of the TMJ and 86.6% according to CT images. For Celiker *et al.*, 1995 [25] none of the patients with RA presented a clinical diagnosis and 45% presented anomalies on imaging. Helenius *et al.*, 2006 [35] found the same clinical and imaging prevalence of 75% in patients with RA. These higher prevalence results with imaging are particularly important in pediatric rheumatology, where it is difficult to apply the clinical definition of arthritis on TMJ to patients with JIA [11,15].

The results also demonstrate that among the patients with TMD (group 2), the prevalence of degenerative disease is lower than in patients with systemic disease, although still considerably high.

Studies in patients with TMD consider the local condition that could affect one or both TMJ in a patient. Thus, the studies may differ in the way they report the frequency: by patients or by joint. Studies that reported by patient presented a higher overall prevalence (62.77%) than those that reported by joint (44.23%). Although the greatest variation occurred between the studies by patient, the prevalence rate varied significantly among both types. This could be due to the heterogeneity of the populations in the studies. Some studies considered specific populations such as seniors, adults with obstructive sleep apnea, or women with bruxism, while others considered broader populations clustering children, teenagers, and adults. Another possibility is the different types of imaging examination used for diagnosis. The overall prevalence of DJD of the TMJ found in patients with TMD is higher than that reported earlier [6], probably because we considered the diagnoses by imaging in addition to clinical diagnoses, increasing the detection of degenerative changes even in mild clinical symptoms. However, we should not disregard the dissociation demonstrated by previous studies [23,58,59] between clinical condition and the presence of degenerative changes on images. Clinical conditions are determinant for treatment decisions while imaging confirmation on diagnosis is the most appropriate to find the correct frequency rates.

LIMITATIONS

Some limitations could be pointed out in this systematic review. The results for systemic diseases are restricted to JIA and RA because the search strategy was intentionally performed

with broader terms like “degenerative joint disease” or “osteoarthritis.” Therefore, the prevalence of TMJ involvement in other specific rheumatic diseases should be further developed. The included studies of systemic disease had small samples, most likely because JIA and RA have low prevalence in the general population [11,60]. Moreover, all studies presented selection bias because all used convenience samples that were not representative of the studied population or of the general population. High and statistically significant heterogeneity was found between studies in all meta-analysis groups, which can be explained by the differences in the study methodologies, populations, and measures of the outcome. Thus, random model effect was selected to analyze the data.

Finally, according to the GRADE system, the quality of the evidence in this review was evaluated as low for the systemic patient outcomes (group 1) and as moderate for the patients with TMD (group 2), suggesting moderate confidence in the estimated effect.

CONCLUSION

This systematic review showed high prevalence of 66.70% and 78.85% for DJD of the TMJ in patients with JIA and RA, respectively. In addition, a significant prevalence of 62.77% was observed among patients with TMD. Both specialist doctors and dentists should be alert to not underestimate and to correct diagnose DJD of the TMJ early in patients with rheumatic disease and TMD. Further research in a well-structured population-based prospective study is necessary to provide a more accurate prevalence of DJD of the TMJ in the general population.

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interest: Author Leticia L Quirino Pantoja declares that he has no conflict of interest. Author Isabela Porto de Toledo declares that he has no conflict of interest. Author Yasmine Mendes Pupo declares that he has no conflict of interest. Author André Luís Porporatti declares that he has no conflict of interest. Author Graziela De Luca Canto declares that he has no conflict of interest. Author Liete Figueiredo Zwir declares that he has no conflict of interest. Author Eliete Neves Silva Guerra declares that he has no conflict of interest.

Funding: This work was not supported by any sources of consultants' fees or other financial arrangements paid directly to investigators.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: For this type of study, formal consent is not required.

REFERENCES

1. Poole AR (2012) Osteoarthritis as a whole joint disease. *HSS J* 8 (1):4-6. doi:10.1007/s11420-011-9248-6
2. Tanaka E, Detamore MS, Mercuri LG (2008) Degenerative disorders of the temporomandibular joint: etiology, diagnosis, and treatment. *J Dent Res* 87 (4):296-307. doi:10.1177/154405910808700406
3. Leeuw R, Gary D. (2013) *Orofacial Pain: guidelines for assessment, diagnosis and management - Fifth edition.*
4. Kalladka M, Quek S, Heir G, Eliav E, Mupparapu M, Viswanath A (2014) Temporomandibular joint osteoarthritis: diagnosis and long-term conservative management: a topic review. *J Indian Prosthodont Soc* 14 (1):6-15. doi:10.1007/s13191-013-0321-3
5. Helenius LM, Hallikainen D, Helenius I, Meurman JH, Kononen M, Leirisalo-Repo M, Lindqvist C (2005) Clinical and radiographic findings of the temporomandibular joint in patients with various rheumatic diseases. A case-control study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 99 (4):455-463. doi:10.1016/j.tripleo.2004.06.079
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 Surg Oral Med Oral Pathol Oral Radiol Endod* 112 (4):453-462. doi:10.1016/j.tripleo.2011.04.021
7. Bracco P, Debernardi C, Piancino MG, Cirigliano MF, Salvetti G, Bazzichi L, De Feo F, Bosco M (2010) Evaluation of the stomatognathic system in patients with rheumatoid arthritis according to the research diagnostic criteria for temporomandibular disorders. *Cranio : the journal of craniomandibular practice* 28 (3):181-186. doi:10.1179/crn.2010.025
8. Bayar N, Kara SA, Keles I, Koç MC, Altinok D, Orkun S (2002) Temporomandibular Joint Involvement in Rheumatoid Arthritis: A Radiological and Clinical Study. *Cranio* 20 (2):105-110
9. Brooks SL, Westesson PL, Eriksson L, Hansson LG, Barsotti JB (1992) Prevalence of osseous changes in the temporomandibular joint of asymptomatic persons without internal derangement. *Oral Surg Oral Med Oral Pathol* 73 (1):118-122
10. Lin YC, Hsu ML, Yang JS, Liang TH, Chou SL, Lin HY (2007) Temporomandibular joint disorders in patients with rheumatoid arthritis. *J Chin Med Assoc* 70 (12):527-534
11. Arvidsson LZ, Smith HJ, Flato B, Larheim TA (2010) Temporomandibular joint findings in adults with long-standing juvenile idiopathic arthritis: CT and MR imaging assessment. *Radiology* 256 (1):191-200
12. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A, Brooks SL, Ceusters W, Drangsholt M, Ettlin D, Gaul C, Goldberg LJ, Haythornthwaite JA, Hollender L, Jensen R, John MT, De Laat A, de Leeuw R, Maixner W, van der Meulen M, Murray GM, Nixdorf DR, Palla S, Petersson A, Pionchon P, Smith B, Visscher CM, Zakrzewska J, Dworkin SF, International Rdc/Tmd Consortium Network IafDR, Orofacial Pain Special Interest Group IAftSoP (2014) Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Groupdagger. *Journal of oral & facial pain and headache* 28 (1):6-27. doi:10.11607/jop.1151
13. Ahmad M, Hollender L, Anderson Q, Kartha K, Ohrbach R, Truelove EL, John MT, Schiffman EL (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. doi:<http://dx.doi.org/10.1016/j.tripleo.2009.02.023>
14. Peck CC, Goulet JP, Lobbezoo F, Schiffman EL, Alstergren P, Anderson GC, de Leeuw R, Jensen R, Michelotti A, Ohrbach R, Petersson A, List T (2014) Expanding the taxonomy of the diagnostic criteria for temporomandibular disorders. *J Oral Rehabil* 41 (1):2-23. doi:10.1111/joor.12132
15. Michelotti A, Alstergren P, Goulet JP, Lobbezoo F, Ohrbach R, Peck C, Schiffman E, List T (2016) Next steps in development of the diagnostic criteria for temporomandibular disorders (DC/TMD):

Recommendations from the International RDC/TMD Consortium Network workshop. *J Oral Rehabil* 43 (6):453-467. doi:10.1111/joor.12378

16. Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA, Group P-P (2015) Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ* 349:g7647. doi:10.1136/bmj.g7647

17. Pantoja L L Q TIP, Pupo Y M, Porporatti A L, Canto G De L , Zwir L F, Guerra E N S (2017) Prevalence of degenerative disease in temporomandibular joint: a systematic review. PROSPERO 2017:CRD42017060281. Available from http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017060281

18. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A (2016) Rayyan-a web and mobile app for systematic reviews. *Syst Rev* 5 (1):210. doi:10.1186/s13643-016-0384-4

19. Munn Z, Moola S, Riitano D, Lisy K (2014) The development of a critical appraisal tool for use in systematic reviews addressing questions of prevalence. *Int J Health Policy Manag* 3 (3):123-128. doi:10.15171/ijhpm.2014.71

20. Abramowicz S, Kim S, Susarla HK, Kaban LB (2013) Differentiating Arthritic From Myofascial Pain in Children With Juvenile Idiopathic Arthritis: Preliminary Report. *Journal of Oral and Maxillofacial Surgery* 71 (3):493-496

21. Bakke M, Petersson A, Wiese M, Svanholt P, Sonnesen L (2014) Bony Deviations Revealed by Cone Beam Computed Tomography of the Temporomandibular Joint in Subjects Without Ongoing Pain. *Journal of Oral & Facial Pain and Headache* 28 (4):331-337

22. Bauss O, Sadat-Khonsari R, Fenske C, Engelke W, Schwestka-Polly R (2004) Temporomandibular joint dysfunction in Marfan syndrome. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 97 (5):592-598

23. Bernhardt O, Biffar R, Kocher T, Meyer G (2007) Prevalence and clinical signs of degenerative temporomandibular joint changes validated by magnetic resonance imaging in a non-patient group. *Ann Anat* 189 (4):342-346

24. Bertram S, Rudisch A, Innerhofer K, PÜmpel E, Grub-Wieser G, Emshoff R (2001) Diagnosing TMJ internal derangement and osteoarthritis with magnetic resonance imaging. *The Journal of the American Dental Association* 132 (6):753-761. doi:http://dx.doi.org/10.14219/jada.archive.2001.0272

25. Celiker R, Gokce-Kutsal Y, Eryilmaz M (1995) Temporomandibular joint involvement in rheumatoid arthritis. Relationship with disease activity. *Scandinavian journal of rheumatology* 24 (1):22-25

26. Cordeiro PCF GJ, Souza VA, Dias IM, Silva JNN, Devito KL, Bonato LL (2016) Temporomandibular joint involvement in rheumatoid arthritis patients: association between clinical and tomographic data. *Acta Odontol Latinoam* 29 (3):219-224

27. Dias GM, Bonato LL, Guimarães JP, Nogueira Silva JN, Ferreira LA, Grossmann E, Pires Carvalho AC (2015) A study of the association between sleep bruxism, low quality of sleep, and degenerative changes of the temporomandibular joint. *Journal of Craniofacial Surgery* 26 (8):2347-2350

28. Eberhard L, Giannakopoulos NN, Rohde S, Schmitter M (2013) Temporomandibular joint (TMJ) disc position in patients with TMJ pain assessed by coronal MRI. *Dentomaxillofacial Radiology* 42 (6)

29. Emshoff R, Brandmaier I, Bertram S, Rudisch A (2002) Magnetic resonance imaging findings of osteoarthrosis and effusion in patients with unilateral temporomandibular joint pain. *Int J Oral Maxillofac Surg* 31 (6):598-602

30. Emshoff R, Brandmaier I, Gerhard S, Strobl H, Bertram S, Rudisch A (2003) Magnetic resonance imaging predictors of temporomandibular joint pain. *J Am Dent Assoc* 134 (6):705-714

31. Emshoff R, Innerhofer K, Rudisch A, Bertram S (2002) The biological concept of "internal derangement and osteoarthrosis": a diagnostic approach in patients with temporomandibular joint pain? *Oral Surg Oral Med*

