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ORIGINAL ARTICLE

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Dental caries on distal surface of mandibular second molar

A cárie dentária na superfície distal do segundo molar inferior

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ABSTRACT

Objective: The aim of this study was to evaluate the frequency of carious lesions on the distal surface of mandibular second molars influenced by the angulation of the adjacent mandibular third molar. **Material and Methods:** This is a descriptive and quantitative study that analyzed 750 panoramic radiographs from a clinic providing dental radiology services. Of these, 120 radiographs met inclusion criteria of the study. **Results:** Of the 157 second and third molars analyzed, the presence of caries lesions on the distal of the second molar was 25.5%. The most prevalent position of the third molar angulation was vertical with 57.3%; however, the position with the highest percentage of the second molar caries on the distal area of the crown was the mesio-angular with 50% of cases. Of the collected teeth, males presented 40% of second molar caries on distal surface, while females showed 17%. The age group of ≥35 years exhibited the highest incidence with 50% of carious lesions on the distal surface, while other groups obtained 16.21% in the group 18-24 years and of 23.52% in the group 25 to 34 years. **Conclusion:** It was possible to establish a decreasing scale of indication for prophylactic removal of mandibular third molar according to the Winter's lines: horizontal, mesio-angular, vertical, and disto-angular. It was also noticed a greater relevance for the prophylactic removal indication of males aged over 35 years.

KEYWORDS

Molar, Third molar; Angulation; Distal caries.

RESUMO

Objetivo: O objetivo do estudo foi avaliar a frequência de cárie distal no segundo molar inferior influenciada pela angulação do terceiro molar inferior adjacente em radiografias panorâmicas em uma clínica de radiologia odontológica. **Material e Métodos:** Foi realizado um estudo descritivo e quantitativo que analisou 750 radiografias panorâmicas, deste total, 120 estavam de acordo com o critério de inclusão da pesquisa. **Resultados:** De 157 segundos e terceiros molares analisados, a prevalência de cárie na distal do segundo molar foi de 25,5%. A posição mais prevalente da angulação do terceiro molar foi a vertical com 57,3%, porém, a posição com maior porcentagem do segundo molar cariado na distal foi a mesioangular com 50% dos casos. Dos elementos coletados, o gênero masculino obteve 40% de segundo molar cariado na distal contra 17% para o gênero feminino. A faixa etária de 35 anos ou mais obteve a maior incidência com 50% de cárie distal, enquanto as demais faixas obtiveram 16,21% no grupo de 18 a 24 anos e de 23,52% no de 25 a 34 anos. **Conclusão:** Os resultados possibilitaram estabelecer uma escala decrescente da indicação para remoção profilática do terceiro molar inferior de acordo com a angulação de Winter: horizontal, mesioangular, vertical e distoangular. Percebe-se também uma maior relevância para a indicação de remoção profilática de indivíduos do gênero masculino e com idade acima de 35 anos.

PALAVRAS-CHAVE

Dente Molar, Dente serotino; Cárie distal; Angulação de Winter.

INTRODUCTION

The third molars have always gained special attention by researchers, mostly because they are teeth that have a higher prevalence of inclusion [1]. Generally, their eruption occurred at between 18 and 24 years of age, with an average of 20 years, although no consensus on the estimated period of third molar eruption have been achieved [2]. In 1926, George Winter ranked third molars regarding their angles [3]; in 1933, Pell and Gregory classified regarding the depth of inclusion and in the mandible, the relations with the mandibular ramus [4]. These classifications made the communication between dentists easy, and assist in planning the surgery, which is usually indicated as to prevent pathologies [5].

George Winter developed a technique classifying third molars according to the inclination of its long axis in relation to the second molar [3]. He established the following angulations: vertical – when the long axis of the third molar is parallel to the second molar; mesio-angular – when the crown is closer to the second molar root than to the third molar root; disto-angular – when distally angled; and horizontal – when the angulation is so pronounced that it is perpendicular to the long axis of the second molar. In cases where the included third molar is inclined towards buccal or lingual sides, they are respectively classified as buccal- or lingual-version [3].

