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OCORRÊNCIA DE PERDA ÓSSEA VERTICAL E INDICADORES DE RISCO ASSOCIADOS A DEFEITOS DE FURCA

Santa Maria, RS
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Tese apresentada ao Curso de Doutorado do Programa de Pós-Graduação em Ciências Odontológicas, Área de concentração em Odontologia, ênfase em Periodontia, da Universidade Federal de Santa Maria (UFSM, RS), como requisito parcial para obtenção do título de **Doutora em Ciências Odontológicas**.

Orientador: Prof. Dr. Carlos Heitor Cunha Moreira

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Aprovada em 24 de outubro de 2023:

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A Deus, pelo amor, graça, bondade e misericórdia, que têm sido repletos em minha vida. Ele tem guiado meus passos e me sustentado em todos os momentos.

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O temor do Senhor é o princípio da sabedoria

Provérbios 9:10a

RESUMO

OCORRÊNCIA DE PERDA ÓSSEA VERTICAL E INDICADORES DE RISCO ASSOCIADOS A DEFEITOS DE FURCA

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As periodontites são doenças inflamatórias que afetam o periodonto causando a destruição dos tecidos de suporte dos dentes. Sua progressão leva à perda óssea na região de bifurcação das raízes, levando ao aparecimento de lesões de furca. Essas lesões são comuns em pacientes periodontais e dificultam o controle de placa da região, favorecendo a progressão da doença, piorando o prognóstico do dente e aumentando o risco de perda dentária. As lesões em área de furca podem ser subclassificadas de acordo com o componente vertical de perda óssea, se a perda ocorreu até o terço coronal (subclasse A), até o terço médio (subclasse B) ou até o terço apical da raiz (subclasse C). Além de fatores anatômicos e etiológicos, fatores demográficos e comportamentais podem estar relacionados à ocorrência desses defeitos. Assim, a presente tese objetiva apresentar 2 artigos. O primeiro artigo observou a ocorrência e gravidade da subclassificação vertical radiográfica de defeitos de furca em primeiros e segundos molares e avaliou os indicadores de risco associados à perda óssea vertical na região de furca. Foram selecionados indivíduos que participaram de um levantamento epidemiológico e que receberam exame periodontal completo e apresentavam, pelo menos, um primeiro ou segundo molar com lesão de furca grau II ou III (n=167). Alguns molares não apresentaram defeito ósseo visível radiograficamente e um total de 85 dentes foram subclassificados. Os resultados mostraram que molares superiores apresentaram maior ocorrência das subclasses mais severas (B e C), o que está relacionado a um pior prognóstico. Na avaliação da perda óssea vertical na região de furca, os dados foram modelados usando regressão linear multinível e analisados em uma estrutura de dois níveis (dente e indivíduo). Os resultados mostraram que o acúmulo de placa, sangramento gengival, bolsas com profundidade de soldagem maior que 4mm e fumante ou ex-fumante tiveram maiores porcentagens médias de perda óssea vertical na região de furca. O segundo artigo descreveu a prevalência, extensão e gravidade do envolvimento de furca dos molares e avalia indicadores de risco associados à ocorrência de defeitos de furca. Foram selecionados indivíduos que receberam exame periodontal completo e apresentavam, pelo menos, um molar. 492 indivíduos tiveram 2421 molares avaliados clinicamente. Os dados desses dentes foram avaliados por meio de regressão logística multinomial multinível (superfície, dente e indivíduo). Foi observado que o acúmulo de placa, sangramento gengival, superfície proximal, profundidade de sondagem maior que 4mm, primeiro molar superior, sexo masculino, indivíduos com idade ≥55 anos e fumante ou ex-fumante foram associados a maiores chances de ocorrência de envolvimento de furca.

Palavras-chave: Periodontite. Lesão de furca. Indicadores de risco. Defeito infraósseo.

ABSTRACT

OCCURENCE OF THE VERTICAL BONE LOSS AND RISK INDICATORS IN FURCATION INVOLVEMENT

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Periodontitis an inflammatory disease causing loss of periodontal attachment. Its progression leads bone loss among roots in the furcation area, causing furcation involvement (FI). These FI frequently occur in individuals with periodontitis, and is more complex the control plaque in teeth with FI. Its progression of attachment loss is faster, the prognosis is worse, and consequently the risk for tooth loss is higher. The FI can be classified according to its vertical bone loss: subclass A, bone loss extending to the coronal third of the root; subclass B**,** bone loss extending to the middle third of the root; subclass C**,** bone loss extending to the apical third of the root. Besides etiological and anatomical factors, behavior and demographic factors can be associated with FI occurrence. Thus, This Thesis presents two manuscripts. The first reported the occurrence and severity of vertical radiographic subclassification of furcation defects in the first and second molars and evaluated the risk indicators associated with vertical bone loss in the furcation region. Individuals who participated of the epidemiologic survey, in which an entire clinical periodontal examination and had at least one molar with horizontal FI class II or III (n=167) were included. Some molars did not show visible bone loss in the radiographs, and 85 teeth were subclassified according to vertical bone loss. The results showed that upper molars had a higher occurrence of the more severe (B and C), more associated with a worse prognosis. For vertical bone loss in furcation area, the data were modeled using a multilevel linear regression into two levels (tooth and individual). The results showed that plaque presence, gingival bleeding, probing depth higher than 4mm, former and smokers had a major mean percentage of vertical bone loss into furcation area. The second manuscript described the prevalence, extent and severity of molar furcation involvement and evaluated risk indicators associated with FI occurrence. Individuals (492) who received an entire periodontal examination and had at least one molar (2421 molars) were included. The factors associated with FI were analyzed by multinomial multilevel logistic regression (according to surface, tooth and individual levels). Plaque presence, gingival bleeding, proximal surface, probing depth higher than 4mm, upper first molar, male, individuals older than 55 years old, former and smokers were associated with major chances for FI occurrence.

Keywords: Periodontitis, Furcation involvement, Risk indicators, Intrabony defect.

SUMÁRIO

1 INTRODUÇÃO GERAL

As periodontites são doenças inflamatórias que afetam o periodonto causando a destruição dos tecidos de suporte dos dentes devido ao acúmulo prolongado de biofilme dentário (PAGE; KORNMAN, 1997). São doenças bucais comuns de alta prevalência em âmbito mundial (OPPERMANN *et al*., 2015; EKE *et al*., 2015). As formas graves de periodontite afetam cerca de 11% da população mundial, sua prevalência é maior no sexo masculino, com pico de incidência por volta dos 60 anos de idade. A doença progride lentamente e é influenciada por vários fatores de risco, como tabagismo e diabetes mellitus que modificam a resposta imune do hospedeiro (MARTIN-CABEZAS *et al*., 2016).

Estudos demonstram que a doença periodontal pode exercer um impacto negativo na qualidade de vida relacionada à saúde bucal de adultos, sendo que a maior severidade de doença leva a um maior impacto negativo, uma vez que pode comprometer aspectos relacionados à função e à estética (FERREIRA *et al*., 2017).

A periodontite é classificada em diferentes estágios (I, II, III e IV), com base na gravidade da doença, e em graus (A, B e C), com base no risco de progressão (TONETTI; GREENWELL; KORNMAN, 2018). Dependendo da direção e extensão da propagação apical da lesão óssea induzida por placa, pode haver a formação de defeitos ósseos horizontais ou verticais (PAPAPANOU; TONETTI, 2000).

A perda óssea é considerada horizontal, quando ocorre ao longo da crista óssea alveolar no sentido perpendicular ao longo eixo do dente, ficando a base da bolsa coronal à crista alveolar. E considerada vertical quando ocorre de maneira obliqua entre a crista óssea e o longo eixo do dente, gerando defeitos angulados denominados infraósseos. Nesses defeitos, a base da bolsa está localizada em posição apical em relação à crista óssea alveolar.

A prevalência estimada pela literatura dos defeitos infraósseos variou de 8 a 32%, de acordo com as características das amostras (PAPAPANOU, WENNSTROM E GRONDAHL, 1988; KIM *et al*., 2006; TAL, 1984). O diagnóstico desses defeitos é realizado com a combinação de informações clínicas do nível de inserção clínico e avaliação radiográfica. Na radiografia intraoral, os defeitos interproximais podem ser visualizados, porém, por fornecer uma ilustração bidimensional, lesões avançadas podem ser mascaradas por estruturas sobrepostas. Se for necessário conhecer a morfologia do defeito, como número de paredes, ângulo e extensão ao redor do dente,

é necessário realizar uma tomografia ou um acesso cirúrgico (PAPAPANOU; TONETTI, 2000).

Quando a destruição periodontal ocorre na região de divergência entre as raízes de dentes multiradiculares, a perda óssea pode atingir a área de separação das raízes, expondo-a à colonização microbiana, ocorrendo assim, os defeitos com envolvimento de furca, nos quais há exposição da região de furca ao meio bucal (NIBALI *et al*., 2016).

Uma variedade de fatores tem sido associados ao aumento do risco para a progressão da doença periodontal. O acúmulo de placa na superfície dentária está relacionado à inflamação do tecido gengival e, a inflamação persistente (LANG; SCHATZLE; LOE, 2009) aumenta as chances de progressão da doença em indivíduos susceptíveis (BYRNE *et al*., 2009). Além disso, a presença de lesões de furca grau II ou III atua como áreas retentivas de placa, fornecendo condições favoráveis para o estabelecimento de microbiota anaeróbica gram-negativa, aumentando, assim, o risco para a progressão da doença periodontal, além de dificultar o acesso aos procedimentos de tratamento (NIBALI *et al*., 2016; SALVI *et al*., 2014).

Componentes anatômicos do complexo radicular podem influenciar no surgimento dos defeitos de furca e na sua progressão, como o comprimento do tronco radicular, a largura da entrada da furca, a presença de áreas retentivas com projeções ou concavidades e o grau de separação das raízes (PAPAPANOU; TONETTI, 2000). O tronco radicular curto piora o prognóstico, pois torna o envolvimento de furca mais provável. Porém, presumivelmente, ocorreu uma menor destruição periodontal (AL-SHAMMARI; KAZOR; WANG, 2001). Bower (1979) avaliou o diâmetro da área de entrada da furca de 114 primeiros molares superiores e 103 inferiores e observou que em mais de 50% das furcas examinadas o diâmetro de entrada da furca era menor do que uma lâmina de cureta (0,75-1,0mm), o que dificulta o acesso e higiene adequada da região com a utilização destes instrumentos. A presença de projeções e pérolas de esmalte, impedem a fixação do tecido conjuntivo, contribuindo assim para o desenvolvimento de um defeito de furca. A presença de áreas retentivas e concavidades reduzem a eficácia da terapia periodontal (AL-SHAMMARI; KAZOR; WANG, 2001). Esses fatores anatômicos interagem com os fatores etiológicos e podem resultar em um defeito de furca.

Fatores etiológicos como a inflamação associada à placa, patologia pulpar, fraturas radiculares verticais e fatores iatrogênicos precisam ser levados em

consideração (AL-SHAMMARI; KAZOR; WANG, 2001). A anatomia da furca favorece a retenção de depósitos bacterianos e dificulta os procedimentos de higiene, e a inflamação associada à placa leva à reabsorção óssea inter-radicular e a formação de defeitos de furca (MATTHEWS E TABESH, 2004). Fraturas radiculares verticais resultam em perda óssea alveolar rápida e localizada, podendo levar ao envolvimento de furca se a fratura se estender para a região da furca. Nesses casos, o prognóstico é ruim, podendo levar à perda dentária. Canais acessórios presentes nos molares permitem que os produtos da necrose pulpar entrem na área de furca e causem uma lesão inflamatória, resultando no envolvimento de furca. Porém, essa lesão é reversível após o tratamento endodôntico. Restaurações dentárias salientes apresentam fatores predisponentes iatrogênicos que podem levar à perda de inserção e ao envolvimento de furca, pois permitem a adesão de placa (MATTHEWS E TABESH, 2004). Além desses fatores, a presença de bolsas periodontais, idade e tabagismo foram indicadores de risco para envolvimento de furca (NAJIM; SLOTTE; NORDERYD, 2016).

O diagnóstico da presença de lesões com envolvimento de furca é realizado através de minuciosa sondagem de todas as entradas de furca, utilizando sondas específicas, tais como a Nabers com marcações de 3 em 3 mm, que permitem uma melhor avaliação e maior reprodutibilidade dos exames (EICKHOLZ; KIM, 1998). O uso de radiografias intrabucais pode auxiliar no diagnóstico, mas não pode substituir o exame clínico, pois, dependendo da localização da furca, pode levar a uma subestimação do defeito (DANNEWITZ *et al*., 2006).

As informações clínicas derivadas da avaliação dos níveis de inserção clínica devem ser combinadas com as informações derivadas das radiografias para que seja feito o diagnóstico do envolvimento de furca. Além de uma imagem radiográfica de qualidade, é necessário um conhecimento preciso da anatomia radicular e suas variações, visto que, a interpretação da imagem radiográfica do septo interdental é complicada, pois a radiografia fornece uma ilustração bidimensional de uma anatomia tridimensional que consiste em estruturas sobrepostas. Devido à possibilidade de sobreposição de estruturas, o uso do exame radiográfico como único instrumento diagnóstico pode subestimar a presença de lesões na região de furca (PAPAPANOU; TONETTI, 2000).

A presença de defeitos de furca é um achado comum em casos de periodontite, com uma prevalência relatada de cerca de 35% na faixa etária de 30 a 39 anos, e com

aumento para mais de 50% na faixa etária acima de 40 anos. Em todas as faixas etárias, os homens tiveram prevalência um pouco maior de envolvimento de furca avançado do que as mulheres. A prevalência de molares com envolvimento de furca é maior na maxila do que na mandíbula (SVÄRDSTRÖM; WENNSTRÖM, 1996; DANNEWITZ *et al*., 2006). A maior frequência de envolvimento de furca foi encontrada na região distal do 1º molar superior (53%), e as faces mesiais do 2º molar superior apresentaram a menor frequência (20%), sendo a morfologia dentária um fator importante que pode explicar a variabilidade na prevalência de envolvimento de furca dos molares (SVÄRDSTRÖM; WENNSTRÖM, 1996). Em estudo no qual a amostra era composta por pacientes que haviam recebido tratamento periodontal e terapia periodontal de suporte por pelo menos 5 anos, foi observada uma prevalência de 24,1% para envolvimento de furca grau II e 13,3% para grau III (DANNEWITZ *et al*., 2006). Já em um estudo realizado em uma população adulta sueca de 40 a 70 anos, que usou apenas exames radiográficos como método de diagnóstico, foi observada uma prevalência de 8,3% de molares com envolvimento de furca (NAJIM; SLOTTE; NORDERYD, 2016).

O envolvimento de furca piora o prognóstico e aumenta o risco de perda de molares. Uma revisão sistemática realizada por Nibali *et al*. (2016) mostrou que molares com envolvimento de furca tinham maior risco de perda dentária, mesmo mantidos em terapia periodontal de suporte por 10 a 15 anos. A média de perda dentária/ano para molares sem envolvimento de furca foi de 0,01, enquanto para molares com envolvimento de furca foi de 0,02. Esta revisão demonstrou também que o risco de perda dentária aumenta com o aumento do grau de envolvimento de furca. No estudo de Dannewitz *et al*. (2006) os autores observaram que o grau III de envolvimento de furca levou a uma deterioração significativa do prognóstico dos molares, principalmente dos superiores, influenciando o tempo de retenção dos molares de forma negativa. Além do envolvimento de furca, o tabagismo e a falta de terapia periodontal de suporte representam fatores de risco para a perda de dentes multirradiculares (SALVI *et al*., 2014).

O principal objetivo da terapia periodontal é controlar a infecção por meio de medidas de controle de placa e prevenir a recolonização da área subgengival (SVÄRDSTRÖM; WENNSTRÖM, 2000). O tratamento de dentes com envolvimento de furca representa um desafio devido suas características anatômicas e difícil acesso ao controle de placa (SALVI *et al*., 2014). Apesar das dificuldades, uma ampla

variedade de tratamentos foram propostos com o objetivo de restabelecer a saúde periodontal dos molares com envolvimento de furca (SVÄRDSTRÖM; WENNSTRÖM, 2000), e a maioria dos molares, mesmo com envolvimento de furca grau III, respondem bem à terapia periodontal, sugerindo que todo esforço deve ser feito para manter esses dentes quando possível (NIBALI *et al*., 2016). A perda dental acarreta prejuízos funcionais na mastigação e fala, além de prejuízos estéticos quando envolve dentes anteriores, o que pode impactar na qualidade de vida do indivíduo (FERREIRA *et al*., 2017). Por isso, esforços devem ser feitos para reduzir a taxa de perda dentária em indivíduos com periodontite, oferecendo a eles um acompanhamento com cuidados de manutenção adequados após realizado o tratamento periodontal (SVÄRDSTRÖM; WENNSTRÖM, 2000).