Oral Pathol Oral Radiol Endod 93 (1):39- 44

32. Emshoff R, Rudisch A, Bosch R, Strobl H (2003) Prognostic indicators of the outcome of arthrocentesis: a short-term follow-up study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 96 (1):12-18
33. Emshoff R, Rudisch A, Innerhofer K, Bösch R, Bertram S (2001) Temporomandibular joint internal derangement type III: relationship to magnetic resonance imaging findings of internal derangement and osteoarthritis. *International Journal of Oral and Maxillofacial Surgery* 30 (5):390-396
34. Ferraz Júnior AML, Devito KL, Guimarães JP (2012) Temporomandibular disorder in patients with juvenile idiopathic arthritis: clinical evaluation and correlation with the findings of cone beam computed tomography. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology* 114 (3):e51-e57
35. Helenius LM, Tervahartiala P, Helenius I, Al-Sukhun J, Kivisaari L, Suuronen R, Kautiainen H, Hallikainen D, Lindqvist C, Leirisalo-Repo M (2006) Clinical, radiographic and MRI findings of the temporomandibular joint in patients with different rheumatic diseases. *Int J Oral Maxillofac Surg* 35 (11):983-989. doi:10.1016/j.ijom.2006.08.001
36. Holmlund A, Axelsson S (1994) Temporomandibular joint osteoarthritis; correlation of clinical and arthroscopic findings with degree of molar support. *Acta Odontologica Scandinavica* 52 (4):214-218
37. Keller H, Muller LM, Markic G, Schraner T, Kellenberger CJ, Saurenmann RK (2015) Is early TMJ involvement in children with juvenile idiopathic arthritis clinically detectable? Clinical examination of the TMJ in comparison with contrast enhanced MRI in patients with juvenile idiopathic arthritis. *Pediatric Rheumatology* 13
38. Kim K, Wojczynska A, Lee JY (2016) The incidence of osteoarthritic change on computed tomography of Korean temporomandibular disorder patients diagnosed by RDC/TMD; a retrospective study. *Acta Odontol Scand* 74 (5):337-342. doi:10.3109/00016357.2015.1136678
39. Kurita H, Kojima Y, Nakatsuka A, Koike T, Kobayashi H, Kurashina K (2004) Relationship between temporomandibular joint (TMJ)-related pain and morphological changes of the TMJ condyle in patients with temporomandibular disorders. *Dentomaxillofac Radiol* 33 (5):329-333.
40. Lamot U, Strojan P, Popovič KŠ (2013) Magnetic resonance imaging of temporomandibular joint dysfunction-correlation with clinical symptoms, age, and gender. *Oral surgery, oral medicine, oral pathology and oral radiology* 116 (2):258-263.
41. Massilla Mani F, Sivasubramanian SS (2016) A study of temporomandibular joint osteoarthritis using computed tomographic imaging. *Biomedical Journal* 39 (3):201-206. doi:<http://dx.doi.org/10.1016/j.bj.2016.06.003>.
42. Mohammed Y, Saeed O, Zaghoul N, Samer S, Mahmud S, Abdulah A (2012) Juvenile idiopathic arthritis and the temporomandibular joint. *Alexandria Journal of Medicine* 48 (2):123-129. doi:10.1016/j.ajme.2011.11.004.
43. Resnick CM, Dang R, Henderson LA, Zander DA, Daniels KM, Nigrovic PA, Kaban LB (2017) Frequency and Morbidity of Temporomandibular Joint Involvement in Adult Patients With a History of Juvenile Idiopathic Arthritis. *J Oral Maxillofac Surg* 75 (6):1191-1200. doi:10.1016/j.joms.2016.11.013.
44. Schmitter M, Essig M, Seneadza V, Balke Z, Schroder J, Rammelsberg P (2010) Prevalence of clinical and radiographic signs of osteoarthritis of the temporomandibular joint in an older persons community. *Dentomaxillofac Radiol* 39 (4):231-234. doi:10.1259/dmfr/16270943.
45. Svechtarov V, Nencheva-Svechtarova S, Uzunov T (2015) Analysis of chronic temporomandibular disorders based on the latest diagnostic criteria. *Acta Medica Bulgarica* 42 (1):49-55.
46. Takahara N, Nakagawa S, Sumikura K, Kabasawa Y, Sakamoto I, Harada H (2017) Association of Temporomandibular Joint Pain According to Magnetic Resonance Imaging Findings in Temporomandibular Disorder Patients. *J Oral Maxillofac Surg*. doi:10.1016/j.joms.2017.03.026.

47. Weiss PF, Arabshahi B, Johnson A, Bilaniuk LT, Zarnow D, Cahill AM, Feudtner C, Cron RQ (2008) High prevalence of temporomandibular joint arthritis at disease onset in children with juvenile idiopathic arthritis, as detected by magnetic resonance imaging but not by ultrasound. *Arthritis Rheum* 58 (4):1189-1196
48. Wiberg B, Wanman A (1998) Signs of osteoarthritis of the temporomandibular joints in young patients - A clinical and radiographic study. *Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Endodontics* 86 (2):158-164
49. Bertram S, Rudisch A, Innerhofer K, Pumpel E, Grubwieser G, Emshoff R (2001) Diagnosing TMJ internal derangement and osteoarthritis with magnetic resonance imaging. *Journal of the American Dental Association* 132 (6):753-761
50. Dworkin SF LL, editors. (1992) Research Diagnostic Criteria for Temporomandibular Disorders: review, criteria, examinations and specifications, critique. *J Craniomandib Disord Facial Oral Pain* Vol. 6 (4.):301-355
51. Holmlund A, Axelsson S (1994) Temporomandibular joint osteoarthritis. Correlation of clinical and arthroscopic findings with degree of molar support. *Acta odontologica Scandinavica* 52 (4):214-218
52. Al-Shwaikh H, Urtane I, Pirttiniemi P, Pesonen P, Krisjane Z, Jankovska I, Davidsons Z, Stanevica V (2016) Radiologic features of temporomandibular joint osseous structures in children with juvenile idiopathic arthritis. Cone beam computed tomography study. *Stomatologija* 18 (2):51-60
53. Sokolove J, Brennan MJ, Sharpe O, Lahey LJ, Kao AH, Krishnan E, Edmundowicz D, Lepus CM, Wasko MC, Robinson WH (2013) Brief report: citrullination within the atherosclerotic plaque: a potential target for the anti-citrullinated protein antibody response in rheumatoid arthritis. *Arthritis Rheum* 65 (7):1719-1724. doi:10.1002/art.37961
54. Krishnamoorthy B, Mamatha N, Kumar VA (2013) TMJ imaging by CBCT: Current scenario. *Ann Maxillofac Surg* 3 (1):80- 83. doi:10.4103/2231-0746.110069
55. Alexiou K, Stamatakis H, Tsiklakis K (2009) Evaluation of the severity of temporomandibular joint osteoarthritic changes related to age using cone beam computed tomography. *Dentomaxillofac Radiol* 38 (3):141-147. doi:10.1259/dmfr/59263880
56. Navallas M, Inarejos EJ, Iglesias E, Cho Lee GY, Rodriguez N, Anton J (2017) MR Imaging of the Temporomandibular Joint in Juvenile Idiopathic Arthritis: Technique and Findings. *Radiographics* 37 (2):595-612. doi:10.1148/rg.2017160078
57. McInnes IB SG (2011) The Pathogenesis of Rheumatoid Arthritis. *N Engl J Med* 365 (23):2205-2219
58. Al-Ekrish AA, Al-Juhani HO, Alhaidari RI, Alfaleh WM (2015) Comparative study of the prevalence of temporomandibular joint osteoarthritic changes in cone beam computed tomograms of patients with or without temporomandibular disorder. *Oral Surg Oral Med Oral Pathol Oral Radiol* 120 (1):78-85. doi:10.1016/j.oooo.2015.04.008
59. Comert Kilic S, Kilic N, Sumbullu MA (2015) Temporomandibular joint osteoarthritis: cone beam computed tomography findings, clinical features, and correlations. *Int J Oral Maxillofac Surg* 44 (10):1268-1274. doi:10.1016/j.ijom.2015.06.023
60. Silman AJ, Pearson JE (2002) Epidemiology and genetics of rheumatoid arthritis. *Arthritis Res* 4 Suppl3:S265-272. doi:10.1186/ar578.

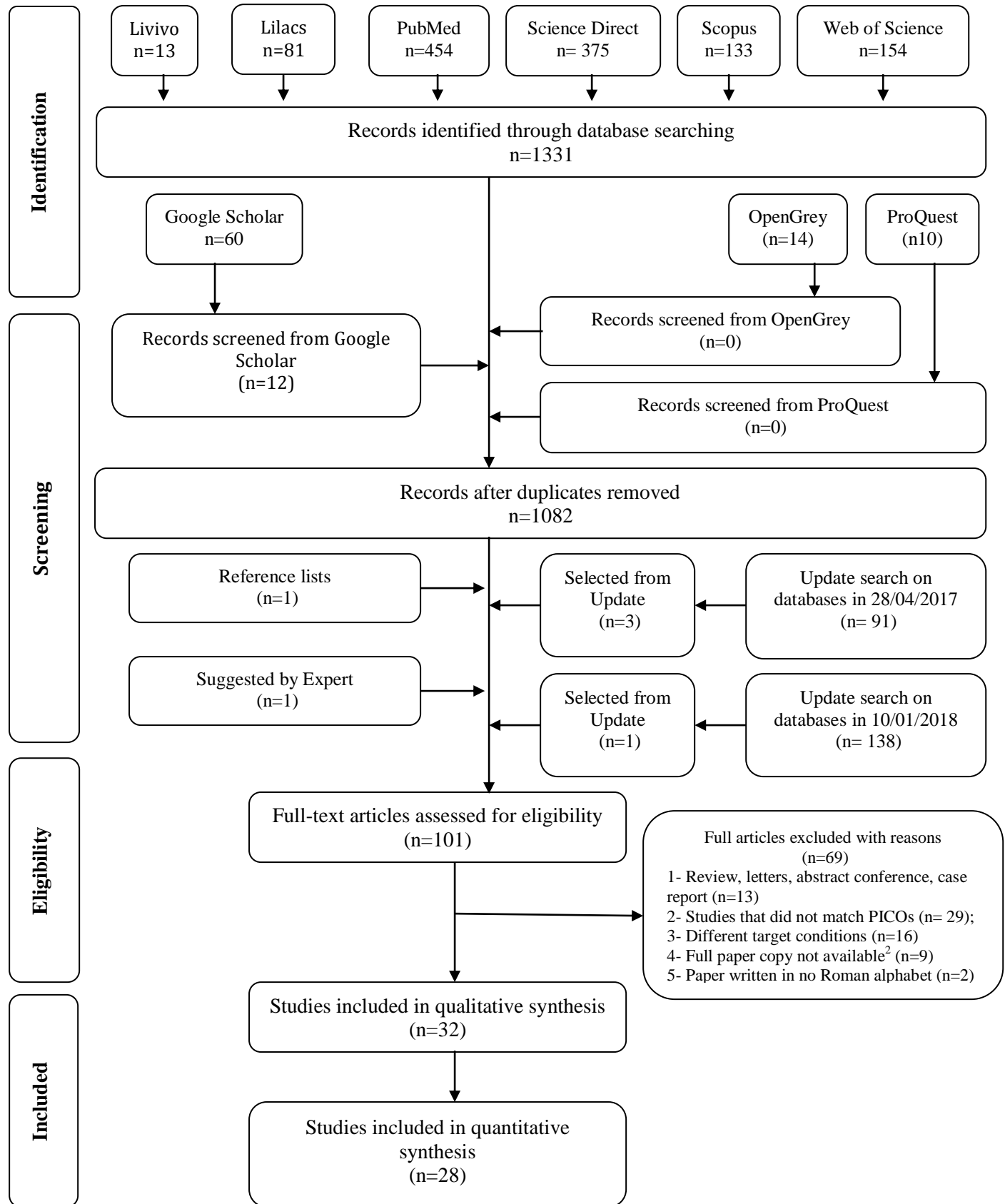
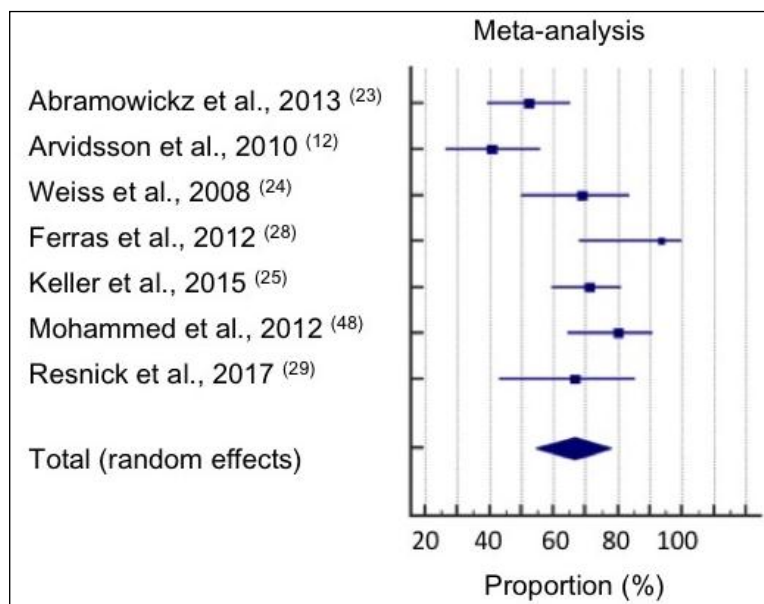
Figure 1 - Flow Diagram of Literature Search and Selection Criteria.¹¹ Adapted from PRISMA.² Papers published between 1985 and 1996, not available online. Authors were contacted unsuccessfully.