Careful radiographic evaluation aims to complement the clinical examination, because it provides additional information about the third molars, such as: the reporting of adjacent teeth, the anatomical characteristics, the amount of surrounding bone; and the position of the third molars according to Winter's classification; however, for the improvement of the clinical and surgical plans with the association of Pell and Gregory's classification, it is very useful for the proper assessment of third molar removal [4].

When more than one third molar needs to be evaluated, the panoramic radiograph is the examination of choice, due to lower radiation dose than that of four periapical radiographs and a larger area provided for better diagnosis [4].

Studies have noted that there are strong indications for the extraction of third molars. McArdle and Renton, in 2005, reported about distal caries on the second molar involving angle related to the adjacent third molar through files of 100 patients with 122 third molars removed because of distal caries on the second molar [5].

In these results there was a higher prevalence of caries on distal surface at mesio-angular position of third molars, caries incidence increasing with age and prophylactic removal of third molar partially erupted at mesio-angular position could prevent cervical caries lesions formed on the distal surface of second mandibular molar [6].

Due to few studies published in the literature and the constant referral for removal of third molars because of the presence of distal caries on the second molar in relation to the adjacent third molar, at daily basis, this study aimed to assess and verify the frequency of the presence of distal caries on the mandibular second molars caused according to the Winter's angulation of the third molars aided by panoramic radiographs.

METHODS

The researchers were calibrated by a professional specialized in radiology to standardize the evaluation of radiographs. The researchers did an internship during August 2012 in order to calibrate the analysis of panoramic radiographs, in which they accompanied the radiologists in making the reports and thus gained enough experience to the critical research development. This was

an observational and quantitative descriptive study because the researchers observed and objectively described according to a structured questionnaire. The study was developed in a private radiologic clinic employing digital radiograph, so that the researcher can make use of its computed databases.

This included patients who were referred by dentists from public and private services to perform panoramic radiographs

All panoramic radiographs of patients with mandibular third molars were included, along with their adjacent second molars, at either one or both sides; and aged 18 years or older. In addition to the general factors (age and gender), the classification of Pell and Gregory (class A and level I and II) was also criterion for inclusion of third molars.

We excluded all radiographs of patients in whom the third molars were not observed along with their second molars and patients younger than 18 years. Also corresponded exclusion factors when: the second or third molar were with partial crown or totally destroyed, because the researcher could not affirmed where the decay was primarily installed and whether it was related to the adjacent third molar; the roots of the second or third molar were absent; patients having the second and/or third molar replaced by implants; second or third molar supporting single fixed crown because the researcher could not have correct analysis; second molar already restored with amalgam or resin on all its surfaces; third molar in class B and C of Pell and Gregory's classification; third molar in level III of Pell and Gregory's classification; second molar restored on the distal surface even having the third molar; second molar decayed or restored on the other surface even in the presence of the third molar.

The study presented no risk to the population, because the collection was in a database already stored on the computer of the private clinics. The benefit was the discovery of the frequency of distal caries on the second molar in relation to the angulation of the adjacent third molar.

The study was conducted in accordance with Resolution no. 196/96 of the Brazilian National Health Council (CNS), and accordingly, it was requested a consent of the private radiology clinic, through request term, authorization term, depositary term and free and clarified consent form.

At the last week of each month, the researcher responsible for the collection of radiographs, analyzed all panoramic stored in the clinical database, which included a period of three years. Of them, the researcher wrote down the x-ray number, sex, age, which was the position of the third molar (mesio-angular, disto-angular, vertical, or horizontal) and which the state of the adjacent second molar was (caries on the distal surface, or not decayed), as found in the chart model (Appendix).