Schwendicke *et al*. (2014) avaliaram o custo-efetividade de reter molares com envolvimento de furca por meio de tratamentos periodontais versus substituí-los por coroas implanto-suportadas e observaram que a retenção de molares com envolvimento de furca por meio de tratamentos periodontais pode ser mais econômica do que substituí-los por coroas implanto-suportadas, nas condições do sistema de saúde alemão. Outros estudos mostraram um baixo número de tratamentos necessários para manter molares comprometidos e que os custos totais do tratamento periodontal para a retenção dentária ficaram abaixo dos custos de opções alternativas, como implantes ou próteses dentárias fixas. No geral, a retenção de molares com envolvimento de furca exige mais esforço do que os dentes não molares ou sem envolvimento de furca, o que tem impacto nos custos necessários para a retenção. Isso é mais relevante em molares com envolvimento severo de furca (grau III), mesmo assim, deve-se comparar esses custos com os gerados por outros tratamentos alternativos na tomada de decisão de manutenção ou extração dentária (SCHWENDICKE *et al*., 2016; PRETZL *et al*., 2009). Deve-se ressaltar que, a retenção ou substituição não são as únicas opções viáveis para o tratamento de molares com envolvimento de furca, uma vez que, arcos dentários reduzidos também podem produzir funcionalidade suficiente e saúde bucal (WOLFART *et al*., 2014).

Para alcançar os objetivos de deter a progressão da doença e manter os dentes multirradiculares com envolvimento de furca saudáveis, funcionais e com estética adequada, podemos lançar mão de procedimentos conservadores, regenerativos ou ressectivos. A escolha da modalidade de tratamento vai depender da situação clínica, de acordo com o grau do envolvimento de furca, com o objetivo de eliminar a placa

bacteriana das superfícies do complexo radicular e estabelecer uma anatomia que facilite a remoção adequada de placa (SVÄRDSTRÖM; WENNSTRÖM, 2000). A eliminação do defeito pode ser obtida com a utilização de terapia regenerativa ou através da remoção da(s) raiz(es) envolvida(s) usando abordagens ressectivas. A terapia ressectiva elimina a lesão radicular removendo as estruturas dentárias e ósseas do defeito. A terapia regenerativa permite a eliminação do defeito de furca através da regeneração dos tecidos periodontais perdidos, porém, deve ser indicada em casos específicos devido sua baixa previsibilidade. Cortellini, Cortellini e Tonetti (2020) demonstraram que molares com envolvimentos de furca grau II combinados com defeitos infraósseos, que foram submetidos a tratamentos regenerativos associados a retalhos de preservação de papila, apresentaram melhoras clínicas significativas, fornecendo melhorias na subclassificação vertical do defeito.

Hamp, Nyman e Lindhe (1975) mensuraram a perda horizontal do tecido periodontal em três diferentes graus, de acordo com a severidade de destruição tecidual (grau I, II e III). Grau I – perda horizontal dos tecidos de suporte menor que 3 mm. Grau II – perda horizontal dos tecidos de suporte excedendo 3 mm, mas não envolvendo toda a área de furca. Grau III – destruição horizontal dos tecidos de suporte “de lado a lado” na área de furca. Esta classificação é baseada na perda óssea horizontal. Em 1984, Tarnow e Fletcher propuseram uma subclassificação do componente vertical do envolvimento de furca. Esta subclassificação leva em consideração a profundidade vertical sondável do teto da furca apicalmente. As seguintes subclasses são sugeridas: Subclasse A - profundidade de 0-3 mm sondada a partir do teto da furca. Subclasse B - profundidade de 4-6 mm e Subclasse C - 7 mm ou mais de profundidade sondada a partir do teto da furca. Os envolvimentos de furca seriam consequentemente classificados como Grau I, subclasse A ,subclasse B ou subclasse C; Grau II A, B ou C ou Grau III A, B ou C. O sistema seria assim descritivo dos componentes horizontal e vertical da perda óssea de furca. O objetivo desta subclassificação é auxiliar na avaliação da quantidade de suporte remanescente e na escolha das opções de tratamento. Tonetti; Christiansen e Cortellini (2017) propuseram uma modificação desta classificação, usando radiografias periapicais e dados clínicos para avaliar o impacto da subclassificação vertical na retenção dentária. A subclassificação vertical foi estabelecida de acordo com os seguintes critérios: subclasse A – perda de inserção/perda óssea estendendo-se até o terço coronal da raiz; subclasse B – perda de inserção/perda óssea estendendo-se até o

terço médio da raiz; subclasse C – perda de inserção/perda óssea estendendo-se até o terço apical da raiz. A perda de inserção clínica foi usada para complementar os dados radiográficos para melhorar a estimativa correta do suporte ósseo residual. Foi observado que a sobrevida de 10 anos de molares com envolvimento de furca classe II foi de 52,5%. A sobrevida foi de 91% para a subclasse A, 67% para a subclasse B e 23% para a subclasse C. Os autores concluíram que o suporte periodontal residual avaliado com a subclassificação vertical do envolvimento de furca parece ser um bom preditor de sobrevivência de molar com furca horizontal classe II.

Até o momento, a maioria dos estudos publicados têm utilizado a classificação horizontal para descrever os defeitos de furca. Recentemente, estudos têm mostrado que o suporte periodontal residual avaliado pela subclassificação vertical parece ser um preditor de sobrevivência do dente. E, poucos estudos relataram os fatores de risco associados à presença de lesões de furca em molares. Assim, o objetivo do presente estudo foi observar a ocorrência e gravidade da subclassificação vertical radiográfica de defeitos de furca em primeiros e segundos molares. E, avaliar e identificar indicadores de risco associados a defeitos de furca em molares.

2 OBJETIVOS

1. Observar a ocorrência e gravidade da subclassificação vertical radiográfica de defeitos de furca em primeiros e segundos molares e avaliar os indicadores de risco associados à perda óssea vertical na região de furca (Artigo 1).

2. Descrever a prevalência, extensão e gravidade do envolvimento de furca dos molares e avaliar e identificar indicadores de risco associados à ocorrência de defeitos de furca (Artigo 2).

3 ARTIGO 1: OCCURRENCE OF VERTICAL BONE LOSS IN MOLARS FURCATION OF ADULT RURAL POPULATION.

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Title: Occurrence of vertical bone loss in molar furcation of adult rural population

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Abstract

Objectives: The aim of this study was to report the occurrence and severity of the vertical subclassification of furcation involvement (FI) in the first and second molars and evaluation of risk indicators associated with vertical bone loss in the furcation area.

Material and methods: This study is nested to a representative sample of individuals who participated in an epidemiologic survey in a rural area of South Brazil. Individuals with at least one first and/or second molar with horizontal furcation involvement class II or III (n=167) were included. Complete periodontal examinations were performed in six sites per tooth. FI was evaluated with Nabers probe. Periapical radiographs were performed with a digital sensor. Radiograph subclassification of the vertical component of FI was established according to the bone loss until the coronal third of the root (Subclass A), until the medium third (subclass B), or apical third (subclass C).

Results: 89 individuals with 139 teeth were evaluated. The maxilla molars showed a higher occurrence of vertical bone loss associated with FI. 48% of these teeth had infrabony defects in the furcation area. Dental plaque, gingival bleeding, Probing deep > 4mm and former and smokers were associated with a greater percentage of the vertical bone loss in the furcation area.

Conclusion: Upper molars showed more occurrence of vertical subclass more severe compared with mandibular molars, which may be associated with poor prognosis for maintenance of these teeth in follow-up. Dental plaque, gingival bleeding, deep pockets and smoker status were associated with more severity in vertical bone loss inside furcation area.

Clinical relevance: Vertical subclassification defined by periapical radiographs can evaluate residual attachment, prognosis, select appropriate treatment, and personal support needs to retain teeth for a long period after treatment.

Keywords: periodontitis, molar furcation, periodontal attachment, infrabony defect

Introduction

Periodontitis is a multifactorial inflammatory disease that results from an imbalance between dysbiotic dental biofilm and the host response. Its primary features include gingival bleeding, periodontal pocketing, and periodontal attachment loss [1]. Regarding the latter, when such a destruction of the tooth-supporting apparatus reaches the area between the roots in multi-rooted teeth, bone defects defined as furcation involvement (FI) occur and expose this area to biofilm accumulation [2] and increased complexity on treatment due to its unique anatomical characteristics [3].

The furcation defects are highly prevalent in individuals with periodontitis [4-6], and more severe involvement is associated with a poorer prognosis and a higher risk of tooth loss [2, 3, 5, 7]. The FI class is associated with bone loss and affects the treatment planning of these teeth [8]. Teeth with FI have a 2-fold risk for loss during supportive periodontal therapy following up to 10-15 years [2].

FI has been mainly evaluated in the literature according to horizontal classification [9]; in addition, Tarnow and Fletcher in 1984 [10] proposed a subclassification of the vertical probing depth from the furcation roof apically. In 2017, Tonetti; Christiansen e Cortellini [11] proposed a modification of this classification, in which periapical radiographs were used to evaluate the impact of the vertical subclassification on tooth retention. It was observed, over up to 10 years, an incidence of loss of molars with class II FI with bone loss until the coronal third (Subclass A) of 9%, medium third (Subclass B) of 33%, and apical third (Subclass C) of 77%. The authors concluded that the residual periodontal support evaluated by vertical subclassification in periapical radiographs could be a good predictor of molars with class II horizontal furcation survival.

Tooth loss is associated with functional damage in chewing, specially, in molars. In this respect, only a few studies have analyzed the occurrence of vertical subclassification associated with FI, which is directly associated with treatment complexities and prognosis. The aim of this study was to report the occurrence and severity of the vertical subclassification of FI in the first and second molars and evaluation of risk indicators associated with vertical bone loss in the furcation area.

Material and Methods

Design and sample

The sample of this cross-sectional study is nested to a representative sample of individuals (≥15 years old) who participated in an Epidemiologic Survey in a rural area of Rosário of Sul city/Brazil. An entire description of methodology and sampling is described by Ferreira *et al*. (2019) [12]. Briefly, 1087 were eligible, 688 were clinically examined, and 584 individuals (≥18 years old) had radiographic exams. For this study,

were selected individuals who showed at least one first or second molar with class II or III (n=167) FI, according to Hamp, Nyman and Lindhe (1975) [9] classification.

Ethical considerations

This study was done according to Helsinque declaration (1964, revised in 1975, 1983, 1989, 1996, and 2000) and approved by Ethical and Research Committee of Federal University of Santa Maria (CAAE 37862414.5.0000.5346). The individuals were informed about the study and signed the informed consent form.

Data collect

Demographic, socioeconomic, and behavioral data were obtained through interviews applied by two trained interviewers (TGMF and SCD).

Entire periodontal exams were performed in six sites per tooth, excluding third molars. Were evaluated: Probing deep (PD), bleeding on probing (BoP), suppuration on probing (SP), clinical attachment level (CAL), Visible plaque Index (VPI), and Gingival bleeding Index (GBI) using a manual UNC-15 probe (Neumar®, São Paulo, Brazil). Exams were performed at a mobile unit equipped with a complete dental unit.

Intra and inter-examiner reproducibility for PD and CAL was evaluated twice by repeated measurements (before data collection and during the study) through Intraclass Correlation Coefficient (ICC). The ICC intra-examiner and inter-examiner values varied from 0.89 to 0.93 (PD) and 0.89 to 0.96 (CAL), respectively.

FI was clinically evaluated with a 2N-Nabers probe (Millennium/Golgran®, São Paulo, Brazil) according to the degree of horizontal clinical attachment in the inter-root area of molars in all furcation entrances, according with a Hamp, Nyman, and Lindhe (1975) [9] classification.

Radiographic examination

A full-mouth series radiographic examination was performed on each individual with a digital sensor (RVG 5100 #1; Carestream Dental, Atlanta, GA, EUA) and an intraoral X-ray machine (Timex 70E; Gnatus, São Paulo, Brasil; 70kVp, 7.0mA, 0.3s exposition). All radiographs were performed using the paralleling technique (XCP-DS positioner; DentsplyRinn, York, PA, EUA).

The CS Imaging Software (Carestream Health, Rochester, NY) was used to acquire and manipulate all radiographs. All images were processed with the filter “Perio” available on the software, which enhances the alveolar crest. Images were exported in .tiff format (Tagged Image File Format) for posterior furcation defects evaluation and measurement on Image J software (U. S. National Institutes of Health, Bethesda, Maryland, USA, https://imagej.nih.gov/ij/, 1997-2018).

Radiographic Evaluation

The radiographic subclassification of the vertical component of furcation involvement of selected teeth was performed according to the classification proposed by Tarnow and Fletcher (1984) [10] and modified by Tonetti; Christiansen, and Cortellini (2017) [11]. The vertical classification of each tooth was based on the most compromised root.

Figure 1 depicts the furcation evaluation performed using ImageJ software. Briefly, a line (1) parallel to the cervical region was traced at the furcation roof; then, a second line (2), parallel to the first one, was placed at the apex of the most compromised root. Three vertical distances were measured: between the furcation level and the tooth apex (line 3), between the furcation level and the vertical bone defect (line 4), and the depth of the vertical bone defect (line 5). The measurements were classified into **subclass A,** bone loss extending to the coronal third of the root; **subclass B,** bone loss extending to the middle third of the root; **subclass C,** bone loss extending to the apical third of the root.

One examiner (FLBM), trained and calibrated by an Oral and Maxillofacial Radiology specialist (GSL), performed all evaluations. Examiner reproducibility for radiographic vertical subclassification was evaluated by Kappa Coefficient = 0.84.

Statistical analysis

Continuous variables were described as mean and standard deviation (SD). Categorical variables were described as frequency and relative frequency. Data analysis was accomplished using the Statistical Package for Social Science (SPSS for Windows, version 25.0, SPSS Inc., Chicago, IL, USA). An infrabony defect was considered as a vertical defect height in the furcation area ≥ 1.5mm. Comparisons among horizontal and vertical FI, upper and lower molar, and frequency of the infrabony defects were performed using chi-square test. The level of significance was set at 5%. Multilevel linear regression was used for the occurrence of vertical furcation defects. Given the limited sample size for this outcome, a two-level framework (tooth- and individual-level) was chosen to respect the appropriate degrees of freedom. The models incorporated a random intercept at the individual-level. Only variables with a p-value < 0.2 in the unadjusted analysis were included in the adjusted model. By employing these strategies, odds ratios (OR) and coefficients (ß) were calculated with 95% confidence intervals (95% CI). The random component was assessed using the deviance (2 log-likelihood).

Covariates

Various covariates were examined at tooth- and individual-level. At the tooth-level, variables included dental plaque, gingival bleeding, tooth group, probing pocket depth, which was dichotomized as ≤ 4 mm or > 4 mm. At the individual-level, variables were derived from both interviews and clinical examinations, and encompassed sex,

race (white or non-white), age groups (≤ 39, 40 – 54, and ≥ 55), educational attainment (< 8 or ≥ 8 years), income (≤ 1 or > 1 Brazilian monthly minimum wage [BMMW]), smoking (non-smokers or ex- and current smokers), body mass index (eutrophic [< 25 kg/m2], overweight [25 – 29.9 kg/m2], or obese [≥ 30 kg/m2], and dental visits in the last year (yes or no).

Results

Of the 584 individuals with clinical and radiographic examinations, 167 had 290 molars that showed class II or III FI. One hundred fifty-one teeth were excluded from the radiographic assessment due to absence in the database (n = 47), or technical errors compromising the reference points for measurements (n = 104), and thus 139 were evaluated for vertical bone loss sub classification on furcation area (Figure 2).

Table 1 describes demographic, socioeconomic, and clinical characteristics of the sample. The 167 individuals who showed molars with class II/III furcation involvement were 47 years old, non-smokers (76.6%), and male (59.9%). These individuals had an average of 86.78% VPI, 77.12% BoP, and 4.83mm ± 2.40 CAL. Higher CAL was observed in individuals who received the vertical radiographic subclassification.

Fifty-five individuals had 85 molars subclassified according to vertical bone loss. A higher occurrence of vertical bone loss was observed in upper molars compared to lower molars (Figure 3).

Table 2 presents the vertical subclassification according to the clinical horizontal furcation involvement class. From the 139 teeth evaluated, 87% presented with class II furcation involvement. The radiographic evaluation could not show visible bone lesions in 53 molars with class II and in one molar with class III. The association between the horizontal class and radiograph vertical subclassification was statistically significant (p=0.003).

Of the 85 molars that received the subclassification A, B, or C, 41 had a vertical defect height in the furcation area ≥ 1.5mm (Table 3). They were classified as having an infrabony defect inside of furcation area. It was statistically significant comparing vertical subclassification and defect height (p=0.0001). Molars with infrabony defects were on majorly (70%) upper molars (Table 3).

Figure 4 describes furcation involvement according to the vertical lesion. Subclass B occurred more frequently in upper molars, while in mandibular molars, it was Subclass A.

Table 4 outlines the adjusted associations for occurrence of the vertical furcation defects through multilevel linear regression. Teeth with dental plaque and gingival bleeding, and individuals who were former or current smokers had an increase in vertical bone loss.

Discussion

Radiographic examination plays an important role in periodontal diagnosis, planning, and follow-up of patients. Specifically regarding to vertical defects in the furcation area, the radiographic assessment method proposed by Tonetti; Christiansen e Cortellini (2017) [11] allows a more comprehensive understanding of the residual periodontal attachment, disease severity, and complexity of treatment. This study reports that the major vertical subclassification occurrence in the furcation area was B (bone loss extending to the middle third of the root), followed by A (bone loss extending to the coronal third of the root). In upper molars, subclass B was the most frequent, while in lower molars it was the A. Upper molars were frequently associated with more severe FI (subclasses B and C), compared to lower molars (subclass A). The low occurrence of subclass C in this sample may have occurred due to the loss of teeth with more severe attachment loss associated with stages III and IV periodontitis, a highly prevalent condition in this population [13].