Figure 2 – Frequency of DJD of the TMJ in rheumatic patients (group1). Results from meta-analysis.

a)



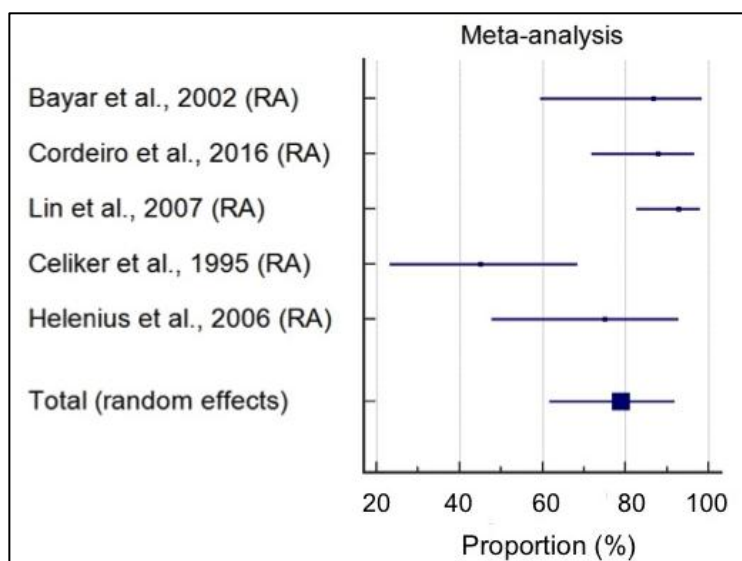
Meta-analysis	Proportion (%)	Confidence interval
Fixed effects	66.39	58.68 to 69.82
Random effects	66.70	54.31 to 78.01

Test for heterogeneity

Q	28.07
DF	6
Significance level	P = 0.0001
I^2 (inconsistency)	78.63%
95% CI for I^2	55.91 to 89.64

Figure 2a - Forest plot for frequency of DJD in TMJ of JIA patients. Sample=292.

b)



Meta-analysis	Proportion (%)	Confidence interval
Fixed effects	82.80	75.66 to 88.55
Random effects	78.85	61.63 to 91.94

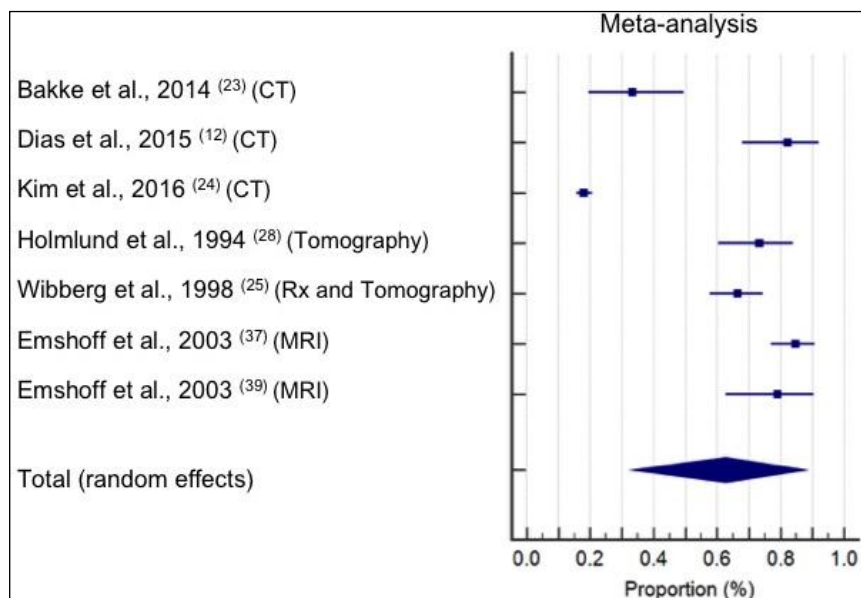
Test for heterogeneity

Q	19.80
DF	4
Significance level	P = 0.0005
I^2 (inconsistency)	79.80%
95% CI for I^2	52.29 to 91.45

Figure 2b - Forest plot for frequency of DJD in RA patients. Sample=140

Figure 3 – Frequency of DJD of the TMJ in TMD patients (group2). Results from meta-analysis.

a)



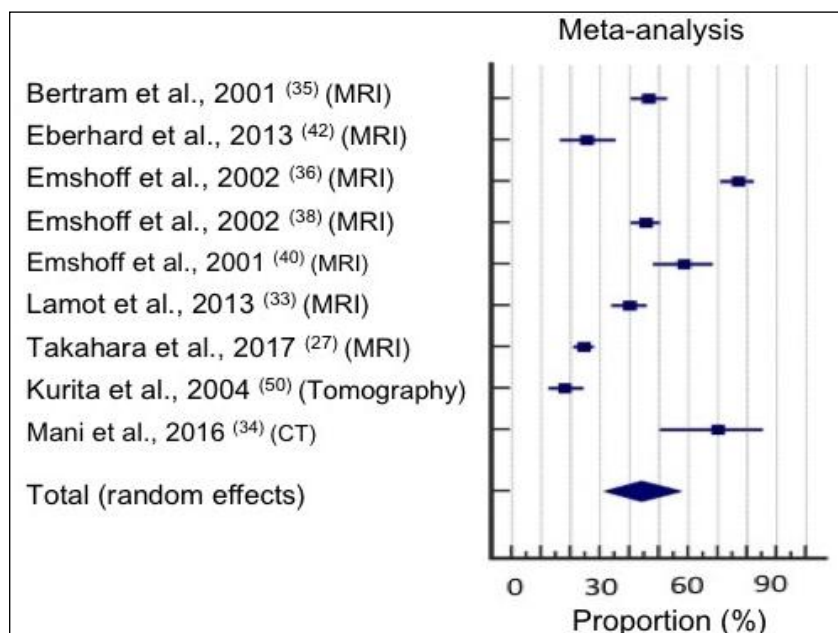
Meta-Analysis	Proportion (%)	Confidence Interval
Fixed effects	32.89	30.50 to 35.35
Random effects	62.77	33.61 to 87.58

Test for heterogeneity

Q	456.44
DF	6
Significance level	P < 0.0001
I^2 (inconsistency)	98.69%
95% CI for I^2	98.20 to 99.04

Figure 3a - Forest plot for frequency of DJD in TMD patients reported by patient. Sample=1472.

b)



Meta-Analysis	Proportion (%)	Confidence interval
Fixed effects	39.38	37,34 to 41,46
Random effects	44.23	31,48 to 57,39

Test for heterogeneity

Q	292.95
DF	8
Significance level	P < 0.0001
I^2 (inconsistency)	97.27%
95% CI for I^2	96,14 to 98,07

Figure 3b - Forest plot for frequency of DJD in TMD patients reported by joints. Sample=219.

Table 1- Summary of descriptive characteristics of studies that reported prevalence of DJD of the TMJ in patients with rheumatic diseases (group1) (n=13).

	Author, year	Country	Study type	Population	Sample size	Age (years) and range	Gender	Clinical Assessment	Imaging exam	Reported Prevalence	Observations
JIA	Abramowicz et al., 2013	USA	Cross-sectional	Children (<16)	61	12.7 (3-16)	44 female/ 17 male	CE	Rx and MRI	45.58 %	Considering groups 1 (TMJ arthritis) and 3 (myofascial pain + arthritis) according to authors classification.
	Arvidsson et al., 2010	Norway	Cross-sectional	children (<16)	47	8.8 ± 2.6	32 female / 15 male	CE	Rx and Tomography	40.4 %	Only the initial data from the first 2 years of the study were used to be in agreement with the JIA criteria of diagnosis.
	Weiss et al., 2008	USA	Cross-sectional	Children (<17)	32	8.4 (1.9–17.2) 9.9 (1.5–13.8)	25 female/ 7 male	CE	MRI (gadolinium contrast)	64% clinically and 69% by imaging	Considering just the result for chronic TMJ arthritis to be in agreement with the DJD definition.
	Ferraz et al., 2012	Brazil	Cross-sectional	Children and adults previously diagnosed with JIA	15	16.3 (6 -28)	7 female/ 8 male	RDC/TMD	CBCT	40% clinically and 93.3 % by imaging	Including 5 patients that continued to have the disease at the adult age (>18 years).
	Keller et al., 2015	Switzerland	Cross-sectional/ case control	Children and teenagers (<19) previously diagnosed with JIA	76	9.7 (1.9–18.6)	42 females/ 34 males	CE	MRI gadolinium contrast	68% clinically and 71% by imaging	TMJ was assessed for the presence of an effusion, increased contrast enhancement and deformity of the mandibular condyle.
	Mohammed et al., 2012	Egypt	Cross-sectional/ case control	Children (<17)	40	14.1±2.3	26 females/ 14 males	CE	MRI Gadolinium contrast	35 % clinically and 80 % by imaging	Variables evaluated on MRI was enhancement of synovial membrane, presence of pannus and intraarticular fluid
	Resnick et al., 2017	USA	Cross-sectional	Adults who had JIA	21	26.0 ± 6.1	15 females/ 6 males	CE	CBCT	24% clinically and 67% by imaging	Considering groups class B (deformation) and Class C (resorption), according to authors classification.
RA	Bayar et al., 2002	Turkey	Cross-sectional	Adults	15	52.8 (35-68)	13 females/ 2 males	CE	CT	40% clinically and 86.6% by imaging	None.
	Cordeiro et al., 2016	Brazil	Cross-sectional	Adults	33	59.4 (± 10.3)	33 females/ 0 males	RDC/TMD	CBCT	87,8%	Considering patients diagnosed with osteoarthritis and osteoarthroses

	Lin et al., 2007	Taiwan	Cross-sectional	Adults	56	56.3 ± 14.6	41 females/ 15 males	CE	Tomography	92.9%	None.
	Celiker et al., 1995	Turkey	Cross-sectional	Adults	20	48.1 (26-68)	18 females/2 males	CE	Rx CT and MRI	0 % clinically and 45% by imaging	Data refer to patients.
	Helenius et al., 2006	Finland	Cross-sectional	Adults	67 (16 RA, 15 MCTD, 18 AS, 18 SPA)	RA= 45.9 (±13.2)	RA= 14 females/ 2 males	CE	Rx and MRI	RA=75% (12 of 16 patients) Clinically and imaging, the same result MCTD = 60% (9 of 15patients)	Data refer to patients. Considering just the RA for results in MA.
						MCTD= 45.1 (±13.0)	MCTD= 14 females/1 male			AS= 67%(12 of 18 patients)	
						AS= 43.9 (±13.0)	AS= 16 females/2 males			SPA= 61% (11 of 18 patients)	
						SPA= 43.4 (±12.7)	SPA= 8 females/ 10 males				
Marfan	Bauss et al., 2004	Germany	Cross-sectional	Adults	21	38 (17-51)	11 females/ 10 males	CE	MRI	19%	None.