Data collection was performed at the end of each month, from September 2012 to May 2013. The radiographic database comprised 750 panoramic radiographs, among which, 120 met the inclusion criteria.

The collected data was stored in Microsoft Excel 2007 program and the information statistically analyzed.

The protocol number was annexed to study in order not to duplicate a panoramic radiograph of the same individual.

Concerning to gender, the classification was very simple with group 1 representing by males and the group 2 group by females.

Age was divided into three groups, the first age group corresponding to the age-range of 18 to 24 years, the second group the age-range of 25 to 34 years, and the third group the age-range ≥ 35 years.

The position of the third molars was classified according to the angle of Winter's classification: mesio-angular (group 1), angles ranging between 20 and 79 degrees; disto-angular (group 2), angles ≥ - 10 degrees; vertical (group 3), angles ranging between 0 and 20 degrees; horizontal (group 4), angles ranging between 80 and 90 degrees.

The condition regarding the second molar caries was divided into two groups: 1 – caries on the distal surface; 2 – no caries.

Data were tabulated in Microsoft Excel 2007 software presented in graphs and frequency tables for analysis and discussion. Data were exported to SPSS 12.0 software for processing and statistical analysis. Statistical analysis was descriptive by reading the percentage of categorical variables and through the position (mean) and variability (standard deviation) measurements. Chi-square test was used to assess the association between the presence of caries and the angulation of the third molar.

Table 1 - Distribution of the number and percentage of panoramic radiographs analyzed

Radiographs	Number	Percentage
Included	120	16%
Excluded	630	84%
Total	750	100%

Table 2 - Distribution of the number and percentage of 2nd molar condition in relation to 3rd molar angulation according to Winter

	2nd M decayed on distal surface		2nd M without caries		Total	
3rd Md Molar angulation	N	%	N	%	N	%
Mesio-angular	20	12.73%	30	19.10%	50	31.8%
Disto-angular	0	0%	10	6.36%	10	6.4%
Vertical	15	9.55%	75	47.77%	90	57.3%
Horizontal	5	3.18%	2	1.27%	7	4.5%
Total	**40**	**25.5%**	**117**	**74.5%**	**157**	**100%**

RESULTS

The very significant sample, demonstrated in Table 1, was represented by a total collection of 750 radiographs, among which 120 met the inclusion criteria of the study, with the percentage of 16%.

For the objective of the study, to analyze the presence of caries on the distal surface of the second molar, the variables analyzed were the second and third molar, where every third molar was associated with its angulation and compared with the presence or absence of caries on the distal surface of the adjacent second molar (Table 2).

The angulation of the third molar influenced in the condition of caries lesion on the adjacent second molar (Table 3). The second molars without caries are shown in Table 4, while the gender and age group were shown in Tables 5 and 6, respectively.

Table 3 - Distribution of the number and percentage of 2nd molar decayed on distal in relation to 3rd molar angulation according to Winter

	2nd M decayed on distal surface	
3rd Md Molar angulation	N	%
Mesio-angular	20	50%
Disto-angular	0	0%
Vertical	15	37.5%
Horizontal	5	12.5%
Total	**40**	**100%**

Table 4 - Distribution of the number and percentage of 2nd molar without caries on distal in relation to 3rd molar angulation according to Winter

	2nd M without caries	
3rd Md Molar angulation	N	%
Mesio-angular	30	25.64%
Disto-angular	10	8.54%
Vertical	75	64.10%
Horizontal	2	1.70%
Total	**117**	**100%**

Table 5 - Distribution of the number and percentage of 2nd molar in relation to 3rd molar angulation regarding gender