The vertical subclassification is an important predictor of tooth survival. Tonetti; Christiansen e Cortellini (2017) [11] showed that molars classified as A or B had a higher survival rate compared to molars with subclass C. One pivotal study evaluated factors associated with tooth loss over a period mean of 22 years. This study suggested that tooth loss associated with the presence of a questionable prognosis, which was assigned to teeth with considerable alveolar bone loss (not necessarily in the furcation area), was associated with an increased rate of such an outcome. Additionally, the tooth loss rate associated with questionable teeth with or without FI was similar [14]. That is, tooth loss was not specifically associated with the presence of horizontal FI. In contrast to the defects assessed through the horizontal classification, which may be restricted to the middle and cervical third of the root, the vertical subclassification is associated with the progression of attachment loss in the root long axis, directly associated with remaining periodontal attachment.

Importantly, more severe vertical attachment loss usually demands more complex treatment options, and the classical approach emphasizes separation and resection techniques. Cortellini & Tonetti (2020) [15] performed papilla preservation flaps associated with regenerative procedures for complex intra-bony defects together with FI and obtained good results in retaining upper and lower molars. It was demonstrated that such techniques may improve the vertical subclassification, increasing teeth retention in well-maintained and compliant subjects.

Our study also observed a higher occurrence of FI in upper molars compared to lower ones, according to previous studies [4,5]. Upper molars offer significant difficulties in accessing proximal furcations [16], both for patient care and for professional treatment, and thus these proximal entrances present an increased risk for dental biofilm accumulation [4]. Otherwise, lower molars anatomy allows easy diagnosis, professional treatment approach, and patient access. The differences between upper and lower molars were also observed during the radiographic

assessment, where 48 upper molars radiographs presented no visible bone defects, while this situation happened in only six lower teeth. Notably, over position of anatomic structures can sub-estimate the FI in the radiographic exam [18]. Despite severe FI usually would be easier to identify in radiographs [19], the reliability of the vertical subclassification may be better in lower molars [20]. Regardless of inherent radiographic limitations, using periapical radiographs for classifying vertical FI presents facilities for the clinical practice, as radiographic exam is performed routinely and with a low radiation dose for the patient.

This sample was obtained in a rural area with limited access to dental services. Rural populations usually have significant difficulties with public policies, such as of health as education, reflected in low educational levels and high levels of biofilm and gingival bleeding, ultimately associated with periodontal pocket and attachment loss. Hass *et al*. (2014) [17] showed in another sample from South Brazil that non-smokers, men, low educational level, and age higher than 30 years were associated with a higher risk for the progression of periodontal attachment loss. Svärdström; Wennström (1996) [4] also observed that men had a higher prevalence of severe furcation involvement. This can be explained by men having a higher risk of progression of periodontal attachment loss [17].

Of the 139 teeth radiographically evaluated, 54 did not observe bone loss in the furcation area. When assessing vertical bone loss in the furcation area in radiographs, around half of them (49.4%) exhibited bone loss until the middle third of the root (subclass B). While maxillary molars had more teeth showing no radiographic evidence of bone loss in the furcation area, subclasses B and C were observed more frequently in these teeth.

Our data also showed that dental plaque, gingival bleeding, a higher PPD mean and ex- and current smokers increased the likelihood of vertical bone loss in the furcation area. These results corroborate Lang, Schatzle & Loe (2009) [21] finds, who demonstrated that the dental plaque and gingival inflammation may have a significant impact in the progression of periodontal attachment loss. Furthermore, Matuliene et al. (2008) [22] observed a higher risk for attachment loss progression in residual periodontal pockets ≥ 6mm. And smoking is a well-established risk factor for periodontitis [17, 23-25].

The high occurrence (48%) of the intrabony defects (height ≥ 1.5mm) inside the furcation area observed in this study is higher than the reported for proximal defects, which varies from 8 to 32%, depending on the sample characteristics and the authors' definition of defect presence (defect height ≥ 2mm) [26-28]. Besides, these measurements might be even higher since radiographic analysis often underestimates bone loss due to geometric projection. This study, observed more intrabony defects in the first upper molars. This may be explained due to higher FI in these teeth since the anatomical characteristics in the furcation with larger inter-roots area can favor the occurrence of vertical defects.

The subsample of this study is nested to a representative sample of the rural population. The examiners were trained and calibrated, and for the radiographic analysis, the images were helpfully selected, and the measurements were performed by one examiner previously trained and calibrated. However, considering the loss due to the evaluation process, the precision of estimates can be biased. Of the 290 teeth with class II or III furcation involvement clinically evaluated, 151 could not be evaluated by radiographs due to absence in database, or technical errors compromising the measurements. Nonetheless, the individuals clinically evaluated were similar to the clinical and radiographic ones (Table 1). External validity can be restricted due to losses, the low access to dental care, and the high prevalence of periodontitis observed.

Conclusion

The evaluations of residual periodontal attachment on first and second molars, performed through periapical radiographs, showed that upper molars presented a higher occurrence of more severe subclasses (B and C) than lower molars. Upper molars had higher attachment loss, which can be associated with a worse prognosis and a higher risk of tooth loss.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Table 1 – Clinical, demographic and socioeconomic characteristics of the sample, considering the clinical and radiographic evaluations, and the vertical radiographic subclassification of the FI.

Characteristics	Clinical evaluation (class II and/or III) (n=167)	Radiographic evaluation (Subclass A/B/C or without defect) (n=89)	Radiographic Subclassification (Subclass A/B/C) (n=55)
Age ($\bar{X}$ ± SD)	47.23 ± 14.09	48.68 ± 13.51	53.25 ± 11.39
Gender - n (%)			
Female	67 (40.1)	31 (34.8)	19 (34.5)
Male	100 (59.9)	58 (65.2)	36 (65.5)
Smoking – n (%)			
Non smoker	128 (76,6)	66 (74.2)	37 (67.3)
Smoker	39 (23.4)	23 (25.8)	18 (32.7)
Educational level - $\bar{X}$ ± DP			
Study years	5.59 ± 3.24	4.97 ± 2.97	4.64 ± 2.72
Molars number - $\bar{X}$ ± DP	1.73 ± 1.08	2.0 ± 1.20	1.54 ± 0.90
Periodontal clinical variables			
VPI ($\bar{X}$ ± DP)	86.78 ± 20.80	89.66 ± 14.92	88.19 ± 18.10
GBI ($\bar{X}$ ± DP)	43.68 ± 32.66	42.86 ± 31.43	39.98 ± 32.98
PD ($\bar{X}$ ± DP)	3.42 ± 0.98	3.49 ± 0.96	3.63 ± 0.98
CAL ($\bar{X}$ ± DP)	4.83 ± 2.40	5.33 ± 2.53	6.39 ± 2.47
BoP ($\bar{X}$ ± DP)	77.12 ± 26.52	77.90 ± 24.27	78.69 ± 28.30

SD: Standard Deviation; VPI: Visible Plaque Index; GBI: Gingival Bleeding Index; PD: Probing Depth (mm); CAL: Clinical Attachment level; BoP: Bleeding on probing.

Table 2 – Vertical radiographic subclassification according to the clinical horizontal furcation involvement class

Radiographic vertical subclassification (n = 139)*	Class II (n= 121)	Class III (n= 18)
Subclass A (%)	32 (94)	2 (6)
Subclass B (%)	32 (76)	10 (24)
Subclass C (%)	4 (44)	5 (56)
Without defect (%)	53 (98)	1 (2)
Upper first molar (n = 64)		
Subclass A (%)	10 (90)	1 (10)
Subclass B (%)	16 (80)	4 (20)
Subclass C (%)	2 (40)	3 (60)
Without defect (%)	28 (100)	0
Upper second molar (n = 39)		
Subclass A (%)	6 (85)	1 (15)
Subclass B (%)	10 (100)	0
Subclass C (%)	1 (50)	1 (50)
Without defect (%)	19 (95)	1 (5)
Lower first molar (n = 24)*		
Subclass A (%)	11 (100)	0
Subclass B (%)	4 (50)	4 (50)
Subclass C (%)	0	0
Without defect. (%)	5 (100)	0
Lower second molar (n = 12)		
Subclass A (%)	5 (100)	0
Subclass B (%)	2 (50)	2 (50)
Subclass C (%)	1 (50)	1 (50)
Without defect (%)	1 (100)	0

*Chi-squared <0.05

Table 3 – Vertical radiographic subclassification according to defect height

	Defect height	
Vertical Radiographic Subclassification (n = 85)*	< 1,5 mm n = 44	≥ 1,5 mm n = 41
Subclass A (%)	26 (59)	8 (19.5)
Subclass B (%)	17 (38.6)	25 (61)
Subclass C (%)	1 (2.4)	8 (19.5)
Upper first molar (n = 36)		
Subclass A (%)	7 (46.7)	4 (19)
Subclass B (%)	7 (46.7)	13 (62)
Subclass C (%)	1 (6.6)	4 (19)
Upper second molar (n = 19)*		
Subclass A (%)	7 (63.6)	0
Subclass B (%)	4 (36.4)	6 (75)
Subclass C (%)	0	2 (25)
Lower first molar (n = 19)		
Subclass A (%)	8 (66.6)	3 (42.8)
Subclass B (%)	4 (33.4)	4 (57.2)
Subclass C (%)	0	0
Lower second molar (n = 11)		
Subclass A (%)	4 (66.7)	1 (20)
Subclass B (%)	2 (33.3)	2 (40)
Subclass C (%)	0	2 (40)

*Chi-squared <0.05

Table 4 Adjusted associations between tooth- and individual level variables and occurrence of vertical furcation defect at molars, determined using multilevel linear regression.

Variable	Adjusted model
	ß (95% CI)
Fixed component (intercept)	0.09 (0.02 – 0.17)
Tooth level	
Dental plaque	
No	1
Yes	0.17 (0.0012 – 0.43)
Gingival bleeding	
No	1
Yes	0.66 (0.37 – 0.97)
Tooth group	
Second molar	1
First molar	0.46 (-0.21 – 0.85)
Probing pocket depth	
≤ 4 mm	1
> 4 mm	0.73 (0.35 – 1.03)
Individual level	
Sex	
Female	1
Male	0.22 (-0.07 – 0.63)

Race	**-**
White	
Non-white	
Age	**-**
≤ 39	
40-54	
≥ 55	
Educational attainment	**-**
≥ 8 years	
< 8 years	
Income	**-**
>BMMW	
≤1 BMMW	
Smoking	
Non-smokers	1
Ex- and current	0.23 (0.11 – 0.34)
Hb1Ac	**-**
BMI	**-**
Eutrophic	
Overweight	
Obese	
Dental visits in the last year	**-**
Yes	
No	
Random component	297698.2

CI: Confidence Interval; BMMW: Brazilian Monthly Minimum Wage; BMI:Body Mass Index

Legends

Fig 1 Sample measurement performed on a tooth presenting a grade II furcation involvement on the buccal and distal sides. The distal root displayed more bone loss and was used as the reference for the tooth classification. Line #1 depicts the furcation roof, and line #2, the tooth apex. Lines #3, #4, and #5 show the measurements between the furcation level and the tooth apex, the furcation level and the vertical bone defect, and the depth of the vertical bone defect, respectively

Fig 2 Sample flowchart

Fig 3 Frequency of vertical subclassification of the class II and III furcation involvement (n=85 teeth)

Fig 4 Vertical radiograph subclassification class (n=139)

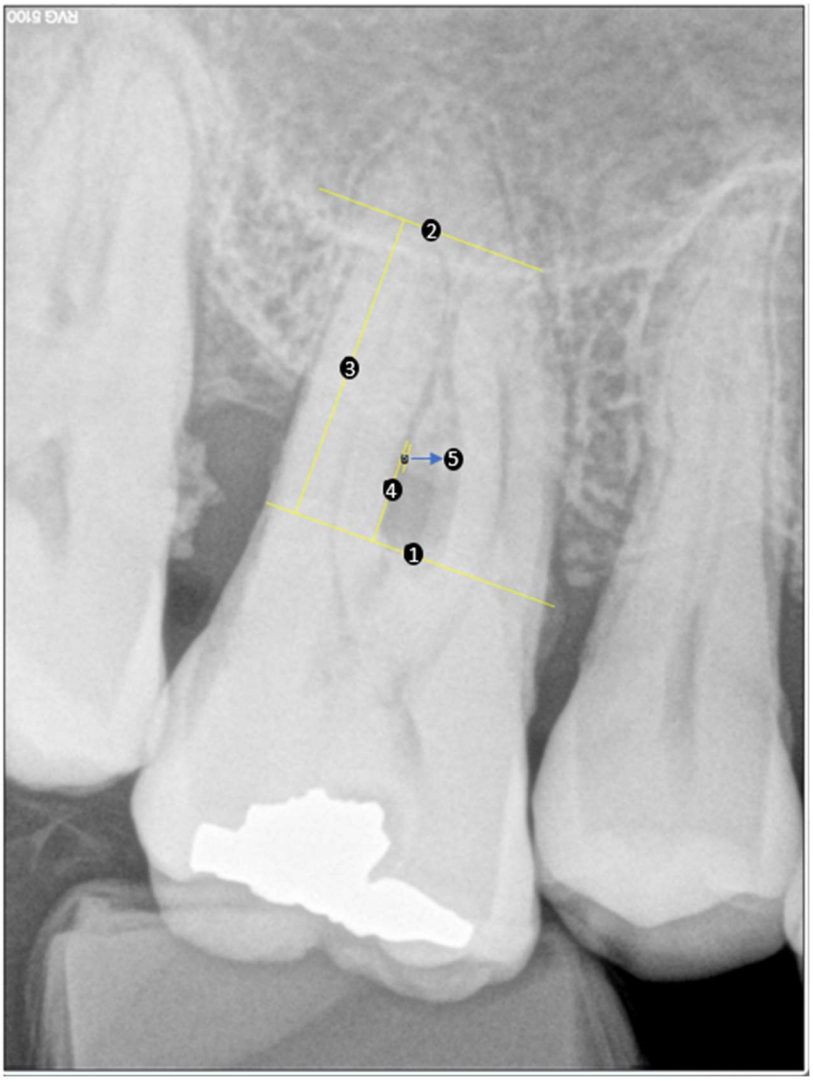

Fig. 1

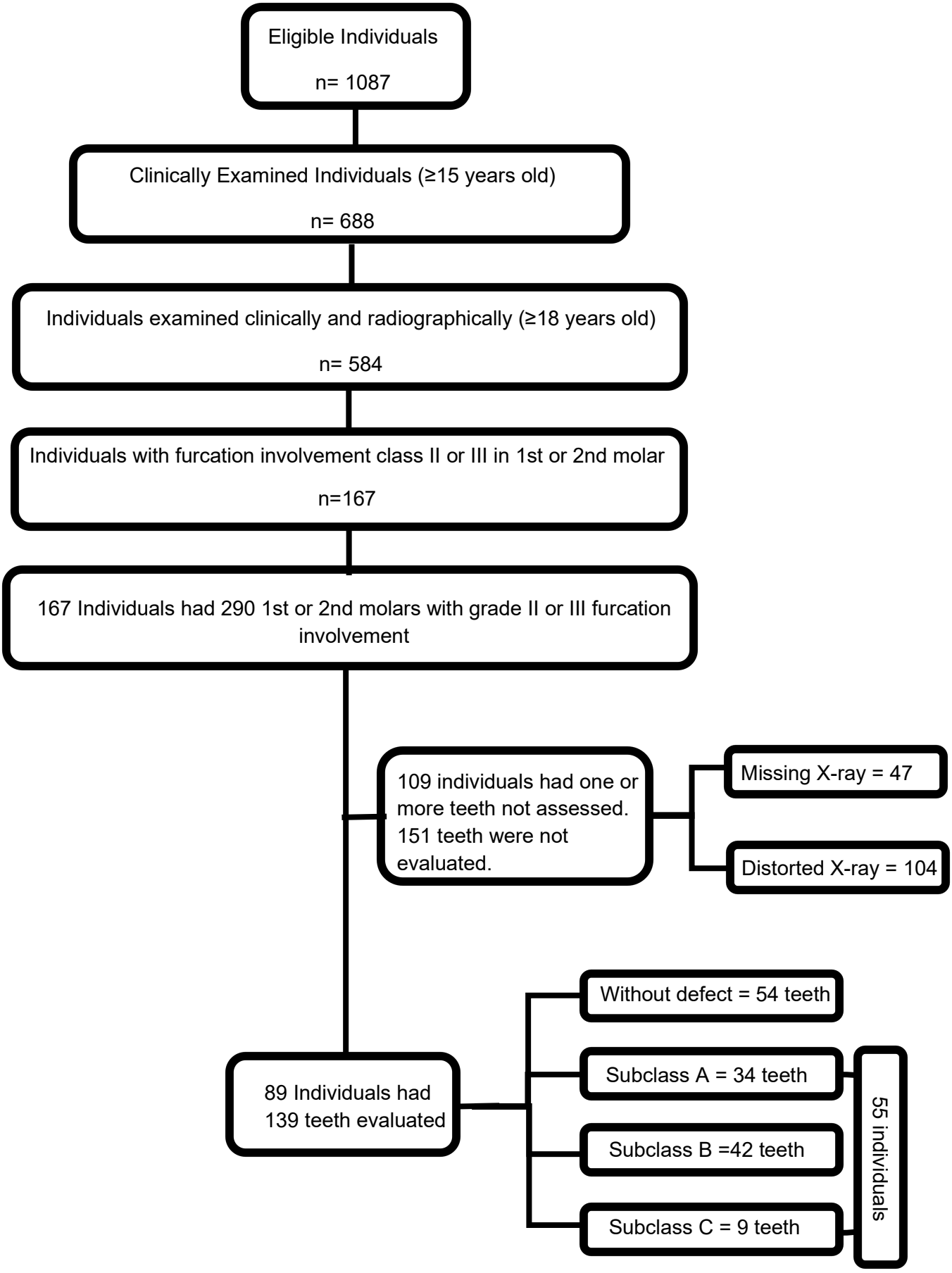
Eligible Individuals
n= 1087
Clinically Examined Individuals (≥15 years old)
n= 688
Individuals examined clinically and radiographically (≥18 years old)
n= 584
Individuals with furcation involvement class II or III in 1st or 2nd molar
n=167
167 Individuals had 290 1st or 2nd molars with grade II or III furcation involvement
109 individuals had one or more teeth not assessed. 151 teeth were not evaluated.
Missing X-ray = 47
Distorted X-ray = 104
89 Individuals had 139 teeth evaluated
Without defect = 54 teeth
Subclass A = 34 teeth
Subclass B =42 teeth
Subclass C = 9 teeth
55 individuals