***Legend:** **JIA:** juvenile idiopathic arthritis; **RA:** rheumatoid arthritis; **MCTD:** mixed connective tissue disease; **AS:** ankylosing spondylitis; **SPA:** spondylosarthritis; **RDC/TMD:** Research Diagnostic Criteria for Temporomandibular Disorders (Dworking et al, 1992); **CDC/TMD:** Clinical Diagnostic Criteria for Temporomandibular Disorders (Trulove et al., 1992); **CE*:** Clinical examination including at least evaluation of mandibular range of motion, joint pain or tenderness and evaluation of joint sounds; **CT:** computed tomography; **CBCT:** cone beam computed tomography; **MRI:** magnetic resonance imaging; **MA:** meta-analysis.

Table 2- Summary of descriptive characteristics of studies that reported prevalence of DJD of the TMJ in patients with TMD (n=19).

	Author, year	Country	Study type	Population	Sample size	Age (years) and range	Gender	Clinical Assessment	Imaging exam	Reported Prevalence	Observations
TMD patients	Bakke et al., 2014	Denmark	Cross-sectional	Adults with OSA**	42	51 ± 11	14 females/ 28 males	CE and RDC/TMD	CBCT	33.3% of patients	Considering patients with osteoarthritis by the author's classification to be in agreement with other studies DJD classification.
	Dias et al., 2015	Brazil	Cross-sectional	Female adults with sleep bruxism	45	43 (± 6.2)	45 females	RDC/TMD	CBCT	82.2% of patients	Considering patients classified at group IIIb (osteoarthritis) and IIIc (osteoarthrosis) from RDC.
	Holmlund et al., 1994	Sweden	Case-control	Adults TMD patients	60 (over a period of 8 years)	55.0 (47-71)	26 females/ 4 males	CE	Tomography	73.3% of patients	Although the original study design is case control, for the variable in question both groups are similar, so prevalence was calculated on total of participants as in a cross-sectional study.
	Kim et al., 2016	Switzerland	Cross-sectional	Adults TMD patients	1038 records	31.1 female (± 17.4)/ 34.0 male (± 16.2)	741 females/ 297 males	RDC/TMD	Rx and CT	18% of patients	Considering patients classified at group IIIb (osteoarthritis) and IIIc (osteoarthrosis) from RDC.
	Wiberg et al., 1998	Sweden	Cross-sectional	Children, teenagers and Adults TMD patients (>12 years < 30 years)	131	21.6 (12-30)	103 females/ 28 males	CE	Rx and Tomography	66% of patients	74% bilateral and 26% unilateral.
	Bernhardt et al., 2007	Germany	Cross-sectional	Adults from population	307	20-49	167 females/ 140 males	CE	MRI	25% of patients	Subjects of this study were selected from a cross sectional epidemiological study and had no request for TMD treatment.
	Emshoff et al., 2003	Austria	Cross-sectional	Children, teenagers and adults TMD patients (>12 years)	118	36.9 (12-69)	102 females/ 16 males	CDC/TMD	MRI	84.7% of patients	Data refer to TMJ pain groups: ID-I/ ID-III/ DJD/ C/S according to author's classification.
	Emshoff et al., 2003	Austria	Cross-sectional	Teenagers and adults TMD patients	38	33.8 (± 14.9)	32 females/ 6 males	CDC/TMD	MRI	79.0% of patients	Data refer to TMJ groups according to author's classifications and correspond to successful

			(>17 years)							and unsuccessful arthrocentesis outcomes.
Schmitter et al., 2010	Germany	Cross-sectional	Seniors	30	74.82 females (± 0.78)/ 74.39 males (± 0.93)	15 females/ 15 males	RDC/TMD	MRI	70% of patients	Subjects of this study were selected from a cohort study and had no request for TMD treatment.
Bertram et al., 2001	Austria	Cross-sectional	Teenagers and adults TMD patients	131	36.4 (14-79)	112 females/ 19 males	CE	MRI	46.5% of joints	Data refer to joints.
Eberhard et al., 2013	Germany	Cross-sectional	Adults TMD patients	66	40.50 (18-80)	44 females/ 22 males	RDC/TMD	MRI	25.3% of joints	Data refer to joints.
Emshoff et al., 2002	Austria	Cross-sectional	Teenagers and adults TMD patients	112	38.2 (15-78)	97 females/ 15 males	CE	MRI	77.2% of joints	Data refer to joints.
Emshoff et al., 2002	Austria	Cross-sectional	Teenagers and adults TMD patients (>15 years)	194	36.0 (17-79)	152 females/ 42 males	CE	MRI	45.4% of joints	Data refer to joints in TMJ groups (pain and non-pain) according to author's classifications.
Emshoff et al., 2001	Austria	Cross-sectional	Children, teenagers and adults TMD patients (>17 years)	48	35.3 (12-79)	40 females/ 8 males	CDC/TMD	MRI	56.3% of joints	Data refer to joints.
Lamot et al., 2013	Slovenia	Cross-sectional	Children, teenagers and adults TMD patients (>12 years)	144	39.4 (12-81)	109 females/ 35 males	CE	MRI	39.93% of joints	50% in the right joints and 56% in the left joints.
Takahara et al., 2017	Japan	Cross-sectional	Teenagers and adults TMD patients (>15 years)	323	44.8 (15-85)	251 females/ 72 males	DC/TMD	MRI	24.3% of joints ***	Considering diagnosis of moderate and severe bone changes by the author's classification to be in agreement with other studies DJD classification.

Kurita et al., 2004	Japan	Cross-sectional	Children, teenagers and adults TMD patients (>12 years)	89	34.6 (12-80)	ND	CE	Tomography	23% of joints	Considering the group of osteoarthric changes on articular surface (OAAS) according the author's classification.
Massila Mani et al., 2016	India	Cross-sectional	Seniors	15	63.06 (50-80)	10 females/ 5 males	CE	CT	70% of joints	Considering the cases presenting erosion, osteophyte and subchondral cyst according to author's classification.
Sverchtarov et al., 2015	Bulgaria	Cross-sectional	Teenagers and adults TMD patients (>17 years)	63	41.49(±13.92)	53 females/ 10 males	DC/TMD	Rx, CT and MRI	14,28% of chronic patients	18.36% of degenerative disease in the arthralgia patients/ 23.68% of degenerative disease in the myogenic symptomatic patients.

***Legend:** TMD: temporomandibular disorders; OSA**: Obstructive Sleep Apnea; ND: Not Determinated; RDC/TMD: Research Diagnostic Criteria for Temporomandibular Disorders (Dworking et al, 1992); CDC/TMD: Clinical Diagnostic Criteria for Temporomandibular Disorders (Trulove et al., 1992); CE*: Clinical examination including at least evaluation of mandibular range of motion, joint pain or tenderness and evaluation of joint sounds; CT: computed tomography; CBCT: cone beam computed tomography; MRI: magnetic resonance imaging; ***: calculated by author

	Author, year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total	Risk of Bias
JIA	Abramowickz et al, 2013	Y	N	Y	Y	NA	Y	N	Y	Y	Y	77%	Low
	Arvidsson et al, 2010	Y	Y	Y	Y	Y	Y	N	Y	N	NA	77%	Low
	Weiss et al, 2008	Y	N	Y	Y	U	Y	Y	Y	Y	NA	77%	Low
	Ferraz et al, 2012	N	U	N	N	U	Y	N	Y	N	NA	22%	High
	Keller et al, 2015	Y	U	Y	Y	Y	Y	Y	Y	Y	NA	88%	Low
	Mohammed et al, 2012	Y	N	Y	Y	U	Y	N	Y	N	NA	55%	Moderate
	Resnick et al., 2016	Y	N	N	N	U	Y	U	Y	N	NA	33%	High
RA	Bayar et al., 2002	Y	U	N	U	U	Y	N	Y	N	NA	33%	High
	Cordeiro et al., 2016	Y	U	Y	N	N	Y	U	Y	N	NA	44%	High
	Lin et al, 2007	Y	N	Y	Y	U	Y	Y	Y	N	NA	66%	Moderate
	Celiker et al., 1995	Y	U	N	Y	U	Y	U	Y	N	NA	44%	High
Marfan	Helenius et al., 2006	Y	U	Y	N	U	Y	U	Y	N	Y	50%	Moderate
	Bauss et al, 2004	Y	N	N	N	U	Y	Y	Y	N	NA	44%	High
	Bakke et al, 2014	Y	U	Y	N	N	Y	Y	Y	N	Y	60%	Moderate
	Bernhart et al, 2007	Y	U	Y	N	U	Y	Y	Y	N	N	50%	Moderate
	Bertram et al, 2001	Y	U	Y	N	U	Y	Y	Y	N	Y	60%	Moderate
	Dias G. et al, 2015	N	N	Y	N	U	Y	Y	Y	Y	Y	60%	Moderate
	Eberhard et al, 2013	Y	N	Y	N	U	Y	N	Y	Y	Y	60%	Moderate
	Emshoff e Brandimaier et al, 2002	Y	N	Y	N	U	Y	Y	Y	Y	N	60%	Moderate
	Emshoff e Brandimaier et al, 2003	Y	N	Y	N	U	Y	Y	Y	N	Y	60%	Moderate
	Emshoff e Innerhofer et al, 2002	Y	N	Y	N	U	Y	Y	Y	N	N	50%	Moderate
TMD	Emshoff e Rudish et al, 2003	Y	U	Y	N	U	Y	N	Y	Y	Y	50%	Moderate
	Emshoff et al, 2001	Y	U	Y	N	U	Y	N	Y	Y	Y	60%	Moderate
	Holmlund et al, 1994	N	U	N	N	U	Y	N	Y	N	Y	30%	High
	Kim et al, 2016	Y	U	Y	Y	Y	Y	U	Y	Y	Y	80%	Low
	Kurita et al, 2004	Y	U	Y	N	Y	Y	U	Y	N	N	50%	Moderate
	Lamot et al, 2013	Y	U	Y	N	U	Y	U	Y	N	N	40%	High
	Schmitter et al, 2010	Y	Y	Y	N	N	Y	Y	Y	N	N	60%	Moderate
	Sverchtarov et al, 2015	Y	U	Y	N	U	Y	U	Y	U	Y	50%	Moderate
	Wiberg et al, 1998	N	N	Y	N	Y	Y	U	Y	Y	Y	60%	Moderate
	Mani et al, 2016	N	U	N	N	U	Y	U	Y	N	NA	22%	High
Takahara et al., 2017	Y	U	Y	Y	Y	Y	Y	Y	Y	N	NA	77%	Low

Table 3- Results from Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data

Q6- Were objective, standard criteria used for the measurement of the condition?
 Q7- Was the condition measured reliably?
 Q8- Was there appropriate statistical analysis?
 Q9- Are all important confounding factors/ subgroups/ differences identified and accounted for?
 Q10- Were subpopulations identified using objective criteria?

Abbreviations: Y= Yes; N= No; U= Unclear; NA= Not applicable

Q1 - Was the sample representative of the target population?

Q2- Were study participant recruited in a appropriate way?