TEETH		GENDER					
3rd Md Molar angulation	2nd Md M condition	Male		Female		Total	
		N	%	N	%	N	%
Mesio-angular	Caries on distal surface	10	17.54%	10	10%	20	12,73%
	Without caries	12	21.05%	18	18%	30	19.10%
Disto-angular	Caries on distal surface	0	0%	0	0%	0	0%
	Without caries	2	3.50%	8	8%	10	6.36%
Vertical	Caries on distal surface	10	17.54%	5	5%	15	9.55%
	Without caries	20	35.08%	55	55%	75	47.77%
Horizontal	Caries on distal surface	3	5.26%	2	2%	5	3.18%
	Without caries	0	0%	2	2%	2	1.27%
Total		**57**	**100%**	**100**	**100%**	**157**	**100%**

Table 6 - Distribution of the number and percentage of 2nd molar in relation to 3rd molar angulation regarding age

		Age group							
3rd Md Molar angulation	2nd Md M condition	18 to 24 yrs.		25 to 34 yrs.		≥35 yrs.		Total	
		N	%	N	%	N	%	N	%
Mesio-angular	Caries on distal surface	7	9.45%	5	9.80%	8	25%	20	12.73%
	Without caries	14	18.91%	11	21.56%	5	15.62%	30	19.10%
Disto-angular	Caries on distal surface	0	0%	0	0%	0	0%	0	0%
	Without caries	6	8.10%	4	7.84%	0	0%	10	6.36%
Vertical	Caries on distal surface	2	2.70%	6	11.76%	7	21.87%	15	9.55%
	Without caries	42	56.75%	24	47.05%	9	28.12%	75	47.77%
Horizontal	Caries on distal surface	3	4.05%	1	1.96%	1	3.12%	5	3.18%
	Without caries	0	0%	0	0%	2	6,25%	2	1,27%
Total		**74**	**100%**	**51**	**100%**	**32**	**100%**	**157**	**100%**

DISCUSSION

The data from this study were collected in a radiology clinics without main focus of referral for removal of third molars. In the selected articles, the surveys were conducted in surgical clinics, a fact that may induce the referral for extraction of third molars. This it is noteworthy because some of this study findings were different from those of other studies probably because of the absence of this direct referral from a surgery clinics, but with all areas of dentistry requesting panoramic radiographs by several factors.

Tables 2, 3 and 4 show the main objective of the study that was to analyze the presence of caries on the distal surface of the second molars according to the angulation of the adjacent third molar. Among the expected results, the majority of third molars at mesio-angular position presented caries on the distal surface of the adjacent second molar, with 20 cases, a significant percentage of 50% when comparing with the 40 s molars decayed on the distal surface, proving thereby that such angulation was favorable to the development of caries on the distal surface, and consequently it could be used as an indicator for the extraction of the third molar (prophylactic removal).

With regard to the second molar presenting caries on the distal surface with the third molar at disto-angular position, no cases of carious lesion (0%) were found, so that in this situation, the carious lesion on the distal surface of the second molar caused by disto-angular position of the third molar would not be indicative of prophylactic removal. Notwithstanding, this position would be a factor likely prone to pericoronitis, where it is the most common indication for removal of mandibular third molars more frequently in young adults, something to weigh in the clinical decision to maintain tooth that element in the oral cavity [6].

Vertical position of the third molar was observed in 15 cases of distal caries (37.5% of the 40 second molars that were decayed), but if compared to the same vertical position of third molars with the second molars without caries, this number increases to 75 teeth, so that the prophylactic removal of the third molar at vertical position was 16.6%, value obtained by comparing the 15 cases to the total universe of 90 vertical third molars. On the other hand, the horizontal position, among all the positions, was the most requiring the prophylactic removal because of the 7 cases found in this study, 5 were decayed on the distal surface and only 2 had no caries, these 5 cases would match 71.42% of this position when analyzed according to the 7 cases of this angle.