Fig. 2

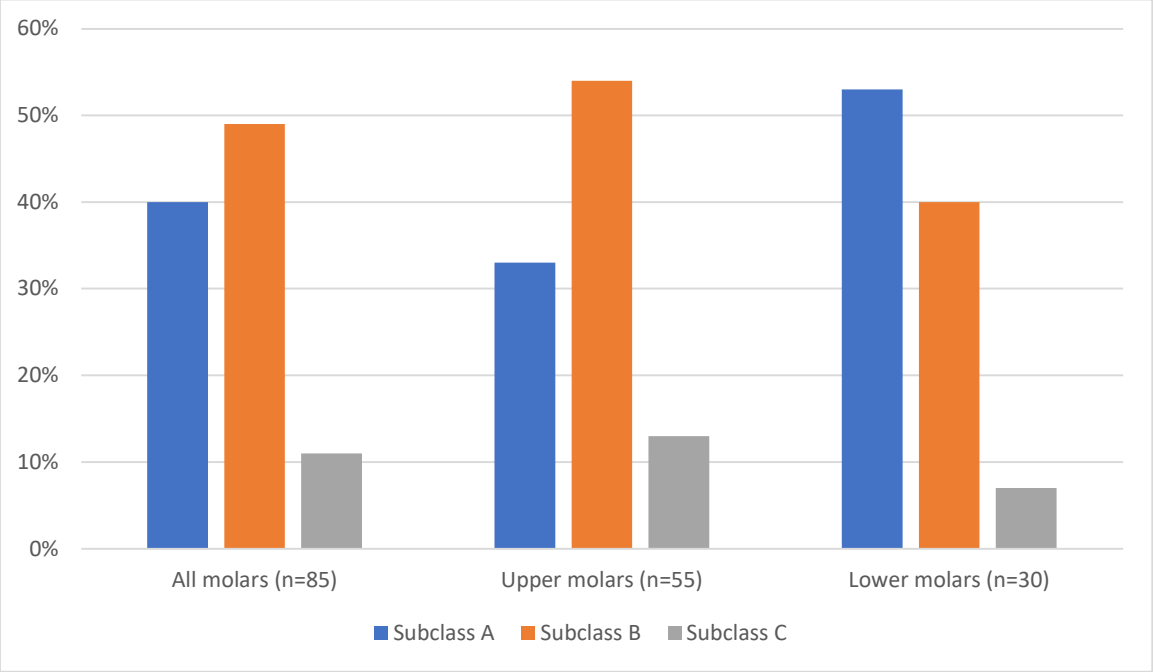
60%
50%
40%
30%
20%
10%
0%
All molars (n=85)
Upper molars (n=55)
Lower molars (n=30)
Subclass A
Subclass B
Subclass C

Fig. 3

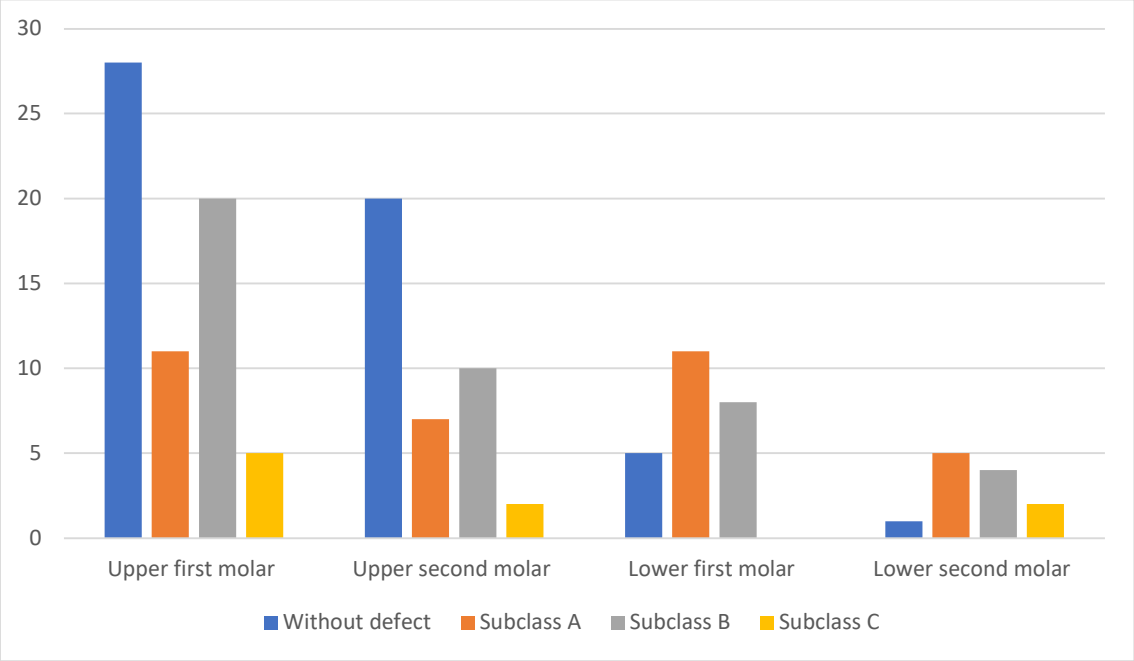
30
25
20
15
10
5
0
Upper first molar
Upper second molar
Lower first molar
Lower second molar
Without defect
Subclass A
Subclass B
Subclass C

Fig 4

4 ARTIGO 2: RISK INDICATORS FOR THE OCCURRENCE OF FURCATION INVOLVEMENT IN A SAMPLE WITH LITTLE ACCESS TO DENTAL CARE.

Este artigo será submetido ao periódico *Journal of Clinical Periodontology*, Online ISSN:1600-051X, Fator de impacto: 6.7, Qualis A1. As normas para publicação estão escritas no Anexo B.

Title: Risk indicators for the occurrence of furcation involvement in a sample with little access to dental care.

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ABSTRACT

Aims: Describe the prevalence, extent, and severity of molars` furcation involvement (FI) and evaluate the risk indicators associated with FI occurrence.

Material and Methods: The sample of this study is nested to a representative sample, which individuals living in a rural area received entire periodontal examination. This study analyzed 2421 molars in 492 individuals who FI were clinically classified using a Nabers probe (Degree I, II and III) in all molar entrances. FI prevalence was estimated considering tooth-, entrance- and individual-level. Extent was evaluated only for molars with FI. Multilevel regression models analyzed risk indicators for occurrence of FI.

Results: The prevalence of FI was 59.7% per individual and was higher in maxillary teeth and with aging. Lower molars showed more FI extent than upper. The first upper molars showed more chance of FI than the second molars. Gingival bleeding, individuals older (+ 55 years old), former and smokers were associated with more chance of the FI occurrence degree II or III.

Conclusion: In this sample high FI occurrence was observed. Dental plaque, gingival bleeding, older, Probing deep > 4mm, male, and smoking habits were associated with more chance for occurrence of FI and severity.

Clinical relevance:

Scientific rationale for study: Furcation involvement occurs frequently in individuals with periodontitis, affecting prognosis and treatment options in molars. Identifying risk factors associated with FI helps in the treatment plan and preventive options.

Principal findings: Local factors like dental plaque and marginal gingival bleeding, individuals older, men, former, and current smokers had more chance for FI occurrence.

Practical implications: To prevent FI, control of etiological and risk factors is needed.

Keywords: periodontitis, molar furcation, logistic model

Introduction

Periodontitis is an inflammatory disease that affects the periodontium, leading to the loss of periodontal attachment of teeth. It affects susceptible individuals exposed to risk factors due to the long-term presence of dental plaque (Page & Kornman, 1997; Meyle & Chapple, 2015). Periodontitis progression may have, as consequence, furcation lesions (Nibali et al., 2016), which are frequently observed in individuals with periodontitis (Svardstrom & Wennstrom, 1996; Najim, Slotte & Norderyd, 2016). Furcation defects can be a retentive factor for dental plaque, making therapeutic procedures more challenging and potentially contributing to disease progression (Salvi et al., 2014).

Various factors are associated with FI`s development of, including etiologic and anatomic factors. Apart from the progressive attachment loss due to periodontitis, other factors, including pulpal pathologies, root fractures, and iatrogenic factors, need to be considered (Al-shammari, Kazor & Wang, 2001). Early FI is usually associated with a short root trunk, while a narrow furcation entrance can challenge access for effective plaque control (Papapanou & Tonetti, 2000). Furthermore, cervical projections and enamel pearls can be associated with furcation involvement (Al-shammari et al., 2001). Thus, it is essential to recognize that risk factors encompass local, systemic, and behavioral.

FI degree is associated with the severity of bone loss in the inter-root area. Higher severity levels are linked to a worse prognosis and increased risk for tooth loss (Nibali et al., 2016; Dannewitz, Krieger, Hüsing & Eickholz, 2006; Salvi et al., 2014; Svardstrom & Wennstrom, 2000; Trullenque-Eriksson, Tomasi, Petzold, Berglundh & Derks., 2023). Tooth loss affects aesthetics and functional impairment, negatively impacting quality of life (Ferreira, Pereira, Almeida, Martins & Paiva, 2017).

In a study by Najim et al. (2016), several factors were examined for their association with furcation involvement. They found that pocket depth, age, and smoking were risk indicators for the furcation defect. However, factors such as scholarship, dental plaque, gingival inflammation, and gender were not associated with the presence of furcation defects. We found that a limited number of studies investigated factors associated with FI. Based on current literature, epidemiological studies which provide detailed data about the prevalence, extent, and severity of FI for representative samples are needed. These estimates, besides providing an overview of the problem in the population, directly assist in health planning, acting in the prevention and control of the disease in the community (Grimes & Schulz, 2002). Furthermore, to the best of our knowledge, comprehensive studies which describe the whole epidemiologic profile of FI have not been published. Therefore, the present study aims to describe the prevalence, extent, and severity of FI at the individual, molar, and furcation entrance level for a population-based sample, and to provide a comprehensive evaluation of risk indicators associated with furcation defects.

Material and Methods

The sample in this study is a subsample nested to a representative epidemiologic survey of a rural area, in which 688 individuals were evaluated. The entire methodological aspects of this survey were described in Ferreira et al. (2019).

Ethical considerations

Individuals were informed about the study aims and signed the informed consent form. This study was approved by the Ethical and Research Committee of Federal University of Santa Maria (CAAE 37862414.5.0000.5346).

Data collect

Six hundred eighty-eight individuals received clinical examinations. In 584 of them, radiographic exams were done. Demographic, socioeconomic, and behavioral data were collected through interviews conducted by two previously trained researchers (TGMF and SCD). Comprehensive periodontal examinations, including assessments of visible plaque index (VPI), gingival bleeding Index (GBI), periodontal probing depth (PPD), clinical attachment level (CAL), and bleeding on probing (BoP), were done at six sites per tooth, excluding third molars. FI was evaluated according to Hamp, Nyman & Lindhe (1975) classification using a 2N-Nabers probe (Millennium/Golgran®, São Paulo, Brazil). For this study, individuals with at least one molar were selected (n=492).

Intra and inter-reproducibility assessments were performed for PPD and CAL before and during data collecting. The Intraclass correlation coefficient (ICC) for PPD ranged from 0.89 to 0.93, and for CAL, it ranged from 0.89 to 0.96.

Theoretical training for diagnosis and severity of FI was performed based on the classification developed by Hamp, Nyman & Lindhe (1975). Clinical training occurred in five individuals with the supervision of an experienced examiner. A pilot study was conducted at the end of the training and calibration period with 15 individuals to test the team of researchers and establish the most appropriate evaluation sequence.

Data analysis

Data analysis was performed by Stata 14.0 software (Stata Corporation, College Station, TX, USA). The prevalence of FI was determined on three analysis levels: individual, tooth, and furcation entrance. The prevalence per individual was estimated considering at least one molar with FI. At the tooth level, the prevalence was determined by at least one furcation entrance involved. The prevalence of furcation entrances was independently assessed. The extent at the molar level was determined for the total number of entrances with FI for each tooth. Severity was defined for the type of tooth. The Kruskal-Wallis test determined the association of all analysis levels

in different age categories. Mixed linear models were used to compare all clinical variables between molars with FI, without FI, and anterior and premolar teeth.

The primary outcome was the occurrence of horizontal furcation defect, categorized as no defect (reference), degree I, and degree II/III (Hamp et al., 1975). This was analyzed through multilevel multinomial logistic regression, considering surface-, tooth-, and individual-level factors (using gsem commands). Importantly, separate models were created for maxillary and mandibular molars due to anatomical differences between upper and lower molars that are not feasible to model and probably are conceptually linked to the probability of furcation occurrence. The models incorporated a random intercept at the individual- and tooth-level. Only variables with a p-value < 0.2 in the unadjusted analysis were included in the adjusted model. By employing these strategies, odds ratios (OR) and coefficients (ß) were calculated with 95% confidence intervals (95% CI). The random component was assessed using the deviance (2 log-likelihood).

COVARIATES

Various covariates were examined at surface-, tooth-, and individual-level. At the surface-level, variables included dental plaque, gingival bleeding, furcation surface, and probing pocket depth, which was dichotomized as ≤ 4 mm or > 4 mm. The tooth-level variable was the tooth group, classified as the second or first molar. At the individual-level, variables were derived from both interviews and clinical examinations, and encompassed sex, race (white or non-white), age groups (≤ 39, 40 – 54, and ≥ 55), educational attainment (< 8 or ≥ 8 years), income (≤ 1 or > 1 Brazilian monthly minimum wage [BMMW]), smoking (non-smokers or ex- and current smokers), body mass index (eutrophic [< 25 kg/m2], overweight [25 – 29.9 kg/m2], or obese [≥ 30 kg/m2], and dental visits in the last year (yes or no).

Results

Table 1 describes an overview of the sample's demographic, socioeconomic, and clinical characteristics.

Table 2 shows the prevalence of FI according to different age groups. More than half of the individuals (59.7%), as well as 27.3% of the molars and 14.7% of the entrances presented FI. The group aged 45-54 years presented the higher prevalence of individuals with FI. Statistically significant differences between the groups were found for two levels of analysis, molars and furcation entrances. The FI prevalence at these levels was higher in the 55-64 years old group ($p<0,05$). The lowest FI prevalence values were found for categories of less than 45 years old in all analysis levels (individual, molar and furcation entrance) (Table 2).

A higher FI prevalence was presented by maxillary molars and furcation entrances ($p< 0.05$). However, the extent of FI and the percentage of lost molars was higher in the mandible ($p<0.05$) (Figure 1).

Distribution of prevalence, extent and severity of FI for different teeth are described in Table 3. Tooth 26 presented the highest prevalence of FI (34.9%). In analyzing furcation entrances, the highest FI prevalence was observed in teeth 17 and 26 (16.2%). The higher extent of FI was in tooth 36, and the smallest in tooth 26. Degree I was more prevalent in tooth 36, while degree II and III in teeth 27 and 26, respectively.

Table 4 shows the adjusted model for the FI occurrence at maxillary molars. Only male was associated with higher odds of degree I furcation. For degree II/III, increased odds were found for PPD > 4mm, proximal surfaces, and sites presenting gingival bleeding. Decreased odds were noted for second molars when compared to first molars. At the individual level, male individuals, with aged 55 years or older and ex- or current smokers showed a higher probability of degree II/III furcation when compared to their counterparts.

Table 5 presents the adjusted model for the FI occurrence in mandibular molars. At the surface-level, individuals with higher levels of dental plaque and gingival bleeding and, at-individual level, ex- and current smokers and older ages had increased odds of degree II/III furcation compared to their counterparts. At surface level, PPD > 4mm was associated with higher degree II/III furcation odds.