Q3- Was the sample size adequate?

Q4- Were the study subjects and the setting described in detail?

Q5- Was the data analysis conducted with sufficient coverage of the identified sample?

Total= ΣY / Items (the Not Applicable (NA) items were excluded from the sum).

Risk of bias was categorized as high when the study reaches up to 49% score “yes”, moderate when the study reached 50% to 69% score “yes”, and low when the study reached more than 70% score “yes”.

Appendix 1 - Search strategy developed individually for each database.

Database	Search (October 10 th 2016/ Updates: April 20 th 2017; January 10 th 2018)
LILACS	In palavras = (articulação temporomandibular OR ATM OR articulación temporomandibular) AND palavras = Osteoartrite OR artrite OR osteoartrose OR artrose OR enfermedad degenerativa articular)
LIVIVO	TI=(temporomandibular OR temporomandibular joint OR "TMJ" OR temporomandibular disorder OR "temporomandibular joint disorder" OR "temporomandibular joint disorders" OR "temporomandibular dysfunction" OR "temporomandibular joint dysfunction" OR "temporomandibular joint dysfunctions" OR "temporomandibular joint dysfunction syndrome" OR "craniomandibular disorder" OR "craniomandibular dysfunction" OR "temporomandibular joint disease" OR "temporomandibular disease") OR KW=(temporomandibular OR temporomandibular joint OR "TMJ" OR temporomandibular disorder OR "temporomandibular joint disorder" OR "temporomandibular joint disorders" OR "temporomandibular dysfunction" OR "temporomandibular joint dysfunction" OR "temporomandibular joint dysfunctions" OR "temporomandibular joint dysfunction syndrome" OR "craniomandibular disorder" OR "craniomandibular dysfunction" OR "temporomandibular joint disease" OR "temporomandibular disease") AND TI=(osteoarthritis OR arthritis OR osteoarthrosis OR arthrosis OR "degenerative joint disease") OR KW=(osteoarthritis OR arthritis OR osteoarthrosis OR arthrosis OR "degenerative joint disease")
PubMed	(temporomandibular OR temporomandibular joint OR "TMJ" OR "temporomandibular joint"[MeSH Terms] OR temporomandibular disorder OR "temporomandibular joint disorder" OR "temporomandibular joint disorders" OR "temporomandibular joint disorders"[MeSH Terms] OR "temporomandibular dysfunction" OR "temporomandibular joint dysfunction" OR "temporomandibular joint dysfunctions" OR "temporomandibular joint dysfunction syndrome" OR "craniomandibular disorder" OR "craniomandibular dysfunction" OR "temporomandibular joint disease" OR "temporomandibular disease" OR "TMJ") AND (osteoarthritis OR "osteoarthritis"[MeSH Terms] OR arthritis OR "arthritis"[MeSH Terms] OR osteoarthrosis OR arthrosis OR "joint diseases"[MeSH Terms] OR "degenerative joint disease") AND ("Computed Tomography" OR "cone-beam computed tomography"[MeSH Terms] OR cone beam computed tomography OR "CT" OR "cone beam" OR "CBCT" OR tomography OR "tomography"[MeSH Terms] OR "tomography, x-ray computed"[MeSH Terms] OR "magnetic resonance imaging" OR "MRI" OR imaging, magnetic resonance [MeSH Terms] OR magnetic resonance imaging [MeSH Terms]) AND (frequency OR "epidemiology"[MeSH Terms] OR prevalence OR "prevalence"[MeSH Terms] OR incidence OR "incidence"[MeSH Terms] OR occurrence OR recurrence OR distribution)
Science Direct	TITLE-ABSTR-KEY("temporomandibular joint") AND TITLE-ABSTR-KEY(osteoarthritis OR osteoarthrosis). Marl off: BOOKS, don't use FILTERS
SCOPUS	TITLE-ABS-KEY("temporomandibular disorder" OR "temporomandibular disorders" OR "temporomandibular joint disorder" OR "temporomandibular joint disorders" OR "temporomandibular dysfunction" OR "temporomandibular joint dysfunction" OR "temporomandibular joint dysfunctions" OR "temporomandibular joint dysfunction syndrome" OR "temporomandibular joint disease" OR "temporomandibular joint diseases" OR TMD) AND TITLE-ABS-KEY("arthritis" OR "degenerative joint disease" OR osteoarthritis OR "degenerative disease" OR "osteoarthrosis") AND TITLE-ABS-KEY ("magnetic resonance imaging" OR "MRI" OR "imaging, magnetic resonance" OR "Computed Tomography" OR "cone beam computed tomography" OR "cone-beam computed tomography" OR "CT" OR "cone beam" OR "CBCT" OR "tomography") AND TITLE-ABS-KEY(frequency OR epidemiology OR prevalence OR incidence OR occurrence OR recurrence OR distribution) Filter = Article
Web of Science	TS=(temporomandibular OR temporomandibular joint OR "TMJ" OR temporomandibular disorder OR "temporomandibular joint disorder" OR "temporomandibular joint disorders" OR "temporomandibular dysfunction" OR "temporomandibular joint dysfunction" OR "temporomandibular joint dysfunctions" OR "temporomandibular joint dysfunction syndrome" OR "craniomandibular disorder" OR "craniomandibular dysfunction" OR "temporomandibular joint disease" OR

	"temporomandibular disease" OR "TMJ" AND TS=(osteoarthritis OR arthritis OR osteoarthritis OR arthrosis OR "degenerative joint disease") AND TS=("Computed Tomography" OR cone beam computed tomography OR "cone-beam computed tomography" OR "CT" OR "cone beam" OR "CBCT" OR tomography OR "magnetic resonance imaging" OR "MRI" OR magnetic resonance imaging) AND TS=(frequency OR epidemiology OR prevalence OR incidence OR occurrence OR recurrence OR distribution)
Google Scholar	"temporomandibular joint" OR TMJ AND osteoarthritis AND "Computed Tomography" OR "magnetic resonance imaging". Mark off: patents and citations.
OpenGrey	"temporomandibular joint"
ProQuest	TI,AB("temporomandibular disorder" OR "temporomandibular disorders" OR "temporomandibular joint disorder" OR "temporomandibular joint disorders" OR "temporomandibular dysfunction" OR "temporomandibular joint dysfunction" OR "temporomandibular joint dysfunctions" OR "temporomandibular joint dysfunction syndrome" OR "temporomandibular joint disease" OR "temporomandibular joint diseases" OR TMD) AND TI,AB(arthritis OR "degenerative joint disease" OR osteoarthritis OR "degenerative disease" OR osteoarthritis) AND ("magnetic resonance imaging" OR "MRI" OR "Computed Tomography" OR "cone beam computed tomography" OR "cone-beam computed tomography" OR "CT" OR "cone beam" OR "CBCT" OR tomography) AND (frequency OR epidemiology OR prevalence OR incidence OR occurrence OR recurrence OR distribution)

Appendix 2 - Articles excluded in phase 2 and the reasons for exclusion (n=69).

	Author, year	Reason for exclusion*
1.	(Boering 1995)	1
2.	(Gynther 1996)	1
3.	(Bolzan 2002)	3
4.	(Abramowicz et al. 2011)	2
5.	(Aceves-Avila et al. 2013)	2
6.	(Al-Ekrish et al. 2015)	2
7.	(Alexiou et al. 2009)	3
8.	(Alkhader et al. 2010)	3
9.	(Alpigiani et al. 2008)	1
10.	(Anderson and Katzberg 1985)	2
11.	(Aveiga et al. 1999)	4
12.	(Barghan et al. 2012)	1
13.	(Boering 1966)	1
14.	(Bono et al. 2011)	3
15.	(Bono et al. 2015)	3
16.	(Borahan et al. 2016)	2
17.	(Bracco et al. 2010)	2
18.	(Broussard Jr 2005)	1
19.	(Butzke et al. 2007)	2
20.	(Cannizzaro et al. 2008)	1
21.	(Cannizzaro et al. 2011)	2
22.	(Capurso 1989)	4
23.	(Capurso 1990)	4
24.	(Capurso 1996)	4
25.	(Capurso et al. 1989)	4
26.	(Christiansen et al. 1985)	4
27.	(Cornejo et al. 1986)	4
28.	(Cornejo et al. 1987)	4
29.	(Cortes et al. 2014)	2
30.	(Cron et al. 2011)	1
31.	(Cron Randy et al. 2012)	1
32.	(Dias et al. 2012)	2
33.	(Dimitroulis 2005)	3
34.	(El-Essawy et al. 2008)	2
35.	(Emshoff and Rudisch 2008)	2
36.	(Emshoff et al. 2000)	3
37.	(Goupille et al. 1993)	3
38.	(Hammond and Vorassi 2014)	1
39.	(Hauser et al. 2014)	2
40.	(Herlin et al. 2011)	1
41.	(Idle et al. 2014)	3
42.	(Kim et al. 2012)	2
43.	(Koos et al. 2014)	3

44.	(Koos et al. 2013)	2
45.	(Krisjane et al. 2012)	2
46.	(Lacerda et al. 2015)	2
47.	(Madsen 1966)	3
48.	(Major et al. 1999)	2
49.	(McCain et al. 1992)	2
50.	(Moncada et al. 2014)	2
51.	(Movahedian et al. 2006)	5
52.	(Muller et al. 2009)	2
53.	(Neveen et al. 2013)	2
54.	(Oliveira et al. 2013)	2
55.	(Ozcan et al. 2008)	2
56.	(Palconet et al. 2014)	2
57.	(Park et al. 2012)	3
58.	(Portelli et al. 2014)	3
59.	(Ronchezel et al. 1995)	4
60.	(Sato et al. 1992)	3
61.	(Savioli et al. 2004)	2
62.	(Silke et al. 2014)	3
63.	(Sostmann et al. 1990)	1
64.	(Stewart and Standish 1983)	1
65.	(Stoll et al. 2012)	2
66.	(Tanaka et al. 2016)	2
67.	(Wang et al. 2013)	5
68.	(Zhao et al. 2011)	2
69.	(Zwir et al. 2015)	3

Legend: 1- Reviews, letters, conference abstracts, editorials; 2- Studies that did not match PICOS; 3- Different target conditions; 4- Full paper copy not available; 5- Paper written in no Roman alphabet.

REFERENCES

1. Abramowicz S, Cheon JE, Kim S, Bacic J, Lee EY. 2011. Magnetic resonance imaging of temporomandibular joints in children with arthritis. *J Oral Maxillofac Surg.* 69(9):2321-2328.
2. Aceves-Avila FJ, Chávez-López M, Chavira-González JR, Ramos-Remus C. 2013. Temporomandibular joint dysfunction in various rheumatic diseases. *Reumatismo*, Vol 65, Iss 3, Pp 126-130.
3. Al-Ekrish AA, Al-Juhani HO, Alhaidari RI, Alfaleh WM. 2015. Comparative study of the prevalence of temporomandibular joint osteoarthritic changes in cone beam computed tomograms of patients with or without temporomandibular disorder. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 120(1):78-85.
4. Alexiou K, Stamatakis H, Tsiklakis K. 2009. Evaluation of the severity of temporomandibular joint osteoarthritic changes related to age using cone beam computed tomography. *Dentomaxillofac Radiol.* 38:141-147.
5. Alkhader M, Ohbayashi N, Tetsumura A, Nakamura S, Okochi K, Momin M, Kurabayashi T. 2010. Diagnostic performance of magnetic resonance imaging for detecting osseous abnormalities of the temporomandibular joint and its correlation with cone beam computed tomography. *Dentomaxillofac Radiol.* 39:270-276.
6. Alpigliani MG, Baldi F, Calcagno A, Salvati P, Servetto R, Lorini R. 2008. Juvenile idiopathic arthritis (jia) and early diagnosis of temporo-mandibular joint (tmj) disorders. *Pediatric Rheumatology*, Vol 6, Iss Suppl 1, p P. 73.