A study conducted by Falci et al. [7] obtained as a result, 5.3% of the third molars at disto-angular position without caries on the distal surface of the second molar (0%). At vertical angulation, the prevalence was 60.2%, and 93.9% had no distal caries and 6.1% were decayed. 17.5% were found at the horizontal position, with 19% decayed on the distal surface and 81% without caries. 17.1% were at mesio-angular position with 37.2% with caries and 62.8% without, so the study concluded that the horizontal and mesio-angular positions were those at higher prevalence of caries on the distal surface of the second molar [7].

The conclusion of the study of Oderinu et al. [8] was that the distal cervical caries on second molars is a phenomenon limited only to the 3rd impacted mandibular molar, but this present study excluded third molar at C level contrary to the study of McArdle and Renton et al. [6] who mentioned that distal caries occurs on the molar in the presence of impacted mesio-angular third molar, thus they suggest that the sooner the prophylactic removal of the third mandibular molar partially erupted is performed, it can prevent distal caries affecting the second molar [6,8].

Besides the position, factors such as patient's oral hygiene, level of caries, and periodontal disease should be considered for the prophylactic removal [7]. Polat et al. [9] cites

other factor influencing impacted third molar level, which may reflected in the incidence of caries on the distal surface of the second molar. When the dentist does the judgment and makes a decision about treatment, he/she must deal with individuality of each patient [7,9].

By comparing the position and the factor "not decayed" shown in table 4, the third molar at mesio-angular position were collected in 30 cases, representing 19.1% of the 117 cases collected in the group not decayed. The disto-angular position was reported in 10 cases of the total (6.4%), all included in group not decayed (100%), then the decision of the dentist will be only to observe this tooth. At vertical position, 75 cases (47.77%) were not decayed, the highest percentage of this group. At the horizontal position of the third molar without caries on the second molar, there were 7 cases with only 2 cases did not present caries lesions and five distal caries and the percentage of only 1.27%.

By isolating cases in which the second molars were decayed on the distal surface shown in Table 3, the mesio-angular position was the most frequent one. The smaller number resulted in a horizontal position, but if one examines the percentage without caries, the horizontal position has a higher incidence of dental caries on distal surface of the adjacent second molar at mesio-angular position, because of the five decayed teeth (12.5% of 40) on the distal surface of horizontal position, 2 teeth were found not decayed at the same position.

At mesio-angular position, 20 cases (50% of 40) of the second molars were decayed on distal surface, but 30 were not decayed. It is worth remembering that both are strong indicators for the prophylactic removal of third molars, with 40% at mesio-angular position to be decayed, and the horizontal position having an even higher percentage of 71.42%. The third molar at disto-angular position showed no caries case (0%), then the third molar angulation, this will be the less indicative of its prophylactic removal.

This result contradicts the positioning of Knutson et al. [10] which mentions that the disto-angular position of molars is at 5 to 12 times greater risk of developing a disease than the other angles. The vertical position of the third molars' was reported with 15 cases (37.5% of 40), compared to 75 cases without caries, the percentage of the total was 16.6%, a small percentage, but not so insignificant, so that the dentist is responsible to decide the procedure to be performed. Table 2 explains this paragraph [10].

Notwithstanding, in the study of Allen et al. [11] it was obtained the result of mesio-angular position of third molars with 42% of caries on the distal surface of the second molar and the sum of the other position groups only 7%. This resulted in the mesio-angular third molar is 9.4 times more likely to have caries on the distal surface of the second molar compared to the other groups [11].

With this conclusion partially disagreeing with the previous studies where only the third molar at mesio-angular position is indicated for prophylactic removal, with the other groups, including the horizontal position, only proservation is indicated. Chang et al. [12] cites that the mesio-angular position also has an increased prevalence of caries in the distal surface of the second molar; however, the author besides analyzing the angles, also considered other factors, such as: the distance between the distal enamel-cementum junction of the second molar and the enamel-cementum junction of the mesial surface of the third molar [11,12].

By dividing the second molars not decayed and analyzing according to the angulation of the adjacent third molars as shown in Table 4, the group with the highest frequency was those of the vertical third molar with 75 cases (64.10%), and the horizontal group had fewer cases with only 2 cases (1.70%).