Discussion

A high FI prevalence per individual was observed, as about 60% them had at least one tooth with FI. The prevalence for molars and furcation entrances was 27.3% and 14.7%, respectively. Maxilla molars showed a higher chance for occurrence of horizontal FI degree II and III in sites proximal and with gingival bleeding, and in first molars was observed more chance for FI degree II or III compared with second molars. Individuals' male, 55 years old or older, former or current smokers, had more chance of FI degree II or III. Similarly, in mandibular molars, FI degree II or III was observed with more chance in sites with dental plaque, gingival bleeding, 55 years old or older, and in former and current smokers.

These individuals living in a rural area had a high prevalence of moderate and severe periodontitis (Ortigara et al., 2021). Almost half of them were either current or former smokers and did not receive dental care last year. In over 75% of molars, dental plaque and gingival bleeding in 34% of molar were observed. PPD mean was higher in molars compared with other teeth. Second molars had more dental plaque, gingival bleeding, and PPD mean than first molars and other teeth.

An analysis into different age groups observed an increase in the prevalence of FI with age. Prevalence rates for individuals, molars, and furcation entrances is concentrated in age groups, being higher in age range of 45 to 64 years old. The relationship between age and disease progression is due to the prolonged and cumulative exposure to dental biofilm (Papapanou, Lindhe, Sterrett, & Eneroth, 1991). This relation It's possible to observe in our analysis due individuals with 55 years old or older, present more chance to develop FI (degree II/III) than younger.

Some studies in individuals with periodontitis have related a higher FI prevalence for maxillary molars compared to mandibular (Dannewitz et al., 2006, 2016; Eickholz et al., 2016; Svärdström & Wennström, 1996). Our study confirms these results, as FI for the maxilla was statistically significant at the molar level and furcation entrance (Figure 1). A plausible explanation for this is the number and location of entrances. Maxillary molars usually have three furcation entrances, two of them on proximal surfaces. The interdental region of maxillary molars are challenging to maintain without dental plaque (Ribeiro et al., 2007), resulting in a higher frequency of dental plaque-associated FI lesions (Svardstrom & Wennstrom, 1996). Consequently, this increases the chance of periodontal attachment loss progression and the occurrence of FI.

In extent, by numbers of entrance with FI, mandibular molars were significantly more affected than maxillary (Figure 1 and Table 3). As maxillary molars have three entrances and mandibular two after FI, the chance of involving only two entrances becomes greater than reaching three. Furthermore, the number of molars lost in the mandible in our sample was significantly higher than in the maxilla. This may have had a direct impact on the prevalence and extent of results by jaw. Thus, the greater number of maxillary molars increased their probability of having at least one of the affected teeth (prevalence), however decreased its chance that the affected teeth had more than one affected entrance at the same time (extent).

We found that a higher PPD mean was associated with an increased chance FI across degree I, II and III, in both maxillary and mandibular molars. These results underscore the correlation between increased PPD and progression of periodontal attachment, ultimately leading to FI, and corroborating Matuliene et al. (2008) findings that observed a higher risk for attachment loss progression in residual periodontal pockets ≥ 6mm.

Maxillary first molars are more likely to exhibit FI degree II or III due to their anatomical characteristics than second molars. Furcation entrance in upper second molars is usually more apically than first molars (Svardstrom & Wennstrom, 1996). We also found more chance for FI in maxillary molars among men in comparison to women. Consistent findings also indicate higher levels of dental plaque and lower yearly dental appointments among men than women (Hass et al., 2014; Chatzopoulos, Jiang, Marka, & Wolff, 2023). Furthermore, older individuals may accumulate higher periodontal attachment loss. Smoking is a well-established risk factor for periodontitis

(Bergström, 2003; Haas et al., 2014; Chrysanthakopoulos, 2017; Chatzopoulos et al., 2023). In this study, former and current smokers were associated with a higher chance of FI occurrence in both upper and lower molars.

The principal strength of this study is that all individuals in this representative sample received an entire periodontal examination, including all furcation entrances by experienced examiners. Data collection allowed that many possible risk indicators, according to literature, can be used to build models at each level (surface, tooth, and individual). However, this sample had little access to dental care, and the periodontal loss attachment probably represents a course that looks like a natural history. The high occurrence of moderate and severe periodontitis limits external validity. Despite this, classical risk factors were significant in our models.

In conclusion, the presence of dental plaque and gingival bleeding, older, male, and smoking habits were associated with more chance for occurrence of FI in severity.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Table 1- Demographic, socioeconomic, and clinical characteristics.

Individual-level characteristics (n=492)	
Age - n (%)	
≤ 39	170 (34.6)
40-54	166 (33.7)
≥ 55	156 (31.7)
Sex - n (%)	
Female	244 (49.6)
Male	248 (50.4)
Race- n (%)	
White	336 (68.3)
No-white	156 (31.7)
Smoking - n (%)	
Non-smokers	267 (54.3)
Ex- and current	225 (45.7)
Years of study - n (%)	
≥8 years	135 (27.4)
< 8 years	357 (72.6)
Income – n (%)	
>1 BMMW	350 (71.1)
≤1 BMMW	142 (28.9)
BMI	
Eutrophic	138 (28.0)
Overweight	162 (32.9)
Obese	192 (39.0)
Dental visits in the last year	
Yes	221 (44.9)
No	271 (55.1)

Tooth-level characteristics			
	First molars	**Second molars**	**Other teeth**
Dental plaque ± SD	75.8 ± 26.4	79.2 ± 38.5	75.9 ± 22.5
Gingival bleeding ± SD	34.3 ± 28.7	35.8 ± 29.2	25.5 ± 24.0
PPD ± SD	2.9 ± 0.6	3.3 ± 0.8	2.5 ± 1.0

BMMW: Brazilian Monthly Minimum Wage; BMI:Body Mass Index; SD: Standard Deviation; PPD: Periodontal Probing Depth (mm).

Table 2 - Prevalence of furcation involvement by individuals, tooth and entrances.

	Age group (years)							
	-24	**25-34**	**35-44**	**45-54**	**55-64**	**65+**	**Total**	**p**
Individual								
n	67	92	111	119	67	38	494	0,464
Furcation Involvement – n (%)	24 (35,8)	44 (47,8)	64 (57,7)	90 (75,6)	50 (74,6)	23 (60,5)	295 (59,7)	0,168
Molars								
n	480	565	586	460	216	114	2421	**0,001***
Furcation Involvement - n (%)	49 (10,2)	114 (20,2)	139 (23,7)	195 (42,4)	110 (50,9)	55 (48,2)	662 (27,3)	**0,001***
Furcation Entrances								
n	1211	1454	1518	1208	569	303	6263	**0,001***
Furcation Involvement - n (%)	56 (4,6)	141 (9,7)	185 (12,2)	274 (22,7)	182 (32,0)	82 (27,1)	920 (14,7)	**0,001***

* Indicates a statistically significant difference between age groups by the Kruskal-Wallis

Table 3 – Prevalence, extent and severity of furcation involvement.

	Tooth 16	Tooth 17	Tooth 26	Tooth 27	Tooth 36	Tooth 37	Tooth 46	Tooth 47
N total	330	378	341	374	201	306	187	304
With Furcation Involvement - n (%)	102 (30,9)	131 (34,7)	119 (34,9)	119 (31,8)	43 (21,4)	54 (17,6)	36 (19,3)	58 (19,1)
Entrances with Furcation Involvement - n (%)	146 (14,7)	184 (16,2)	166 (16,2)	169 (15,1)	60 (14,9)	73 (11,9)	47 (12,6)	75 (12,4)
Extent of Furcation Involvements	47,7 %	46,8%	46,5%	47,3%	69,8%	67,6%	58,3%	64,7%
Degree I – n (%)	75 (7,6)	101 (8,9)	94 (9,2)	87 (7,8)	42 (10,4)	51 (8,3)	30 (8,0)	51 (8,4)
Degree II – n (%)	58 (5,9)	71 (6,3)	54 (5,3)	73 (6,5)	14 (3,5)	20 (3,3)	11 (2,9)	16 (2,6)
Degree III – n (%)	13 (1,3)	12 (1,1)	18 (1,8)	9 (0,8)	4 (1,0)	2 (0,3)	6 (1,6)	8 (1,3)

Table 4 - Adjusted associations between surface-, tooth- and individual level variables and furcation occurrence at maxillary molars, determined using multilevel multinomial logistic regression.

Variable	Adjusted model	
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Fixed component (intercept)		
Tooth		1.16 (1.02 – 1.31)
Individual		2.51 (1.12 – 3.82)
	No furcation vs furcation degree I	No furcation vs furcation degree II/III
Surface level		
Dental plaque		
No	1	1
Yes	0.99 (0.56 – 1.69)	1.03 (0.86 – 1.28)
Gingival bleeding		
No	1	1
Yes	1.07 (0.45 – 1.81)	1.29 (1.05 – 1.72)
Furcation surface		
Free	1	1
Proximal	1.38 (0.97 – 1.80)	1.69 (1.04 – 2.36)
Probing Pocket Depth		
≤ 4 mm	1	1
> 4 mm	1.12 (0.84 – 1.41)	1.71 (1.03 – 2.38)
Tooth level		

Tooth group		
Second molar	1	1
First molar	1.16 (0.76 – 1.61)	1.52 (1.19 – 1.90)
	Individual level	
Sex		
Female	1	1
Male	1.64 (1.02 – 2.19)	2.04 (1.02 – 3.10)
Race	**-**	**-**
White		
Non-white		
Age		
≤ 39	1	1
40-54	1.26 (0.89 – 1.54)	1.61 (0.78 – 2.12)
≥ 55	0.72 (0.39 – 0.99)	1.98 (1.03 – 2.90)
Years of study	**-**	**-**
≥ 8 years		
< 8 years		
Income	**-**	**-**
>1 BMMW		
≤1 BMMW		
Smoking		
Non-smokers	1	1
Ex- and current	1.04 (0.55 – 1.71)	2.14 (1.05 – 3.11)
Hb1Ac	**-**	**-**
BMI	**-**	**-**

Eutrophic		
Overweight		
Obese		
Dental visits in the last year		
Yes	1	1
No	1.33 (0.81 – 1.93)	1.09 (0.40 – 2.00)
Random component	2919438.9	1847264.2

CI: Confidence Interval; PPD: Periodontal Probing Depth (mm); BMMW: Brazilian Monthly Minimum Wage; BMI:Body Mass Index.

Table 5 Adjusted associations between surface-, tooth- and individual level variables and furcation occurrence at mandibular molars, determined using multilevel multinomial logistic regression.

Variable	Adjusted model	
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Fixed component (intercept)		
Tooth		2.37 (1.22 – 3.56)
Individual		4.78 (2.12 – 7.23)
	No furcation vs furcation degree I	No furcation vs furcation degree II/III
Surface level		
Dental plaque		
No	1	1
Yes	0.97 (0.54 – 1.70)	1.08 (1.00 – 1.20)
Gingival bleeding		
No	1	1
Yes	1.02 (0.29 – 1.75)	1.24 (1.07 – 1.49)
Probing Pocket Depth		
≤ 4 mm	1	1
> 4 mm	1.06 (0.73 – 1.40)	1.31 (1.02 – 1.60)
Tooth level		
Tooth group		
Second molar	1	1
First molar	1.08 (0.72 – 1.45)	1.47 (0.90 – 2.03)
Individual level		

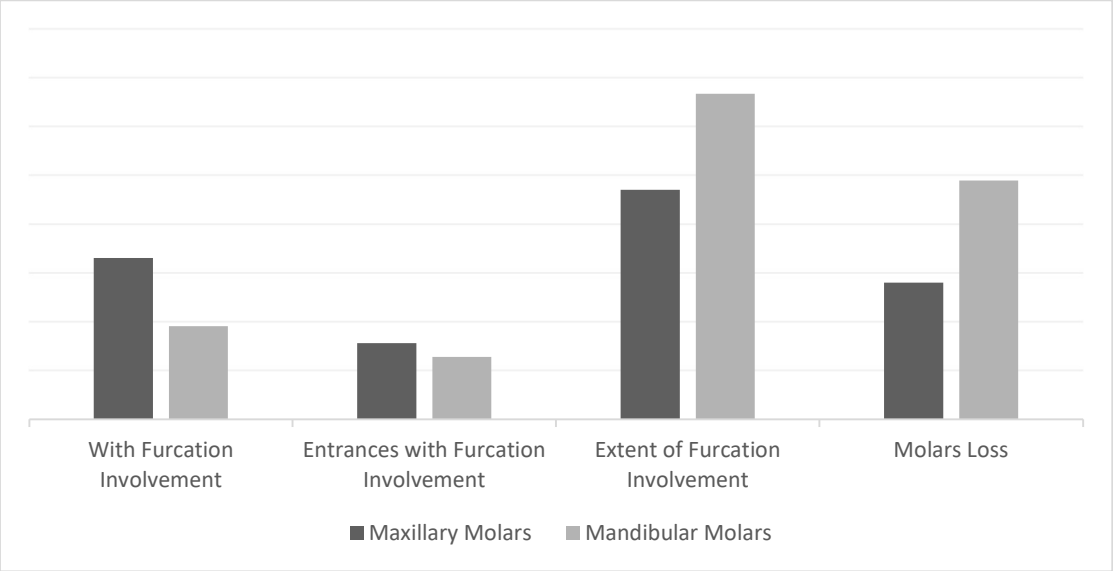
Sex		
Female	1	1
Male	1.32 (0.71 – 1.96)	1.85 (0.98 – 2.66)
Race	**-**	**-**
White		
Non-white		
Age		
≤ 39	1	1
40-54	0.91 (0.54 – 1.50)	1.18 (0.61 – 1.72)
≥ 55	1.06 (0.32 – 1.78)	2.02 (1.08 – 3.00)
Years of study	**-**	**-**
≥ 8 years		
< 8 years		
Income	**-**	**-**
>BMMW		
≤1 BMMW		
Smoking		
Non-smokers	1	1
Ex- and current	1.03 (0.49 – 1.44)	1.96 (1.02 – 2.75)
Hb1Ac	**-**	**-**
BMI	**-**	**-**
Eutrophic		
Overweight		
Obese		

Dental visits in the last year		
Yes	1	1
No	1.79 (0.66 – 2.80)	1.32 (0.48 – 2.08)
Random component	2578578.2	2184726.4

CI: Confidence Interval; PPD: Periodontal Probing Depth (mm); BMMW: Brazilian Monthly Minimum Wage; BMI:Body Mass Index.

Legends

Fig 1 Percentage of teeth lost, with furcation, entrances and extent of jaw involvement.



*Indicates statistically significant difference between maxillary and mandibular molars by mixed linear models, $p < 0.05$.

Fig. 1

5 CONSIDERAÇÕES FINAIS

A presente tese se propôs, por meio de dois artigos científicos, responder questões a respeito da ocorrência e gravidade da subclassificação vertical radiográfica de defeitos de furca em primeiros e segundos molares e avaliar os indicadores de risco associados à perda óssea vertical na região de furca, através do Artigo 1; e, descrever a prevalência, extensão e gravidade do envolvimento de furca dos molares e avaliar e identificar indicadores de risco associados à ocorrência de defeitos de furca, através do artigo 2.

Foi observada uma alta prevalência de envolvimento de furca por indivíduo, pois cerca de 60% deles apresentavam pelo menos um dente com envolvimento de furca. Molares superiores apresentaram maior ocorrência das subclasses mais severas (B e C) quando comparados aos molares inferiores. Além disso, acúmulo de placa, sangramento gengival, superfície proximal, PS mais profunda, primeiro molar, sexo masculino, indivíduos com idade ≥55 anos e fumante ou ex-fumante foram associados a maiores chances de ocorrência de envolvimento de furca. Fatores como presença de placa dentária, sangramento gengival, PS > 4mm e fumante ou ex-fumante foram associados a maior perda óssea vertical na região de furca.

O envolvimento de furca é uma lesão frequente em dentes de indivíduos com diagnóstico de periodontite (SVÄRDSTRÖM; WENNSTRÖM, 1996), uma doença de alta prevalência em âmbito mundial (OPPERMANN *et al*., 2015) e que pode levar à perda dentária, que impacta na qualidade de vida dos indivíduos (FERREIRA *et al*., 2017). Quanto maior o grau de envolvimento de furca, pior o prognóstico dentário (NIBALI *et al*., 2016).

A subclassificação vertical radiográfica foi pouco abordada em estudos publicados até o momento. Está relacionada à quantidade de suporte residual e pode ser um bom preditor de sobrevivência do dente (TONETTI, CHRISTIANSEN, CORTELLINI 2017). Por necessitar de um exame radiográfico periapical, já utilizado na prática clínica diária, é de fácil execução e pode auxiliar o clínico na tomada de decisão no planejamento do tratamento com o objetivo de manutenção dentária.

No nosso estudo, os molares superiores apresentaram maior ocorrência das subclasses mais severas (Subclasses B e C), ou seja, estes dentes apresentavam menor quantidade de suporte residual, o que está relacionado a um pior prognóstico. Esse resultado pode estar relacionado ao fato de que os molares superiores

apresentam 3 entradas de furca e, 2 delas, estão localizadas em região interproximal, o que dificulta o controle de placa e favorece a perda de inserção. Já os envolvimentos vestibulares e linguais respondem melhor à terapia não cirúrgica em comparação com envolvimentos interproximais (RIBEIRO *et al*., 2007).