7. Anderson QN, Katzberg RW. 1985. Pathologic evaluation of disc dysfunction and osseous abnormalities of the temporomandibular joint. *J Oral Maxillofac Surg.* 43(12):947-951.
8. Aveiga T, Lanosa E, Bruno C. 1999. Diagnóstico por imágenes en la articulación temporomandibular. *Ortodoncia.* 63(125):15-30.
9. Barghan S, Tetradis S, Mallya S. 2012. Application of cone beam computed tomography for assessment of the temporomandibular joints. *Australian Dent J.* 57(s1):109-118.
10. Boering G. 1966. Arthrosis deformans van het kaakgewricht een klinisch en röntgenologisch onderzoek = temporomandibular joint arthrosis. van Denderen. 549 p.
11. Boering G. 1995. Temporomandibular joint osteoarthritis: Boering g, the Hague, the Netherlands, cip-gegevens kloninklijke bibliotheek, 1994, 555 pages, illustrated, paperback. *J Oral Maxillofac Surg.* 53(4):491.
12. Bolzan MC. 2002. Estudo da correlação entre sinais clínicos e achados imagenológicos na ressonância magnética da articulação temporomandibular. São Paulo.
13. Bono AE, Learreta JA, Rodríguez G, Marcos JC. 2011. Hallazgos clínicos y radiográficos en la articulación temporomandibular en pacientes con artritis reumatoidea. *Rev Soc Odontol Plata.* 24(43):19-24.
14. Bono AE, Learreta JA, Rodríguez G, Marcos JC. 2015. Marcadores tempranos de patologías de la articulación temporomandibular en pacientes con artritis reumatoidea. *Rev Asoc Odontol Argent.* 103(1):9-17.
15. Borahan MO, Mayil M, Pekiner FN. 2016. Using cone beam computed tomography to examine the prevalence of condylar bony changes in a Turkish subpopulation. *Nigerian J Clin Pract.* 19(2):259-266.
16. Bracco P, Debernardi C, Piancino MG, Cirigliano MF, Salvetti G, Bazzichi L, De Feo F, Bosco M. 2010. Evaluation of the stomatognathic system in patients with rheumatoid arthritis according to the research diagnostic criteria for temporomandibular disorders. *Cranio.* 28(3):181-186.
17. Broussard Jr JS. 2005. Derangement, osteoarthritis, and rheumatoid arthritis of the temporomandibular joint: Implications, diagnosis, and management. *Dent Clin North Am.* 49(2):327-342.
18. Butzke KW, Chaves KD, Silveira HD. 2007. Avaliação da presença de edema ósseo intramedular, efusão e osteoartrose em atms com deslocamento de disco por meio da ressonância magnética nuclear. *RFO UPF.* 12(2).
19. Cannizzaro E, Schroeder S, Bolt I, Müller L, Kellenberger C, Saurenmann T. 2008. Temporomandibular joint involvement in children with juvenile idiopathic arthritis. *Pediatric Rheumatology*, Vol 6, Iss Suppl 1, p P. 92.
20. Cannizzaro E, Schroeder S, Müller LM, Kellenberger CJ, Saurenmann RK. 2011. Temporomandibular joint involvement in children with juvenile idiopathic arthritis. *J Rheumatol.* 38(3):510-515.
21. Capurso U. 1989. [joint and functional changes in the masticatory system in chronic rheumatoid arthritis in adults. Preliminary study]. *Minerva Stomatol.* 38(2):173-180.
22. Capurso U. 1990. [tmj lesions. Dysfunction and occlusion. Radiographic study]. *Dental Cadmos.* 58(10):66-76, 79-81.
23. Capurso U. 1996. [clinical aspects of cranio-mandibular disorders. II. Symptom profiles of subgroups]. *Minerva Stomatol.* 45(7-8):321-330.
24. Capurso U, Scutellari PN, Orzincolo C, Calura G. 1989. [involvement of the temporomandibular joint in rheumatoid arthritis]. *La Radiologia medica.* 78(4):299-304.
25. Christiansen E, Thompson J, Kopp S, Hasso A, Hinshaw Jr D. 1985. Radiographic signs of temporomandibular joint disease: An investigation utilizing x-ray computed tomography. *Dentomaxillofac Radiol.* 14(2):83-92.
26. Cornejo E, Gómez Carpio M, Ramírez J, Cobo L. 1986. Compromiso de la articulación temporomandibular en la artritis reumatoidea. *Rev Med Chile.* 114(7):659-664.
27. Cornejo E, Gómez Carpio M, Ramírez J, Cobo L. 1987. Consideraciones clínicas y radiológicas de la articulación temporomandibular en la osteoartrosis. *Rev otorrinolaringol cir cabeza cuello.* 47(2):67-71.
28. Cortes D, Marholz C, Millas R, Moncada G. 2013. Manifestaciones óseas de las enfermedades degenerativas de la articulación temporomandibular disfuncionada estudio tomográfico. *Acta odontol Venez.* 51(2).

29. Cron R, Wierk A, Tzaribachev N, Foeldvari I. 2011. Update of the results of a multinational survey regarding diagnosis and treatment of the temporomandibular joint involvement in juvenile idiopathic arthritis- reflection of the day to day practice. *Pediatric Rheumatol.*, Vol 9, Iss Suppl 1, p P. 110.
30. Cron Randy Q, Fain E, Atkinson G, Weiser P, Beukelman T. 2012. Temporomandibular joint arthritis in patients with non-jia childhood arthritis. *Pediatric Rheumatol.*, Vol 10, Iss Suppl 1, p A. 76.
31. Dias IM, Coelho PR, Assis N, Leite FPP, Devito KL. 2012. Evaluation of the correlation between disc displacements and degenerative bone changes of the temporomandibular joint by means of magnetic resonance images. *Int J Oral Maxillofac Surg.* 41(9):1051-1057.
32. Dimitroulis G. 2005. The prevalence of osteoarthritis in cases of advanced internal derangement of the temporomandibular joint: A clinical, surgical and histological study. *Int J Oral Maxillofac Surg.* 34(4):345-349.
33. El-Essawy MT, Al-Nakshabandi NA, Al-Boukai AA. 2008. Magnetic resonance imaging evaluation of temporomandibular joint derangement in symptomatic and asymptomatic patients. *Saudi Med J.* 29(10):1448-1452.
34. Emshoff R, Puffer P, Rudisch A, Gassner R. 2000. Temporomandibular joint pain: Relationship to internal derangement type, osteoarthritis, and synovial fluid mediator level of tumor necrosis factor-alpha. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 90(4):442-449.
35. Emshoff R, Rudisch A. 2008. Likelihood ratio methodology to identify predictors of treatment outcome in temporomandibular joint arthralgia patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 106(4):525-533.
36. Goupille P, Fouquet B, Goga D, Cotty P, Valat JP. 1993. The temporomandibular joint in rheumatoid arthritis: Correlations between clinical and tomographic features. *J Dent.* 21(3):141-146.
37. Gynther GW. 1996. Temporomandibular joint involvement in generalized osteoarthritis and rheumatoid arthritis: Clinical and arthroscopic findings. *J Cranio- Maxillofac Surg.* 24:136.
38. Hammond RJ, Vorassi J. 2014. Patient standardization for diagnosis, treatment, and outcomes of osteoarthritis of the temporomandibular joint. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 117(5):e332-e333.
39. Hauser RA, Schroeder S, Cannizzaro E, Muller L, Kellenberger CJ, Saurenmann RK. 2014. How important is early magnetic resonance imaging of the temporomandibular joint for the treatment of children with juvenile idiopathic arthritis: A retrospective analysis. *Pediatric Rheumatol.* 12:36.
40. Herlin T, Kùseler A, Kristensen Kasper D, Verna C, Stoustrup P, Pedersen Thomas K. 2011. Smallest detectable differences in clinical variables related to temporomandibular joint arthritis in juvenile idiopathic arthritis. *Pediatric Rheumatol*, Vol 9, Iss Suppl 1, p P. 127
41. Idle MR, Lowe D, Rogers SN, Sidebottom AJ, Speculand B, Worrall SF. 2014. Uk temporomandibular joint replacement database: Report on baseline data. *Brit J Oral Maxillofac Surg.* 52(3):203-207.
42. Kim Y-K, Kim S-G, Im J-H, Yun P-Y. 2012. Clinical survey of the patients with temporomandibular joint disorders, using research diagnostic criteria (axis ii) for tmd: Preliminary study. *J Cranio-Maxillofac Surg.* 40(4):366-372.
43. Koos B, Twilt M, Kyank U, Fischer-Brandies H, Gassling V, Tzaribachev N. 2014. Reliability of clinical symptoms in diagnosing temporomandibular joint arthritis in juvenile idiopathic arthritis. *J Rheumatol.* 41(9):1871-1877.
44. Koos B, Tzaribachev N, Bott S, Ciesielski R, Godt A. 2013. Classification of temporomandibular joint erosion, arthritis, and inflammation in patients with juvenile idiopathic arthritis. *J Orofac Orthopedics-Fortschritte Der Kieferorthopadie.* 74(6):506-519.
45. Krisjane Z, Urtane I, Krumina G, Neimane L, Ragovska I. 2012. The prevalence of tmj osteoarthritis in asymptomatic patients with dentofacial deformities: A cone-beam ct study. *Int J Oral Maxillofac Surg.* 41(6):690-695.
46. Lacerda F, Barbosa C, Pereira S, Manso MC. 2015. Estudo de prevalência das disfunções temporomandibulares articulares em estudantes de instrumentos de sopro. *Rev Port Estomatol Med Dent Cirurg Maxilofac.* 56(1):25-33.