The mesio-angular position totaled 30 cases (25.64%) and the disto-angular position

obtained a percentage of 8.54%, in the group of second molars not decayed, but if one compares the same position with respect to the second molar condition, this frequency rises to 100% with 10 cases focusing only on the second molar not decayed.

According to the above results, the study established a decreasing scale of indication for prophylactic removal of mandibular third molar in relation to the Winter's classification in relation to caries on the distal surface of the adjacent mandibular second molar: horizontal, mesio-angular, vertical and disto-angular

In table 5, it can be seen that the highest frequency was female with 100 cases (63.70% of 157), compared with 57 of male cases (36.30% of 157). In addition to the results already described, males showed more cases for both mesio-angular and vertical position, with 10 cases of caries on the distal surface of the second molar each, corresponding both to 17.54% of the 157 cases. On the other hand, the highest frequency of caries on the distal surface of the second molar for females was the mesio-angular position with 10 cases (10% of 100).

By analyzing the universe of each gender, the male had 23 cases of caries on the distal surface of the second molar of a total of 57 cases (40%), while females had 17 caries cases of a total of 100 (17%), a result agreeing with the study of Falci et al. who obtained males with higher prevalence of caries on the distal surface of second molar according to the angulation of the third molar.

Thus, females had a lower relevance for the prophylactic removal of third molar compared to males. In most studies, males were at higher caries risk, probably because women are more concerned about oral health [7].

The analysis of the age group in relation to the angulation of the third molar together with the condition of the adjacent second molar is exposed in table 6, in which it was inferred that the group of 18 to 24 years had a higher percentage of 47.13% with 74 cases of the 157 collected; the group of 25 to 34 years with 32.48% (51 cases out of the 157), and the age group of ≥ 35 years with 20.38% (32 of 157). The third molar at mesio-angular position showed the greatest number of second molars decayed on the distal surface at age group of 18 to 24 years with 7 cases (17.5% of decayed) and in the group of ≥35 years with 8 cases (20% of decayed). Concerning the age group of 25-34 years, the vertical position had the highest frequency among the second molars decayed on the distal surface with 6 cases (15% of decayed).

By verifying the second molars decayed on the distal surface and the factor age, the age range presenting the highest indication for prophylactic removal was the group of ≥35 years with 50% having caries (16 decayed of 32 cases in the group), compared with the other age groups 18-24 years, with 16.21% (12 of 74 cases) and the 25 to 34 years with 23.52% (12 of 51 cases). It can be seen that the higher the age, the greater is the percentage of decayed teeth.

This result corroborates that from the study Oderinu et al. and Ozeç et al. [8,13] who cited that with increasing age a significant association with caries on the distal surface of the second molar was found, consequently Brickley et al. [14] cited that the most common age in which third molars are removed is between 25 to 28 years. Falci et al. [7] examined two age groups 16-22 years and 23-57 years where the authors found a percentage of second molar caries at age between 16 and 22 years of only 8.8%, while in the older age group this percentage increased to 19.3% [7,8,13,14].

The relationship of age was published by Bruce et al. [15] who showed that the incidence of caries on distal surface is an indication for the third molar removal that significantly increases with age. Notwithstanding, in addition to age and position, other factors such as patient's oral hygiene, level of caries lesions, and periodontal disease accounts for the decision of prophylactic removal [15].

CONCLUSIONS

The vertical position was the most frequent one among the third molars analyzed; the largest number of second molars decayed on distal surface was observed when the third molar was at mesio-angular position. The males and the age range of ≥35 years have a greater indication for prophylactic extraction of third molars. According to this present study, the decreasing scale of indication for prophylactic removal of the mandibular third molar according to the Winter's classification and caries on the distal surface of the adjacent second molar would be: horizontal, mesio-angular, vertical and disto-angular.

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