Ao avaliar os fatores relacionados à ocorrência do envolvimento de furca, observamos que dentes que apresentavam presença de placa e sangramento gengival, que são fatores locais relacionados à progressão de perda de inserção (LANG; SCHATZLE; LOE, 2009), tiveram maior chance de ocorrência de envolvimento de furca. E que, dentes com profundidades de sondagem maiores que 4mm, tiveram maior chance de ocorrência de envolvimento de furca, o que pode estar relacionado ao fato de que bolsas residuais podem estar associadas ao risco de progressão de doença, favorecendo a perda de inserção e ocorrência de envolvimento de furca (MATULIENE *et al*., 2008). A nível dente, os primeiros molares apresentaram maior chance de ocorrência de envolvimento de furca, mesmo os segundos molares apresentando maior acúmulo de placa, sangramento gengival e média de PS. Isso pode ser explicado pela anatomia dentária, uma vez que os segundos molares apresentam um tronco radicular mais longo, é necessário que ocorra mais perda de inserção para que ocorra o envolvimento de furca nesses dentes (SVÄRDSTRÖM; WENNSTRÖM, 1996). A nível de indivíduo, aqueles que eram homens, mais velhos (≥ 55 anos), fumantes ou ex-fumantes tiveram maior chance de ter molares com envolvimento de furca. Isso pode ter ocorrido porque homens tendem a apresentar piores condições de saúde bucal quando comparados a mulheres, o que os torna com maior risco de progressão de perda de inserção e, indivíduos com mais idade, tendem a apresentar maior perda de inserção devido ao acúmulo de doença ao longo do tempo (HASS *et al*., 2014). Além disso, o fumo é um fator de risco estabelecido para a periodontite, aumentando o risco de perda de inserção em indivíduos fumantes (BERGSTRÖM, 2003).

O envolvimento de furca piora o prognóstico e aumenta o risco de perda de molares (NIBALI *et al*., 2016), por isso, faz-se necessário compreender os fatores relacionados ao surgimento e progressão dos defeitos de furca, a fim de auxiliar na prevenção, tratamento, controle da doença e manter os dentes ao longo do tempo.

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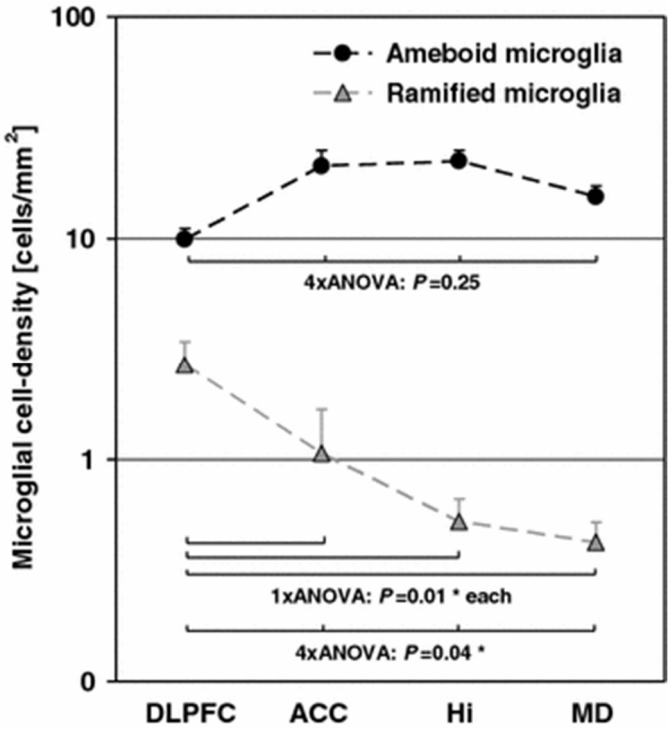

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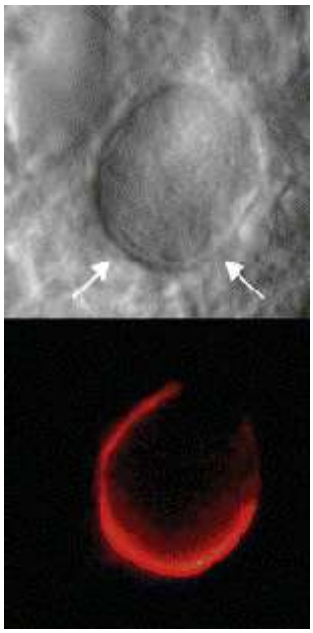

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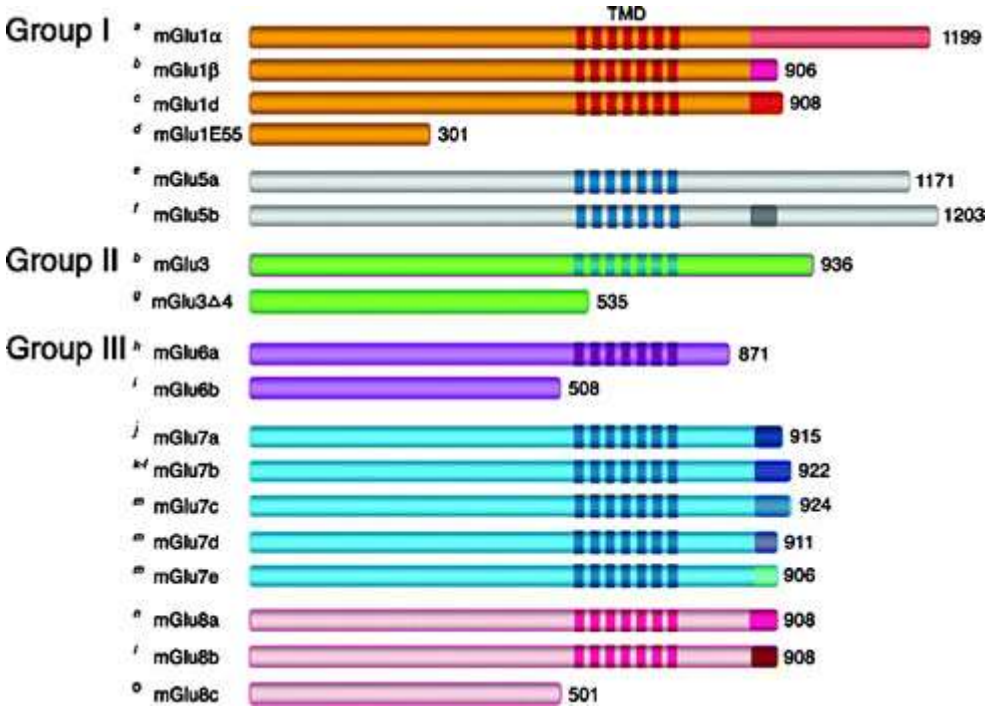

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with the specific requirements of their institution and seek ethics approval where needed. Authors should be aware to secure informed consent from the individual (or parent or guardian if the participant is a minor or incapable) See also section on **Informed Consent**.

Cell lines

If human cells are used, authors must declare in the manuscript: what cell lines were used by describing the source of the cell line, including when and from where it was obtained, whether the cell line has recently been authenticated and by what method. If cells were bought from a life science company the following need to be given in the manuscript: name of company (that provided the cells), cell type, number of cell line, and batch of cells.

It is recommended that authors check the NCBI database for misidentification and contamination of human cell lines. This step will alert authors to possible problems with the cell line and may save considerable time and effort.

Further information is available from the International Cell Line Authentication Committee (ICLAC).

Authors should include a statement that confirms that an institutional or independent ethics committee (including the name of the ethics committee) approved the study and that informed consent was obtained from the donor or next of kin.

Research Resource Identifiers (RRID)

Research Resource Identifiers (RRID) are persistent unique identifiers (effectively similar to a DOI) for research resources. This journal encourages authors to adopt RRIDs when reporting key biological resources (antibodies, cell lines, model organisms and tools) in their manuscripts.

Examples:

Organism: *Filip1*$^{tm1a(KOMP)Wtsi}$ **RRID:MMRRC_055641-UCD**

Cell Line: RST307 cell line **RRID:CVCL_C321**

Antibody: Luciferase antibody DSHB Cat# LUC-3, **RRID:AB_2722109**

Plasmid: mRuby3 plasmid **RRID:Addgene_104005**

Software: ImageJ Version 1.2.4 **RRID:SCR_003070**

RRIDs are provided by the Resource Identification Portal. Many commonly used research resources already have designated RRIDs. The portal also provides authors links so that they can quickly register a new resource and obtain an RRID.

Clinical Trial Registration

The World Health Organization (WHO) definition of a clinical trial is "any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects on health outcomes". The WHO defines health interventions as “A health intervention is an act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions” and a health-related outcome is generally defined as a change in the health of a person or population as a result of an intervention.

To ensure the integrity of the reporting of patient-centered trials, authors must register prospective clinical trials (phase II to IV trials) in suitable publicly available repositories.

For example www.clinicaltrials.gov or any of the primary registries that participate in the WHO International Clinical Trials Registry Platform.
The trial registration number (TRN) and date of registration should be included as the last line of the manuscript abstract.

For clinical trials that have not been registered prospectively, authors are encouraged to register retrospectively to ensure the complete publication of all results. The trial registration number (TRN), date of registration and the words 'retrospectively registered' should be included as the last line of the manuscript abstract.

Standards of reporting
Springer Nature advocates complete and transparent reporting of biomedical and biological research and research with biological applications. Authors are recommended to adhere to the minimum reporting guidelines hosted by the EQUATOR Network when preparing their manuscript.
Exact requirements may vary depending on the journal; please refer to the journal's Instructions for Authors.

Checklists are available for a number of study designs, including:

Randomised trials (CONSORT) and Study protocols (SPIRIT)
Observational studies (STROBE)
Systematic reviews and meta-analyses (PRISMA) and protocols (Prisma-P)
Diagnostic/prognostic studies (STARD) and (TRIPOD)
Case reports (CARE)
Clinical practice guidelines (AGREE) and (RIGHT)
Qualitative research (SRQR) and (COREQ)
Animal pre-clinical studies (ARRIVE)
Quality improvement studies (SQUIRE)
Economic evaluations (CHEERS)
Summary of requirements
The above should be summarized in a statement and placed in a 'Declarations' section before the reference list under a heading of 'Ethics approval'.

Examples of statements to be used when ethics approval has been obtained:

• 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. The study was approved by the Bioethics Committee of the Medical University of A (No. ...).

• This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of University B (Date.../No. ...).

• Approval was obtained from the ethics committee of University C. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

• The questionnaire and methodology for this study was approved by the Human Research Ethics committee of the University of D (Ethics approval number: ...).

Examples of statements to be used for a retrospective study:

• Ethical approval was waived by the local Ethics Committee of University A in view of the retrospective nature of the study and all the procedures being performed were part of the routine care.

• This research study was conducted retrospectively from data obtained for clinical purposes. We consulted extensively with the IRB of XYZ who determined that our study did not need ethical approval. An IRB official waiver of ethical approval was granted from the IRB of XYZ.

• This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Human Investigation Committee (IRB) of University B approved this study.

Examples of statements to be used when no ethical approval is required/exemption granted:

• This is an observational study. The XYZ Research Ethics Committee has confirmed that no ethical approval is required.

• The data reproduced from Article X utilized human tissue that was procured via our Biobank AB, which provides de-identified samples. This study was reviewed and deemed exempt by our XYZ Institutional Review Board. The BioBank protocols are in accordance with the ethical standards of our institution and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Authors are responsible for correctness of the statements provided in the manuscript. See also Authorship Principles. The Editor-in-Chief reserves the right to reject submissions that do not meet the guidelines described in this section.

Informed consent
All individuals have individual rights that are not to be infringed. Individual participants in studies have, for example, the right to decide what happens to the (identifiable) personal data gathered, to what they have said during a study or an interview, as well as to any photograph that was taken. This is especially true concerning images of vulnerable people (e.g. minors, patients, refugees, etc) or the use of images in sensitive contexts. In many instances authors will need to secure written consent before including images.

Identifying details (names, dates of birth, identity numbers, biometrical characteristics (such as facial features, fingerprint, writing style, voice pattern, DNA or other

distinguishing characteristic) and other information) of the participants that were studied should not be published in written descriptions, photographs, and genetic profiles unless the information is essential for scholarly purposes and the participant (or parent/guardian if the participant is a minor or incapable or legal representative) gave written informed consent for publication. Complete anonymity is difficult to achieve in some cases. Detailed descriptions of individual participants, whether of their whole bodies or of body sections, may lead to disclosure of their identity. Under certain circumstances consent is not required as long as information is anonymized and the submission does not include images that may identify the person.

Informed consent for publication should be obtained if there is any doubt. For example, masking the eye region in photographs of participants is inadequate protection of anonymity. If identifying characteristics are altered to protect anonymity, such as in genetic profiles, authors should provide assurance that alterations do not distort meaning.

Exceptions where it is not necessary to obtain consent:

• Images such as x rays, laparoscopic images, ultrasound images, brain scans, pathology slides unless there is a concern about identifying information in which case, authors should ensure that consent is obtained.

• Reuse of images: If images are being reused from prior publications, the Publisher will assume that the prior publication obtained the relevant information regarding consent. Authors should provide the appropriate attribution for republished images.

Consent and already available data and/or biologic material
Regardless of whether material is collected from living or dead patients, they (family or guardian if the deceased has not made a pre-mortem decision) must have given prior written consent. The aspect of confidentiality as well as any wishes from the deceased should be respected.

Data protection, confidentiality and privacy
When biological material is donated for or data is generated as part of a research project authors should ensure, as part of the informed consent procedure, that the participants are made aware what kind of (personal) data will be processed, how it will be used and for what purpose. In case of data acquired via a biobank/biorepository, it is possible they apply a broad consent which allows research participants to consent to a broad range of uses of their data and samples which is regarded by research ethics committees as specific enough to be considered “informed”. However, authors should always check the specific biobank/biorepository policies or any other type of data provider policies (in case of non-bio research) to be sure that this is the case.

Consent to Participate
For all research involving human subjects, freely-given, informed consent to participate in the study must be obtained from participants (or their parent or legal guardian in the case of children under 16) and a statement to this effect should appear in the manuscript. In the case of articles describing human transplantation studies, authors

must include a statement declaring that no organs/tissues were obtained from prisoners and must also name the institution(s)/clinic(s)/department(s) via which organs/tissues were obtained. For manuscripts reporting studies involving vulnerable groups where there is the potential for coercion or where consent may not have been fully informed, extra care will be taken by the editor and may be referred to the Springer Nature Research Integrity Group.

Consent to Publish
Individuals may consent to participate in a study, but object to having their data published in a journal article. Authors should make sure to also seek consent from individuals to publish their data prior to submitting their paper to a journal. This is in particular applicable to case studies. A consent to publish form can be found

here. (Download docx, 36 kB)
Summary of requirements
The above should be summarized in a statement and placed in a 'Declarations' section before the reference list under a heading of 'Consent to participate' and/or 'Consent to publish'. Other declarations include Funding, Competing interests, Ethics approval, Consent, Data and/or Code availability and Authors' contribution statements.

Please see the various examples of wording below and revise/customize the sample statements according to your own needs.

Sample statements for **"Consent to participate"**:
Informed consent was obtained from all individual participants included in the study.

Informed consent was obtained from legal guardians.

Written informed consent was obtained from the parents.

Verbal informed consent was obtained prior to the interview.

Sample statements for **"Consent to publish"**:
The authors affirm that human research participants provided informed consent for publication of the images in Figure(s) 1a, 1b and 1c.

The participant has consented to the submission of the case report to the journal.

Patients signed informed consent regarding publishing their data and photographs.

Sample statements if identifying information about participants is available in the article:

Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.

Authors are responsible for correctness of the statements provided in the manuscript. See also Authorship Principles. The Editor-in-Chief reserves the right to reject submissions that do not meet the guidelines described in this section.

Images will be removed from publication if authors have not obtained informed consent or the paper may be removed and replaced with a notice explaining the reason for removal.

Research Data Policy
This journal operates a type 1 research data policy. The journal encourages authors, where possible and applicable, to deposit data that support the findings of their research in a public repository. Authors and editors who do not have a preferred repository should consult Springer Nature's list of repositories and research data policy.
List of Repositories
Research Data Policy
General repositories - for all types of research data - such as figshare and Dryad may also be used.

Datasets that are assigned digital object identifiers (DOIs) by a data repository may be cited in the reference list. Data citations should include the minimum information recommended by DataCite: authors, title, publisher (repository name), identifier.

DataCite
If the journal that you're submitting to uses double-blind peer review and you are providing reviewers with access to your data (for example via a repository link, supplementary information or data on request), it is strongly suggested that the authorship in the data is also blinded. There are data repositories that can assist with this and/or will create a link to mask the authorship of your data.
Authors who need help understanding our data sharing policies, help finding a suitable data repository, or help organising and sharing research data can access our Author Support portal for additional guidance.