47. Madsen B. 1966. Normal variations in anatomy, condylar movements, and arthrosis frequency of the temporomandibular joints. *Acta Radiol: diagnosis*. 4(3):273-288.
48. Major P, Ramos-Remus C, Suarez-Almazor ME, Hatcher D, Parfitt M, Russell AS. 1999. Magnetic resonance imaging and clinical assessment of temporomandibular joint pathology in ankylosing spondylitis. *J Rheumatol*. 26(3):616-621.
49. McCain JP, Sanders B, Koslin MG, Quinn JD, Peters PB, Indresano AT. 1992. Temporomandibular joint arthroscopy: A 6-year multicenter retrospective study of 4,831 joints. *J Oral Maxillofac Surg*. 50(9):926-930.
50. Moncada G, Cortés D, Millas P, Marholz C. 2014. Relationship between disk position and degenerative bone changes in temporomandibular joints of young subjects with tmd. An mri study. *J Clin Ped Dent*. 38(3):269-276.
51. Movahedian B, Razavi M, Movahedian A, Moeini M. 2006. Assessment of manifestations of temporomandibular joint involvement in rheumatoid arthritis patients. *J Isfahan Dent School* , Vol 2, Iss 3, Pp 32-. 37.
52. Muller L, Kellenberger CJ, Cannizzaro E, Ettlin D, Schraner T, Bolt IB, Peltomaki T, Saurenmann RK. 2009. Early diagnosis of temporomandibular joint involvement in juvenile idiopathic arthritis: A pilot study comparing clinical examination and ultrasound to magnetic resonance imaging. *Rheumatology (Oxford, England)*. 48(6):680-685.
53. Neveen A, Hamid Masoud M, Anca Irinel C, Per A. 2013. Impact of temporomandibular joint pain in rheumatoid arthritis. *Mediators of Inflammation*, Vol. 2013.
54. Oliveira JXd, Rosa JAd, Dutra MEP, Santos KCP, Gil C. 2013. Assessing joint effusion and bone changes of the head of the mandible in mr images of symptomatic patients. *Braz oral res*. 27(1):37-41.
55. Ozcan I, Ozcan KM, Keskin D, Bahar S, Boyacigil S, Dere H. 2008. Temporomandibular joint involvement in rheumatoid arthritis: Correlation of clinical, laboratory and magnetic resonance imaging findings. *B-ent*. 4(1):19-24.
56. Falconet G, Ludlow J, Tyndall DA, Lim PF. 2014. Correlating cone beam ct results with temporomandibular joint pain of osteoarthritic origin. *Dentomaxillofac Radiol*. 41(2):126-30.
57. Park J, Song H, Roh H, Kim Y, Lee J. 2012. Correlation between clinical diagnosis based on rdc/tmd and mri findings of tmj internal derangement. *Int J Oral Maxillofac Surg*. 41(1):103-108.
58. Portelli M, Matarese G, Militi A, Lo Giudice G, Nucera R, Lucchese A. 2014. Temporomandibular joint involvement in a cohort of patients with juvenile idiopathic arthritis and evaluation of the effect induced by functional orthodontic appliance: Clinical and radiographic investigation. *Eur J Paed Dent*. 15(1):63-66.
59. Ronchezel MV, Hilario MO, Goldenberg J, Lederman HM, Faltin K, Jr., de Azevedo MF, Naspitz CK. 1995. Temporomandibular joint and mandibular growth alterations in patients with juvenile rheumatoid arthritis. *J Rheumatol*. 22(10):1956-1961.
60. Sato H, Fujii T, Yamada N, Kitamori H. 1992. A clinical and tomographic study on temporomandibular joint osteoarthritis. *Oral Radiol*. 8(2):1-10.
61. Savioli C, Silva CAA, Lin HC, Campos LMMA, Prado EFBG, Siqueira JTT. 2004. Dental and facial characteristics of patients with juvenile idiopathic arthritis. *Rev Hosp Clin Fac Med Univ São Paulo*. 59(3):93-98.
62. Silke W, Thomas JV, Stefan R, Peter O. 2014. Evaluation of the tmj by means of clinical tmd examination and mri diagnostics in patients with rheumatoid arthritis. *BioMed Res Int*, Vol. 2014.
63. Sostmann M, Reich RH, Grapentin D, Langer HE. 1990. [clinical study on rheumatoid arthritis of the tmj]. *Deutsche zahnärztliche Zeitschrift*. 45(7 Spec No):S70-74.
64. Stewart CL, Standish SM. 1983. Osteoarthritis of the tmj in teenaged females: Report of cases. *J Am Dent Assoc*. 106(5):638-640.
65. Stoll ML, Sharpe T, Beukelman T, Good J, Young D, Cron RQ. 2012. Risk factors for temporomandibular joint arthritis in children with juvenile idiopathic arthritis. *The Journal of rheumatology*. 39(9):1880-1887.
66. Tanaka MMY, Joias RM, Josgrilberg E, Rode SdM, Jóias RP. 2016. Evaluation of tmd signs and symptoms in individuals undergoing orthodontic treatment. *Braz dent sci*. 19(1).

67. Wang ZH, Jiang L, Zhao YP, Ma XC. 2013. [investigation on radiographic signs of osteoarthritis in temporomandibular joint with cone beam computed tomography in adolescents]. Beijing da xue xue bao Yi xue ban = Journal of Peking University Health sciences. 45(2):280-285.
68. Zhao Y-p, Zhang Z-y, Wu Y-t, Zhang W-L, Ma X-c. 2011. Investigation of the clinical and radiographic features of osteoarthritis of the temporomandibular joints in adolescents and young adults. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 111(2):e27-e34.
69. Zwir L, Terreri M, Sousa SA, Fernandes ARC, Guimaraes AS, Hilario MOE. 2015. Are temporomandibular joint signs and symptoms associated with magnetic resonance imaging findings in juvenile idiopathic arthritis patients? A longitudinal study. Clin Rheumatol. 34(12):2057-2063.

Appendix 3. Supplementary data from Meta-analysis

1. DEGENERATIVE JOINT DISEASE SECONDARY TO SYSTEMIC DISEASE:

1.1. Juvenile Idiopathic Arthritis (JIA)

Author, year (Disease)	N (Total Sample)	N (Positive Cases)	Risk of Bias
Abramowickz et al., 2013 (JIA)	61	32	L
Arvidsson et al., 2010 (JIA)	47	19	L
Weiss et al., 2008 (JIA)	32	22	L
Ferraz et al., 2012 (JIA)	15	14	H
Keller et al., 2015 (JIA)	76	54	L
Mohammed et al, 2012 (JIA)	40	32	M
Resnick et al., 2016 (JIA)	21	14	H

1.2. Rheumatoid Arthritis (RA)

Author, year (Disease)	N (Total Sample)	N (Positive Cases)	Risk of Bias
Bayar et al., 2002 (RA)	15	13	H
Cordeiro et al., 2016 (RA)	33	29	H
Lin et al., 2007 (RA)	56	52	M
Celiker et al., 1995 (RA)	20	9	H
Helenius et al., 2006 (RA)	16	12	M

2. DEGENERATIVE JOINT DISEASE IN TMD PATIENTS

2.1. Positive cases reported by patients

Author, year (Imaging exam)	<i>N</i> (Total Sample)	<i>N</i> (Positive Cases)	<i>Risk of Bias</i>
Bakke et al., 2014 (CT)	42	14	M
Dias G. et al., 2015 (CT)	45	37	M
Kim et al., 2016 (CT)	1038	187	L
Holmlund et al., 1994 (Tomography)	60	44	H
Wiberg et al., 1998 (Rx and Tomography)	131	87	M
Emshoff and Brandimaier, 2003 (MRI)	118	100	M
Emshoff and Rudish, 2003 (MRI)	38	30	M

2.2. Positive cases reported by joints

Author, year (Imaging exam)	<i>N</i> (Total Sample)	<i>N</i> (Positive Cases)	<i>Risk of Bias</i>
Bertram et al., 2001 (MRI)	262	122	M
Eberhard et al., 2013 (MRI)	87	22	M
Emshoff and Brandimaier, 2002 (MRI)	224	173	M
Emshoff and Innerhofer, 2002 (MRI)	388	176	M
Emshoff et al., 2001 (MRI)	96	56	M
Lamot et al., 2013 (MRI)	288	115	H
Takahara et al., 2017 (MRI)	646	157	L
Kurita et al., 2004 (Tomography)	178	41	M
Mani et al, 2016 (CT)	30	21	H

CT: Computed Tomography

MRI: Magnetic Resonance Imaging

N (Total number of samples), *N* (number of positive cases)

L: Low

M: Moderate

H: High

6 CONSIDERAÇÕES GERAIS

O objetivo deste trabalho foi avaliar e sintetizar a melhor evidência científica disponível sobre a prevalência da DAD da ATM. Seguindo as recomendações mais atuais do consórcio internacional que define os padrões e referências para o estudo das DTM, foram incluídos apenas estudos que utilizaram diagnóstico clínico confirmado por imagem. Os parâmetros clínicos deveriam estar em conformidade com os descritos no DC, ou seja, deveriam analisar pelo menos a movimentação e amplitude de abertura bucal, dor ou sensibilidade nas articulações e sons articulares. Para confirmação do diagnóstico deveriam ser utilizados exames de tomografia ou ressonância magnética (18). Nas imagens, deveriam ser identificadas alterações ósseas como a presença de cisto subcondral, erosão, osteófitos e esclerose generalizada (22). Optou-se ainda por avaliar e comparar a prevalência da DAD tanto de origem local como as secundárias a AR e AIJ (30).

Os dados encontrados na literatura conforme os critérios estabelecidos neste trabalho não revelaram prevalência da doença na população em geral. Manfredini et al., 2011 (26) já tinham alertado para este fato, salientando que os dados existentes sobre populações em geral não são relevantes do ponto de vista clínico, devido ao número muito baixo de estudos que adotam um protocolo padrão. Entretanto, os dados coletados permitiram avaliar a prevalência da DAD em populações de paciente com DTM e entre pacientes com AIJ e AR. Essa RS mostrou uma alta relevância clínica tanto para dentistas que tratam DTM quanto para reumatologistas, pois constituem sua população alvo de trabalho. Os resultados confirmaram a hipótese de que a prevalência da DAD é elevada em populações de pacientes. Entretanto, não se confirmou a hipótese de que a DAD de origem local seja mais prevalente do que a de origem sistêmica. A hipótese de que o diagnóstico por imagem aumenta a prevalência de DAD também foi confirmada.

A prevalência é a medida que expressa a proporção de indivíduos portadores de uma doença em uma população (37). A prevalência de DAD da ATM encontrada foi elevada, provavelmente pelo fato de todos os estudos incluídos serem realizados com amostras de conveniência, ou seja, a população estudada foi um grupo específico de pacientes. Entretanto a hipótese de que a DAD de origem local são mais prevalentes que a DAD de origem sistêmica foi refutada. A frequência de

DAD de origem local entre pacientes com DTM foi de 62,77%. Já a prevalência da DAD secundária em pacientes com AIJ foi de 66,70% e entre pacientes com AR, de 76,21%. A prevalência de uma doença depende da incidência, ou seja, do surgimento de novos casos em função do tempo e da duração desta doença desde seu início até a cura ou morte. Portanto, assume-se que mesmo para doenças com baixa incidência, mas que sejam de evolução lenta e crônica, a prevalência poderá ser alta (38).

Segundo Black et al., 1990 a prevalência de uma doença também tende a aumentar com o uso de imagens no diagnóstico, pois ele se torna mais acurado (29). A análise dos estudos realizados em pacientes com DTM também revelou uma prevalência de DAD de origem local maior do que a relatada anteriormente (26). Provavelmente, pelo fato de considerar o diagnóstico por imagens, além do diagnóstico clínico, aumentando a detecção de alterações degenerativas, mesmo em sintomas clínicos leves.

A necessidade do uso de imagens para confirmação do diagnóstico clínico está preconizado pelo critério de referência atual. Porém, implica em que o diagnóstico seja sempre realizado em uma fase tardia da doença degenerativa, em que a probabilidade do paciente já ter tido uma perda funcional é possivelmente maior (11). Até que se tenha uma alteração estrutural detectável por imagem o paciente é diagnosticado apenas com artralgia ou artrite (30).

Não se pode, entretanto, restringir o diagnóstico da DAD da ATM ao diagnóstico por imagem, sob risco de se aumentar os casos falso-positivos e o tratamento desnecessário (1). As articulações assintomáticas com imagens de alterações ósseas como osteofitose e aplainamento podem representar apenas um processo de remodelação óssea adaptativa ou mesmo o resultado de uma doença degenerativa inativa (3).

Diante dessas considerações, o diagnóstico mais próximo do ideal para a DAD da ATM deveria ser realizado na fase precoce da doença. Assim, o diagnóstico seria realizado antes mesmo das alterações macroestruturais. Isso permitiria o tratamento e interrupção do processo degenerativo antes das perdas funcionais. A adoção de um modelo de diagnóstico abrangente que integre avaliações clínicas e morfológicas mas que também considere marcadores biomoleculares do processo patológico tem sido indicado como a principal alternativa nesse sentido (11). Alguns biomarcadores já foram estudados em

pacientes com DTM para elucidar os mecanismos da dor e fornecer uma base para a detecção precoce de degeneração. Dessa forma, os biomarcadores podem ser um alvo potencial para agentes terapêuticos com a finalidade de prevenir a progressão de disfunções mais severas (39). Uma revisão recente relatou que o estudo do processo patológico da DAD da ATM com foco especial na dor produzida por mediadores inflamatórios e da degradação da cartilagem articular deve ser o ponto de partida para o estudo desses biomarcadores (40).

A atividade inflamatória na DAD da ATM está presente desde os estágios iniciais, antes mesmo da visualização de alterações estruturais nas imagens. Isso ocorre tanto na OA como na DAD secundária a uma doença sistêmica, embora em intensidades diferentes (13). Como esse processo inflamatório é complexo e afeta muitos tecidos na ATM, é improvável que um biomarcador único conduza e forneça uma descrição abrangente da DAD (11). Mediadores químicos como as citocinas, as proteinases, as proteoglicanas e outros marcadores moleculares parecem ser os responsáveis pela degradação tecidual e produção de dor e poderiam ser utilizados na elaboração de um novo modelo diagnóstico (40). Entretanto, a relevância biológica ou o valor clínico dos biomarcadores apresentados na literatura para DTM são até agora insuficientemente investigados (41).