After Acceptance
Upon acceptance, your article will be exported to Production to undergo typesetting. Once typesetting is complete, you will receive a link asking you to confirm your affiliation, choose the publishing model for your article as well as arrange rights and payment of any associated publication cost.

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The purpose of the proof is to check for typesetting or conversion errors and the completeness and accuracy of the text, tables and figures. Substantial changes in content, e.g., new results, corrected values, title and authorship, are not allowed without the approval of the Editor.

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The article will be published online after receipt of the corrected proofs. This is the official first publication citable with the DOI. After release of the printed version, the paper can also be cited by issue and page numbers.

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ANEXO B – NORMAS PARA PUBLICAÇÃO NO *JOURNAL OF CLINICAL PERIODONTOLOGY*

Author Guidelines

Journal of Clinical Periodontology now offers Free Format submission for a simplified and streamlined submission process. Read more here.

Sections

1. SUBMISSION

New submissions should be made via the Research Exchange submission portal **https://wiley.atyponrex.com/journal/JCPE**. Should your manuscript proceed to the revision stage, you will be directed to make your revisions via the same submission portal. You may check the status of your submission at anytime by logging on to submission.wiley.com and clicking the "My Submissions" button. For technical help with the submission system, please review our FAQs or contact **submissionhelp@wiley.com**.

Data protection

By submitting a manuscript to or reviewing for this publication, your name, email address, and affiliation, and other contact details the publication might require, will be used for the regular operations of the publication, including, when necessary, sharing with the publisher (Wiley) and partners for production and publication. The publication and the publisher recognize the importance of protecting the personal information collected from users in the operation of these services, and have practices in place to ensure that steps are taken to maintain the security, integrity, and privacy of the personal data collected and processed. You can learn more at **https://authorservices.wiley.com/statements/data-protection-policy.html**.

Preprint policy

Please find the Wiley preprint policy here.

This journal accepts articles previously published on preprint servers.

Journal of Clinical Periodontology will consider for review articles previously available as preprints. Authors may also post the submitted version of a manuscript to a preprint server at any time. Authors are requested to update any pre-publication versions with a link to the final published article.

For help with submissions, please contact: **cpeedoffice@wiley.com**

2. AIMS AND SCOPE

The aim of the *Journal of Clinical Periodontology* is to provide a platform for the exchange of scientific and clinical progress in the field of periodontology and allied disciplines, and to do so at the highest possible level. The Journal also aims to facilitate the application of new scientific knowledge to the daily practice of the concerned disciplines and addresses both practicing clinicians and members of the academic community.

The Journal is the official publication of the European Federation of Periodontology but serves an international audience by publishing contributions of high scientific merit in the fields of periodontology and implant dentistry. The journal accepts a broad spectrum of original work characterized as clinical or preclinical, basic or translational, as well as authoritative reviews, and proceedings of important scientific workshops. The journal's scope encompasses the physiology and pathology of the periodontal and peri-implant tissues, the biology and the modulation of periodontal and peri-implant tissue healing and regeneration, the diagnosis, etiology, epidemiology, prevention and therapy of periodontal and peri-implant diseases and conditions, the association of periodontal infection/inflammation and general health, and the clinical aspects of comprehensive rehabilitation of the periodontitis-affected patient.

3. MANUSCRIPT CATEGORIES AND REQUIREMENTS

Journal of Clinical Periodontology publishes original research articles, reviews, clinical innovation reports and case reports. The latter will be published only if they provide new fundamental knowledge and if they use language understandable to the clinician. It is expected that any manuscript submitted represents unpublished original research.

i. Original Research Articles

Original Research articles must describe significant and original experimental observations and provide sufficient detail so that the observations can be critically evaluated and, if necessary, repeated. Original articles will be published under the heading of clinical periodontology, implant dentistry or pre-clinical sciences and must conform to the highest international standards in the field.

Word limit: 3,500 words maximum, excluding references.
Abstract: 200 words maximum; must be structured, under the sub-headings: Aim(s), Materials and methods, Results, Conclusion(s).
Figures/Tables: Total of no more than 7 figures and tables.

Introduction: should be focused, outlining the historical or logical origins of the study and not summarize the results; exhaustive literature reviews are not appropriate. It should close with the explicit statement of the specific aims of the investigation.

Material and Methods: must contain sufficient detail such that, in combination with the references cited, all clinical trials and experiments reported can be fully reproduced. As a condition of publication, authors are required to make materials and methods used freely available to academic researchers for their own use. This includes antibodies and the constructs used to make transgenic animals, although not the animals themselves.

Results: should present the observations with minimal reference to earlier literature or to possible interpretations.

Discussion: may usefully start with a brief summary of the major findings, but repetition of parts of the abstract or of the results section should be avoided. The discussion section should end with a brief conclusion and a comment on the potential clinical relevance of the findings. Statements and interpretation of the data should be appropriately supported by original references.

The discussion may usefully be structured with the following points in mind (modified from the proposal by **Richard Horton (2002), The Hidden Research Paper, The Journal of the American Medical Association, 287, 2775-2778)**. Not all points will apply to all studies and its use is optional, but we believe it will improve the discussion section to keep these points in mind.

Summary of key finding

- Primary outcome measure(s)
- Secondary outcome measure(s)
- Results as they relate to a prior hypothesis

Strengths and Limitations of the Study

- Study Question
- Study Design
- Data Collection
- Analysis
- Interpretation
- Possible effects of bias on outcomes

Interpretation and Implications in the Context of the Totality of Evidence

- Is there a systematic review to refer to?
- If not, could one be reasonably done here and now?

- What this study adds to the available evidence
- Effects on patient care and health policy
- Possible mechanisms

Controversies Raised by This Study Future Research Directions

- For this particular research collaboration
- Underlying mechanisms
- Clinical research

ii. Clinical Innovation Reports

Clinical Innovation Reports are suited to describe significant improvements in clinical practice such as the report of a novel surgical technique, a breakthrough in technology or practical approaches to recognized clinical challenges. They should conform to the highest scientific and clinical practice standards.

Word limit: 3,000 words maximum, excluding references.
Main text: should be organized with Introduction; Clinical Innovation Report; Discussion and Conclusion.
Figures/Tables: Total of no more than 12 figures and tables.

iii. Case Reports

Case Reports illustrating unusual and clinically relevant observations are acceptable, but their merit needs to provide high priority for publication in the Journal. On rare occasions, completed cases displaying non-obvious solutions to significant clinical challenges will be considered.

Main text: should be organised with Introduction; Case report; Discussion and Conclusion.

iv. Reviews and Systematic Reviews

The Journal primarily publishes invited reviews or systematic reviews by experts in the field.

Unsolicited systematic reviews may be considered under the following conditions:

1. In the submission letter, the authors convincingly articulate the novelty of the findings, and the potential impact of the review on clinical practice, policy or research.
2. There is enough new evidence generated by high quality/large sample size studies that has the potential to modify the conclusions supported by systematic reviews published to date.
3. If not a Cochrane review, the systematic review has been prospectively registered in PROSPERO (https://www.crd.york.ac.uk/prospero/).

Word limit: 4,000 words maximum, excluding references.
Main text: should be organized with Introduction; Review; Discussion and Conclusion.

Revisions and Resubmissions

Please note that all revisions and resubmissions of papers should also include a separate rebuttal and a tracked changes document to assist in peer review.

4. PREPARING THE SUBMISSION

Free Format submission

Journal of Clinical Periodontology now offers Free Format submission for a simplified and streamlined submission process.

Before you submit, you will need:

- Your manuscript: this can be a single file including text, figures, and tables, or separate files – whichever you prefer. All required sections should be contained in your manuscript, including a title page with all author details, including affiliations and email addresses, a statement of clinical relevance, abstract, introduction, methods, results, and conclusions. Figures and tables should have legends. References may be submitted in any style or format, as long as it is consistent throughout the manuscript. If the manuscript, figures or tables are difficult for you to read, they will also be difficult for the editors and reviewers. If your manuscript is difficult to read, the editorial office may send it back to you for revision.
  (Why is this important? We need to make sure your manuscript is suitable for review.
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  - Statement of funding source
  - Ethical approval statement
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- A separate Conflict of Interest form for each author. *(Why is this important? We need to uphold rigorous ethical standards for the research we consider for publication.)*
- Your co-author details, including affiliation and email address. *(Why is this important? We need to keep all co-authors informed of the outcome of the peer review process.)*
- An ORCID ID, freely available at https://orcid.org. *(Why is this important? Your article, if accepted and published, will be attached to your ORCID profile. Institutions and funders are increasingly requiring authors to have ORCID IDs.)*

To submit, login at **https://mc.manuscriptcentral.com/jcpe** and create a new submission. Follow the submission steps as required and submit the manuscript.

If you are invited to revise your manuscript after peer review, the journal will also request the revised manuscript to be formatted according to journal requirements as described below.

Cover Letters

A cover letter is mandatory and must be signed by the corresponding author. It is required to confirm that the submitted work is (i) original, (ii) not currently under consideration for publication elsewhere, and (iii) in compliance with all rules stipulated by the Journal.

Parts of the Manuscript

Manuscripts can be uploaded either as a single document (containing the main text, tables and figures), or with figures and tables provided as separate files. Should your manuscript reach revision stage, figures and tables must be provided as separate files. The main manuscript file can be submitted in Microsoft Word (.doc or .docx) format.

Main Text File

Your main document file should include:

i. A short informative title containing the major key words. The title should not contain abbreviations;
ii. The full names of the authors with institutional affiliations where the work was conducted, with a footnote for the author's present address if different from where the work was conducted;
iii. Acknowledgments;
iv. Abstract structured (intro/methods/results/conclusion) or unstructured;
v. Up to seven keywords;
vi. Main body: formatted as introduction, materials & methods, results, discussion, conclusion
vii. References;
viii. Tables (each table complete with title and footnotes);
ix. Figures: Figure legends must be added beneath each individual image during upload AND as a complete list in the text;
x. Appendices (if relevant)

Figures and supporting information should be supplied as separate files.

Authorship

Please refer to the journal's authorship policy the **Editorial Policies and Ethical Considerations section** for details on eligibility for author listing.

Acknowledgments

Contributions from anyone who does not meet the criteria for authorship should be listed, with permission from the contributor, in an Acknowledgments section. Financial and material support should also be mentioned. Thanks to anonymous reviewers are not appropriate.

Conflict of Interest Statement

Authors will be asked to provide a conflict of interest statement during the submission process. For details on what to include in this section, see the section 'Conflict of Interest' in the **Editorial Policies and Ethical Considerations section** below. Submitting authors should ensure they liaise with all co-authors to confirm agreement with the final statement.

Abstract

The abstract is limited to 200 words in length and should not contain abbreviations or references. The abstract should be organized according to the content of the paper.

For Original Research Articles the abstract should be organized with aim, materials and methods, results and conclusions.

For clinical trials, it is encouraged that the abstract finish with the clinical trial registration number on a free public database such as clinicaltrials.gov.

Keywords

Please provide 1-5 keywords. When appropriate keywords are available, they should be taken from those recommended by the US National Library of Medicine's Medical Subject Headings (MeSH) browser list at **www.nlm.nih.gov/mesh**. Authors may add specific keywords.

Main Text

All manuscripts should emphasize clarity and brevity. Authors should pay special attention to the presentation of their findings so that they may be communicated clearly. Technical jargon should be avoided as much as possible and be clearly explained where its use is unavoidable.

Clinical Relevance

This section is aimed at giving clinicians a reading light to put the present research in perspective. It should be no more than 100 words and should not be a repetition of the

abstract. It should provide a clear and concise explanation of the rationale for the study, of what was known before and of how the present results advance knowledge of this field. If appropriate, it may also contain suggestions for clinical practice.

It should be structured with the following headings: Scientific rationale for study; Principal findings; Practical implications.

Authors should pay particular attention to this text as it will be published in a highlighted box within their manuscript; ideally, reading this section should leave clinicians wishing to learn more about the topic and encourage them to read the full article.

References

It is the policy of the Journal to encourage reference to the original papers rather than to literature reviews. Authors should therefore keep citations of reviews to the absolute minimum.

References should be prepared according to the Publication Manual of the American Psychological Association (6th edition). This means in text citations should follow the author-date method whereby the author's last name and the year of publication for the source should appear in the text, for example, (Jones, 1998). The complete reference list should appear alphabetically by name at the end of the paper.

A sample of the most common entries in reference lists appears below. Please note that a DOI should be provided for all references where available. For more information about APA referencing style, please refer to the **APA FAQ**. Please note that for journal articles, issue numbers are not included unless each issue in the volume begins with page one.

Journal article

Beers, S. R. , & De Bellis, M. D. (2002). Neuropsychological function in children with maltreatment-related posttraumatic stress disorder. The American Journal of Psychiatry, 159, 483–486. doi:**10.1176/appi.ajp.159.3.483**

Book

Bradley-Johnson, S. (1994). Psychoeducational assessment of students who are visually impaired or blind: Infancy through high school (2nd ed.). Austin, TX: Pro-ed.

Chapter in an Edited Book

Borstrøm, I., & Elbro, C. (1997). Prevention of dyslexia in kindergarten: Effects of phoneme awareness training with children of dyslexic parents. In C. Hulme & M. Snowling (Eds.), Dyslexia: Biology, cognition and intervention (pp. 235–253). London: Whurr.

Internet Document

Norton, R. (2006, November 4). How to train a cat to operate a light switch [Video file]. Retrieved from ***http://www.youtube.com/watch?v=Vja83KLQXZs***

Please note that all unpublished papers (submitted or in press) included in the reference list should be provided in a digital version at submission. The unpublished paper should be uploaded as a supplementary file for review.

Tables

Tables should be self-contained and complement, not duplicate, information contained in the text. They should be supplied as editable files, not pasted as images. Legends should be concise but comprehensive – the table, legend, and footnotes must be understandable without reference to the text. All abbreviations must be defined in footnotes. Footnote symbols: †, ‡, §, ¶, should be used (in that order) and *, **, *** should be reserved for P-values. Statistical measures such as SD or SEM should be identified in the headings.

Figure Legends

Legends should be concise but comprehensive – the figure and its legend must be understandable without reference to the text. Include definitions of any symbols used and define/explain all abbreviations and units of measurement.

Figures

Although authors are encouraged to send the highest-quality figures possible, for peer-review purposes, a wide variety of formats, sizes, and resolutions are accepted.

Click here for the basic figure requirements for figures submitted with manuscripts for initial peer review, as well as the more detailed post-acceptance figure requirements.

Colour Figures. Figures submitted in colour may be reproduced in colour online free of charge. Please note, however, that it is preferable that line figures (e.g. graphs and charts) are supplied in black and white so that they are legible if printed by a reader in black and white.

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Data Citation

Please review Wiley's data citation policy here.

Additional Files

Appendices

Appendices will be published after the references. For submission they should be supplied as separate files but referred to in the text.

Supporting Information

Supporting information is information that is not essential to the article, but provides greater depth and background. It is hosted online and appears without editing or typesetting. It may include tables, figures, videos, datasets, etc.

Click here for Wiley's FAQs on supporting information.

Note: if data, scripts, or other artefacts used to generate the analyses presented in the paper are available via a publicly available data repository, authors should include a reference to the location of the material within their paper.

General Style Points

The following points provide general advice on formatting and style.

- **Abbreviations, Symbols and Nomenclature:** *Journal of Clinical Periodontology* adheres to the conventions outlined in Units, Symbols and Abbreviations: A Guide for Medical and Scientific Editors and Authors. Abbreviations should be kept to a minimum, particularly those that are not standard. Non-standard abbreviations must be used three or more times and written out completely in the text when first used.

Resource Identification Initiative

The journal supports the Resource Identification Initiative, which aims to promote research resource identification, discovery, and reuse. This initiative, led by the Neuroscience Information Framework and the Oregon Health & Science University Library, provides unique identifiers for antibodies, model organisms, cell lines, and tools including software and databases. These IDs, called Research Resource Identifiers (RRIDs), are machine-readable and can be used to search for all papers where a particular resource was used and to increase access to critical data to help researchers identify suitable reagents and tools.

Authors are asked to use RRIDs to cite the resources used in their research where applicable in the text, similar to a regular citation or Genbank Accession number. For antibodies, authors should include in the citation the vendor, catalogue number, and RRID both in the text upon first mention in the Methods section. For software tools and databases, please provide the name of the resource followed by the resource website, if available, and the RRID. For model organisms, the RRID alone is sufficient.

Additionally, authors must include the RRIDs in the list of keywords associated with the manuscript.

To Obtain Research Resource Identifiers (RRIDs)

1. Use the Resource Identification Portal, created by the Resource Identification Initiative Working Group.
2. Search for the research resource (please see the section titled “Search Features and Tips” for more information).
3. Click on the “Cite This” button to obtain the citation and insert the citation into the manuscript text.

If there is a resource that is not found within the **Resource Identification Portal**, authors are asked to register the resource with the appropriate resource authority. Information on how to do this is provided in the “Resource Citation Guidelines” section of the Portal.

If any difficulties in obtaining identifiers arise, please contact **rii-help@scicrunch.org** for assistance.