Este trabalho realizado sobre a prevalência da DAD na ATM apresenta algumas limitações. Durante o levantamento da literatura, foram encontrados apenas dois estudos que mediram a prevalência em amostras da população geral usando os critérios de diagnóstico aqui definidos. Ainda assim, as amostras destes estudos foram constituídas de indivíduos com uma idade específica. Um deles avaliou adultos, o outro apenas idosos e não eram, portanto, amostras representativas da população geral. Logo não foi possível compilar os dados de prevalência das DAD como inicialmente proposto. Dessa forma, os resultados aqui apresentados constituem uma evidência indireta do desfecho inicial, mas que tem uma importância clínica imediata por demonstrar.

Outra limitação encontrada está na inexistência de uma ferramenta específica para avaliar a força da evidência gerada pela meta-análise de estudos observacionais. O processo sistemático de revisão de literatura gera uma evidência secundária e recomendações que tem um papel de destaque na elaboração de diretrizes clínicas. Ao fim desse processo são utilizados sistemas para avaliação da qualidade da evidência e para a gradação da força da recomendação. O objetivo

final é informar a confiança nas evidências apresentadas. Neste trabalho foi utilizado o sistema GRADE, considerado o mais abrangente e utilizado na prática da saúde baseada em evidência (42). Entretanto, a metodologia foi desenvolvida em princípio para ser utilizada em questões de intervenção ou diagnóstico. Embora seja possível e recomendável a utilização desse sistema em questões epidemiológicas, algumas adaptações nos quesitos de avaliação são necessárias, o que pode tornar o resultado da avaliação subjetiva.

7 CONCLUSÕES

Frente aos objetivos propostos podemos concluir que:

- A literatura científica apresenta uma lacuna com estudos epidemiológicos insuficientes sobre a prevalência de DAD da ATM na população geral, considerando-se os critérios de diagnóstico clínico e por imagem adequados;
- A prevalência da DAD da ATM é elevada em populações de pacientes, quando considerado o diagnóstico por exame clínico e por imagem;
- A prevalência de DAD em pacientes com AIJ é de 66,7% (IC: 54,31-78,01) e em pacientes com AR é de 78,85% (CI: 61,63-91,94);
- A prevalência de DAD em pacientes com DTM e sem envolvimento sistêmico é de 62,77% dos pacientes (IC: 33,6-87,6) ou de 44,23% das articulações (IC: 31,4-57,4);
- A prevalência de DAD da ATM confirmada pelo diagnóstico por imagem é mais elevada quando comparada à prevalência aferida apenas por diagnóstico clínico.

REFERÊNCIAS BIBLIOGRÁFICAS

1. Orofacial Pain: guidelines for assessment, diagnosis and management. 5th ed 2013.
2. NIDCR. Prevalence of TMJD and Its Signs and Symptoms 2014 [Available from: <https://www.nidcr.nih.gov/DataStatistics/FindDataByTopic/FacialPain/PrevalenceTMJD.htm>].
3. Kalladka M, Quek S, Heir G, Eliav E, Mupparapu M, Viswanath A. Temporomandibular joint osteoarthritis: diagnosis and long-term conservative management: a topic review. *J Indian Prosthodont Soc.* 2014;14(1):6-15.
4. Wang XD, Zhang JN, Gan YH, Zhou YH. Current understanding of pathogenesis and treatment of TMJ osteoarthritis. *J Dent Res.* 2015;94(5):666-73.
5. Institute TJB. Joanna Briggs Institute Reviewers' Manual: 2014 edition/supplement. The Joanna Briggs Institute; 2014.
6. Tanaka E, Detamore MS, Mercuri LG. Degenerative disorders of the temporomandibular joint: etiology, diagnosis, and treatment. *J Dent Res.* 2008;87(4):296-307.
7. Helenius LM, Hallikainen D, Helenius I, Meurman JH, Kononen M, Leirisalo-Repo M, et al. Clinical and radiographic findings of the temporomandibular joint in patients with various rheumatic diseases. A case-control study. *Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics.* 2005;99(4):455-63.
8. Arvidsson LZ, Smith HJ, Flato B, Larheim TA. Temporomandibular joint findings in adults with long-standing juvenile idiopathic arthritis: CT and MR imaging assessment. *Radiology.* 2010;256(1):191-200.
9. Bayar N, Kara SA, Keles I, Koç MC, Altınok D, Orkun S. Temporomandibular Joint Involvement in Rheumatoid Arthritis: A Radiological and Clinical Study. *Cranio.* 2002;20(2):105-10.
10. Okeson JP. Tratamento das Desordens Temporomandibulares e Oclusão. 7 Ed ed. Rio de Janeiro: EZ2 Translate Tecnologia e Serviço; 2013.
11. Cevidanes LH, Walker D, Schilling J, Sugai J, Giannobile W, Paniagua B, et al. 3D osteoarthritic changes in TMJ condylar morphology correlates with specific

systemic and local biomarkers of disease. *Osteoarthritis Cartilage*. 2014;22(10):1657-67.

12. Poole AR. Osteoarthritis as a whole joint disease. *HSS J*. 2012;8(1):4-6.

13. Sokolove J LC. Role of inflammation in the pathogenesis of osteoarthritis: latest findings and interpretations. *Ther Adv Musculoskel Dis*. 2013;5(22):77-94.

14. Helenius LM, Tervahartiala P, Helenius I, Al-Sukhun J, Kivisaari L, Suuronen R, et al. Clinical, radiographic and MRI findings of the temporomandibular joint in patients with different rheumatic diseases. *Int J Oral Maxillofac Surg*. 2006;35(11):983-9.

15. Ferraz Júnior AML, Devito KL, Guimarães JP. Temporomandibular disorder in patients with juvenile idiopathic arthritis: clinical evaluation and correlation with the findings of cone beam computed tomography. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*. 2012;114(3):e51-e7.

16. McInnes IB SG. The Pathogenesis of Rheumatoid Arthritis. *N Engl J Med*. 2011;365(23):2205-19.

17. Restrepo R, Lee EY. Epidemiology, pathogenesis, and imaging of arthritis in children. *Orthop Clin North Am*. 2012;43(2):213-25, vi.

18. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group†. *J Oral Facial Pain Headache*. 2014;28(1):6-27.

19. Dworkin SF LL, editors. Research Diagnostic Criteria for Temporomandibular Disorders: review, criteria, examinations and specifications, critique. *J Craniomandib Disord Facial Oral Pain*. 1992;Vol. 6(4.):301–55.

20. Look JO SE, Truelove EL, Ahmad M. Reliability and Validity of Axis I of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) with Proposed Revisions. *J Oral Rehabil*. 2010;37(10):744-59.

21. Peck CC, Goulet JP, Lobbezoo F, Schiffman EL, Alstergren P, Anderson GC, et al. Expanding the taxonomy of the diagnostic criteria for temporomandibular disorders. *J Oral Rehabil*. 2014;41(1):2-23.

22. Ahmad M HL, Anderson Q, Kartha K, Ohrbach R, Truelove EL, John MT, Schiffman EL. Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD): Development of Image Analysis Criteria and Examiner Reliability for

Image Analysis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;107(6):844-60.

23. Alexiou K, Stamatakis H, Tsiklakis K. Evaluation of the severity of temporomandibular joint osteoarthritic changes related to age using cone beam computed tomography. *Dentomaxillofac Radiol*. 2009;38(3):141-7.

24. Navallas M, Inarejos EJ, Iglesias E, Cho Lee GY, Rodriguez N, Anton J. MR Imaging of the Temporomandibular Joint in Juvenile Idiopathic Arthritis: Technique and Findings. *Radiographics : a review publication of the Radiological Society of North America, Inc.* 2017;37(2):595-612.

25. Dworkin SF HK, LeResche L, Korff MV, Howard J, ruelove E, Sommers E. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. *J Am Dent Assoc* 1990;120(3):273-81.

26. Manfredini D, Guarda-Nardini L, Winocur E, Piccotti F, Ahlberg J, Lobbezoo F. Research diagnostic criteria for temporomandibular disorders: a systematic review of axis I epidemiologic findings. *Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics*. 2011;112(4):453-62.

27. Bracco P DC, Piancino MG, Cirigliano MF, Salvetti G, Bazzichi L, De Feo F, Bosco M. Evaluation of the stomatognathic system in patients with rheumatoid arthritis according to the research diagnostic criteria for temporomandibular disorders. *Cranio*. 2010;28(3):181-6.

28. Brooks SL, Westesson PL, Eriksson L, Hansson LG, Barsotti JB. Prevalence of osseous changes in the temporomandibular joint of asymptomatic persons without internal derangement. *Oral surgery, oral medicine, and oral pathology*. 1992;73(1):118-22.

29. Black WC HH. Advances in diagnostic Imaging adn overestimations of disease prevalence and the benefits os therapy. *The New England Journal of Medicine*. 1990;328(1237-43).

30. Michelotti A, Alstergren P, Goulet JP, Lobbezoo F, Ohrbach R, Peck C, et al. Next steps in development of the diagnostic criteria for temporomandibular disorders (DC/TMD): Recommendations from the International RDC/TMD Consortium Network workshop. *J Oral Rehabil*. 2016;43(6):453-67.

31. Zina LG MS. Evidence-based dentistry: steps and methods of a systematic review. *Arq Odontol*. 2012;48(3):188-99.

32. Murad MH AN, Alsawas M, Alahdab F. New evidence pyramid. *Evid Based Med.* 2016;21(4):123-5.
33. Brasil. Ministério da Saúde. Secretaria de Ciência TeIEdCeT. Diretrizes metodológicas : elaboração de revisão sistemática e metanálise de ensaios clínicos randomizados. In: Ministério da Saúde SdC, Tecnologia e Insumos Estratégicos, Departamento de Ciência e Tecnologia, editor. Série A: Normas e Manuais Técnicos. **Brasília**: Editora do Ministério da Saúde; 2012. p. 92.
34. Collaboration TC. *Cochrane Handbook for Systematic Reviews of Interventions: The Cochrane Collaboration*; 2011.
35. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg.* 2010;8(5):336-41.
36. Balshem H, Helfand M, Schunemann HJ, Oxman AD, Kunz R, Brozek J, et al. GRADE guidelines: 3. Rating the quality of evidence. *J Clin Epidemiol.* 2011;64(4):401-6.
37. Mércham-Haman E TP, Costa, MP. Terminologia das Medidas e Indicadores em Epidemiologia: subsídios para uma possível padronização da nomenclatura. *Informe Epidemiológico do SUS.* 2000;9(4):273-84.
38. Pereira M. *Epidemiologia: teoria e prática.* Rio de Janeiro: Guanabara Koogan; 1995.
39. Rodriguez de Sotillo D VA, Hadley M, Friction JR. Evidence of Oxidative Stress in Temporomandibular Disorders: A Pilot Study. *J Oral Rehabil.* 2011;38(10):722-8.
40. Ernberg M. The role of molecular pain biomarkers in temporomandibular joint internal derangement. *J Oral Rehabil* 2017;44(6):481-91.
41. Alstergren P. *Molecular Temporomandibular Joint Pain Biomarkers.* 2017:95-105.
42. Ministério da Saúde SdC, Tecnologia e Insumos Estratégicos, Departamento, Tecnologia dCe. Diretrizes metodológicas : Sistema GRADE – Manual de graduação da qualidade da evidência e força de recomendação para tomada de decisão em saúde. In: Ministério da Saúde SdC, Tecnologia e Insumos Estratégicos, Departamento, Tecnologia dCe, editors. Brasília: Ministério da Saúde; 2014. p. 72.