Example Citations

Antibodies: "Wnt3 was localized using a rabbit polyclonal antibody C64F2 against Wnt3 (Cell Signaling Technology, Cat# 2721S, RRID: AB_2215411)"

Model Organisms: "Experiments were conducted in c. elegans strain SP304 (RRID:CGC_SP304)"

Cell lines: "Experiments were conducted in PC12 CLS cells (CLS Cat# 500311/p701_PC-12, RRID:CVCL_0481)"

Tools, Software, and Databases: "Image analysis was conducted with CellProfiler Image Analysis Software, V2.0 (http://www.cellprofiler.org, RRID:nif-0000-00280)"

Wiley Author Resources

Manuscript Preparation Tips: Wiley has a range of resources for authors preparing manuscripts for submission available **here**. In particular, authors may benefit from referring to Wiley’s best practice tips on **Writing for Search Engine Optimization.**

Article Preparation Support: **Wiley Editing Services** offers expert help with English Language Editing, as well as translation, manuscript formatting, figure illustration, figure formatting, and graphical abstract design – so you can submit your manuscript with confidence.
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Japanese authors can also find a list of local English improvement services at **http://www.wiley.co.jp/journals/editcontribute.html**. All services are paid for and arranged by the author, and use of one of these services does not guarantee acceptance or preference for publication.

Guidelines for Cover Submission

If you would like to send suggestions for artwork related to your manuscript to be considered to appear on the cover of the journal, **please follow these guidelines**.

5. EDITORIAL POLICIES AND ETHICAL CONSIDERATIONS

Peer Review and Acceptance

The acceptance criteria for all papers are the quality and originality of the research and its significance to journal readership. Manuscripts are single-blind peer reviewed. Papers will only be sent to review if the Editor-in-Chief determines that the paper meets the appropriate quality and relevance requirements.

Wiley's policy on the confidentiality of the review process is **available here.**

Appeal of Decision

Under exceptional circumstances, authors may appeal the editorial decision. Authors who wish to appeal the decision on their submitted paper may do so by e-mailing the editorial office at **cpeedoffice@wiley.com** with a detailed explanation for why they find reasons to appeal the decision.

Human Studies and Subjects

For manuscripts reporting medical studies that involve human participants, a statement identifying the ethics committee that approved the study and confirmation that the study conforms to recognized standards is required, for example: **Declaration of Helsinki**; **US Federal Policy for the Protection of Human Subjects**; or **European Medicines Agency Guidelines for Good Clinical Practice**. It should also state clearly in the text that all persons gave their informed consent prior to their inclusion in the study.

Patient anonymity should be preserved. When detailed descriptions, photographs, or videos of faces or identifiable body parts are used that may allow identification, authors should obtain the individual's free prior informed consent. Authors do not need to provide a copy of the consent form to the publisher; however, in signing the author license to publish, authors are required to confirm that consent has been obtained. Wiley has a **standard patient consent form** available for use. Where photographs are used they need to be cropped sufficiently to prevent human subjects being recognized; black eye bars should not be used as they do not sufficiently protect an individual's identity).

Animal Studies

A statement indicating that the protocol and procedures employed were ethically reviewed and approved, as well as the name of the body giving approval, must be included in the Methods section of the manuscript. Authors are encouraged to adhere to animal research reporting standards, for example the **ARRIVE guidelines** for reporting study design and statistical analysis; experimental procedures; experimental animals and housing and husbandry. Authors should also state whether experiments were performed in accordance with relevant institutional and national guidelines for the care and use of laboratory animals:

- US authors should cite compliance with the US National Research Council's Guide for the Care and Use of Laboratory Animals, the US Public Health Service's Policy on Humane Care and Use of Laboratory Animals, and Guide for the Care and Use of Laboratory Animals.
- UK authors should conform to UK legislation under the Animals (Scientific Procedures) Act 1986 Amendment Regulations (SI 2012/3039).
- European authors outside the UK should conform to Directive 2010/63/EU.

Clinical Trial Registration

The Journal will only consider for publication clinical trials that have been registered *prospectively* in a publicly accessible database. (Please note that the International Committee of Medical Journal Editors require registration of clinical trials prior to enrollment of the first participant. Section 801 of the Food and Drug Administration Amendments Act (FDAAA 801) states that Clinical Trials need to be registered within 21 days of enrollment of the first participant).

Studies that do not meet the above requirements for potentially valid reasons (e.g., manuscripts reporting on long-term outcomes of trials initiated in the distant past) may be considered after special deliberation among the Associate Editors and the Editor in Chief.

The registration database, the registration number, and the registration date must be noted at the end of the abstract as well as in the text of the Materials and Methods.

In addition, the cover letter should include:

1. Registration number and a link to the study registration in the registration database
2. An explicit statement on when the study was registered and when enrollment commenced.

For further information about Clinical Trial Registration please see:

https://grants.nih.gov/policy/clinical-trials/definition.html

https://www.icmje.org/about-icmje/faqs/clinical-trials-registration/

Research Reporting Guidelines

Accurate and complete reporting enables readers to fully appraise research, replicate it, and use it. Authors are required to adhere to recognised research reporting standards. The EQUATOR Network collects more than 370 reporting guidelines for many study types, including for:

- Randomised trials : CONSORT
  Clinical trials should be reported using the CONSORT guidelines. A CONSORT checklist should also be included in the submission material. If your study is a randomized clinical trial, you will need to fill in all sections of the CONSORT Checklist. If your study is not a randomized trial, not all sections of the checklist might apply to your manuscript, in which case you simply fill in N/A.
- Observational studies : STROBE
- Systematic reviews : PRISMA
- Case reports : CARE
- Qualitative research : SRQR
- Diagnostic / prognostic studies : STARD
- Quality improvement studies : SQUIRE
- Economic evaluations : CHEERS
- Animal pre-clinical studies : ARRIVE
- Study protocols : SPIRIT
- Clinical practice guidelines : AGREE

We also encourage authors to refer to and follow guidelines from:

- Future of Research Communications and e-Scholarship (FORCE11)
- National Research Council's Institute for Laboratory Animal Research guidelines
- The Gold Standard Publication Checklist from Hooijmans and colleagues
- Minimum Information Guidelines from Diverse Bioscience Communities (MIBBI) website

Species Names

Upon its first use in the title, abstract, and text, the common name of a species should be followed by the scientific name (genus, species, and authority) in parentheses. For

well-known species, however, scientific names may be omitted from article titles. If no common name exists in English, only the scientific name should be used.

Genetic Nomenclature

Sequence variants should be described in the text and tables using both DNA and protein designations whenever appropriate. Sequence variant nomenclature must follow the current HGVS guidelines; see **varnomen.hgvs.org**, where examples of acceptable nomenclature are provided.

Sequence Data

Nucleotide sequence data can be submitted in electronic form to any of the three major collaborative databases: DDBJ, EMBL, or GenBank. It is only necessary to submit to one database as data are exchanged between DDBJ, EMBL, and GenBank on a daily basis. The suggested wording for referring to accession-number information is: 'These sequence data have been submitted to the DDBJ/EMBL/GenBank databases under accession number U12345'. Addresses are as follows:

- DNA Data Bank of Japan (DDBJ): www.ddbj.nig.ac.jp
- EMBL Nucleotide Archive: ebi.ac.uk/ena
- GenBank: www.ncbi.nlm.nih.gov/genbank

Proteins sequence data should be submitted to either of the following repositories:

- Protein Information Resource (PIR): pir.georgetown.edu
- SWISS-PROT: expasy.ch/sprot/sprot-top

Structural Data

For papers describing structural data, atomic coordinates and the associated experimental data should be deposited in the appropriate databank (see below). **Please note that the data in databanks must be released, at the latest, upon publication of the article.** We trust in the cooperation of our authors to ensure that atomic coordinates and experimental data are released on time.

- Organic and organometallic compounds: Crystallographic data should not be sent as Supporting Information, but should be deposited with the *Cambridge Crystallographic Data Centre* (CCDC) at ccdc.cam.ac.uk/services/structure%5Fdeposit.
- Inorganic compounds: *Fachinformationszentrum Karlsruhe* (FIZ; fiz-karlsruhe.de).
- Proteins and nucleic acids: *Protein Data Bank* (rcsb.org/pdb).
- NMR spectroscopy data: *BioMagResBank* (bmrb.wisc.edu).

Conflict of Interest

The journal requires that all authors disclose any potential sources of conflict of interest. Any interest or relationship, financial or otherwise that might be perceived as influencing an author's objectivity is considered a potential source of conflict of interest. These must be disclosed when directly relevant or directly related to the work that the authors describe in their manuscript. Potential sources of conflict of interest include, but are not limited to: patent or stock ownership, membership of a company board of directors, membership of an advisory board or committee for a company, and consultancy for or receipt of speaker's fees from a company. The existence of a conflict of interest does not preclude publication. If the authors have no conflict of interest to declare, they must also state this at submission. It is the responsibility of the corresponding author to review this policy with all authors and collectively to disclose with the submission ALL pertinent commercial and other relationships. Please provide adequate detail that allows reproduction of the analyses after access to the original data. Be explicit about the basis of computation of the sample size and the power calculations. For clinical trials, Intent-to-treat analyses are expected, and may be supplemented by per-protocol or other types of analyses, if applicable.

See former Editor-in-Chief Maurizio Tonetti's **Editorial on Conflict of Interest and Source of Funding** and **www.icmje.org/#conflicts** for generally accepted definitions.

The above policies are in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals produced by the International Committee of Medical Journal Editors (**http://www.icmje.org/**). It is the responsibility of the corresponding author to have all authors of a manuscript fill out a conflict of interest disclosure form, and to upload all forms together with the manuscript on submission. The disclosure statement should be included under Acknowledgements. Please find the form below:

Conflict of Interest Disclosure Form

Funding

Authors should list all funding sources at submission. Authors are responsible for the accuracy of their funder designation. If in doubt, please check the Open Funder Registry for the correct nomenclature: **https://www.crossref.org/services/funder-registry/**

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1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
2. Drafting the work or revising it critically for important intellectual content; AND

3. Final approval of the version to be published; AND
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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All those designated as authors should meet all four criteria for authorship, and all who meet the four criteria should be identified as authors. Those who do not meet all four criteria should be acknowledged. These authorship criteria are intended to reserve the status of authorship for those who deserve credit and can take responsibility for the work. The criteria are not intended for use as a means to disqualify colleagues from authorship who otherwise meet authorship criteria by denying them the opportunity to meet criterion #s 2 or 3. Therefore, all individuals who meet the first criterion should have the opportunity to participate in the review, drafting, and final approval of the manuscript.

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Journal of Clinical Periodontology expects that data supporting the results in the paper will be archived in an appropriate public repository. Authors are required to provide a data availability statement to describe the availability or the absence of shared data. When data have been shared, authors are required to include in their data availability statement a link to the repository they have used, and to cite the data they have shared. Whenever possible the scripts and other artefacts used to generate the analyses presented in the paper should also be publicly archived. If sharing data compromises ethical standards or legal requirements then authors are not expected to share it.

See the Standard Templates for Author Use to select an appropriate data availability statement for your dataset.

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ORCID

As part of the journal's commitment to supporting authors at every step of the publishing process, the journal requires the submitting author (only) to provide an ORCID iD when submitting a manuscript. This takes around 2 minutes to complete. **Find more information here.**

6. AUTHOR LICENSING

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7. PUBLICATION PROCESS AFTER ACCEPTANCE

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8. POST PUBLICATION

Access and sharing

When the article is published online:

- The author receives an email alert (if requested).
- The link to the published article can be shared through social media.
- The author will have free access to the paper (after accepting the Terms & Conditions of use, they can view the article).
- The corresponding author and co-authors can nominate up to ten colleagues to receive a publication alert and free online access to the article.

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9. EDITORIAL OFFICE CONTACT DETAILS

For queries about submissions, please contact **cpeedoffice@wiley.com**

Author Guidelines Updated 30 September 2021

ANEXO C – PARECER CONSUBSTANCIADO DO COMITÊ DE ÉTICA EM PESQUISA

UNIVERSIDADE FEDERAL DE SANTA MARIA/ PRÓ-REITORIA DE PÓS-GRADUAÇÃO E

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: LEVANTAMENTO EPIDEMIOLÓGICO NA ÁREA RURAL DE ROSÁRIO DO SUL/RS
Pesquisador: CARLOS HEITOR CUNHA MOREIRA
Área Temática:
Versão: 1
CAAE: 37862414.5.0000.5346
Instituição Proponente: Universidade Federal de Santa Maria/ Pró-Reitoria de Pós-Graduação e
Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 869.323
Data da Relatoria: 10/11/2014

Apresentação do Projeto:
Doenças periodontais compreendem condições infecciosas e inflamatórias resultantes da interação entre biofilme bacteriano e resposta do hospedeiro. Essa relação é modulada por uma variedade de fatores, dentre eles, diabetes e fumo, capazes de alterar o início e a progressão dessas afecções. A doença periodontal também pode acarretar alterações sistêmicas, como na doença cardiovascular e no controle da glicemia, e comprometimento funcional e estético. O entendimento de uma pequena quantidade de fatores de risco pode ter potencial impacto no encargo de muitas doenças, com custo reduzido e maior eficiência e efetividade que abordagens específicas para cada condição isolada. Assim, esse projeto objetiva avaliar condições bucais, parâmetros inflamatórios e microbiológicos associados, indicadores e fatores de risco às doenças periodontais, impacto desses parâmetros na qualidade de vida, além de questões relacionadas à saúde geral, como obesidade, diabetes e hipertensão, na zona rural de Rosário do Sul - RS.

Realizaremos um censo das crianças de 10 a 14 anos, para avaliação de cárie e fluorose. E uma amostra representativa dos indivíduos, maiores de 15 anos, residentes na área rural desse município (N= 828) receberá exame bucal completo (periodonto, dentes, mucosas, saliva e análise microbiológica de biofilme), avaliações antropométricas (pressão

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arterial, peso, altura, circunferência da cintura) e exames sanguíneos (hemograma completo, hemoglobina glicada, proteína C-reativa ultrassensível e continina plasmática).
Adicionalmente, os moradores que aceitarem participar do estudo, mediante a assinatura de termo de consentimento livre e esclarecido, responderão a questionários sobre qualidade de vida, características médicas e sociodemográficas e hábitos de higiene bucal.

Esperamos que, através do conhecimento gerado após a análise dos resultados desse projeto, medidas de controle e/ou erradicação dos problemas encontrados possam ser adotadas, visando melhorias na saúde dos indivíduos dessa área. Caso essas estratégias sejam implementadas, avaliações posteriores poderão ser realizadas a fim de verificar a efetividade das mesmas. Além disso, com a obtenção de resultados positivos/benéficos, há a possibilidade de extensão para outras populações, na tentativa de melhorar as condições globais de saúde.

Objetivo da Pesquisa:
Objetivo geral: realizar um levantamento epidemiológico em uma amostra representativa da população rural de Rosário do Sul/ RS.

Objetivos específicos
Avaliar a condição periodontal (prevalência, extensão e gravidade de doença) dessa população;
Buscar associações entre condição periodontal e parâmetros inflamatórios e icrobiológicos;
Avaliar a presença de fatores de risco (fumo e diabetes) para as doenças periodontais;
Verificar possíveis indicadores de risco para doença periodontal;
Investigar o impacto da utilização de protocolos de exame parciais em comparação com exames de toda a boca em prevalência, gravidade e extensão de doença periodontal;
Avaliar prevalência, extensão e gravidade de recessão gengival (RG);
Avaliar a associação de potenciais indicadores de risco com a ocorrência de RG;
Avaliar prevalência, extensão e gravidade de abrasão gengival (AG);
Avaliar a associação de potenciais indicadores de risco com a ocorrência de AG;
Verificar a associação entre AG e RG, identificando se o aumento na prevalência de AG pode gerar aumento na prevalência de RG;
Verificar a associação entre fatores demográficos (sexo, renda, idade e raça), comportamentais (fumo, presença de cálculo...) e as condições de abrasão e recessão gengivais encontradas;

Avaliar o impacto da periodontite como condição clínica preditora de uma pior qualidade de vida relacionada à saúde bucal (OHRQoL);
Investigar as condições clínicas associadas a uma pior OHRQoL;
Avaliar a correlação entre dois instrumentos sócio-dentais, OHIP-14 e GOHAI, para avaliação da OHRQoL;
Avaliar o efeito da avaliação periodontal em boca reduzida realizada por meio de diferentes protocolos parciais nas medidas de associação com a OHRQoL.
Avaliar a condição cariológica das crianças e jovens com idades compreendidas entre 10 e 14 anos;
Buscar associação entre a presença de lesões cariosas ativas e o grau eruptivo dos segundos molares permanentes;
Avaliar os indicadores de risco para cárie dentária;
Avaliar a presença de fluorose dentária.

Avaliação dos Riscos e Benefícios:
Previstos de modo suficiente.

Comentários e Considerações sobre a Pesquisa:
-

Considerações sobre os Termos de apresentação obrigatória:
Termos apresentados.

Recomendações:
Veja no site do CEP - http://coral.ufsm.br/cep - SITE NOVO - na aba "orientações gerais", modelos e orientações para apresentação dos documentos. Acompanhe as orientações disponíveis, evite pendências e agilize a tramitação do seu projeto.

Conclusões ou Pendências e Lista de Inadequações:
-

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

SANTA MARIA, 12 de Novembro de 2014

Assinado por:
CLAUDEMIR DE QUADROS
(Coordenador)

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