Effects of demographics and lower third molar eruption status on mandibular second molar management protocol

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ABSTRACT

Objectives: The study objectives were to evaluate the prevalence of distal caries in mandibular second molars affected by impacted third molar teeth, along with the most common type of third molar impaction associated with cervical caries of second molar teeth.

Methods: A retrospective cross-sectional study which included OPGs from the records of military personnel at dental department of Royal Medical Services with a total 431 patients included in the study from January 2017 to May 2021. Each OPG was analyzed by a minimum of three investigators. OPGs with impacted third molar teeth were identified. The obtained data were analyzed in relation to age group, gender, specific type of impacted third molar causing distal caries in second molar were identified and recorded. Age, decayed/missing/filled teeth (DMFT) index, and the eruption and impaction status of mandibular third molars at the time caries were diagnosed were recorded.

Results: About 264(61.3%) were male patients compare to 167(38.7%) female patients, with mean age of 38.12±6.69 years, more than half of sample were non-smoker 298(69.1%) compare to 133(30.9) smokers, the vast majority have no medical illness 395(91.6%) and having DMFT mean of 6.11±1.3 The prevalence of second molar distal caries associated with impacted third molar 79 (18.3%) and the most common type of third molar impaction associated with cervical caries of second molar teeth is mesio-angluar impaction which is conjunctional with previously published papers discussing the prevalence of distal caries of second molar affected by third molar impaction.

Conclusion: Our research found a strong relationship between distal caries of the lower second molar and the degree of angulation of the lower third molar, with the highest in mesioangular impaction of the lower third molar. Other demographic variables, such as gender, smoking, age, medical history, contact of the mesial cusp of the lower third molar in relation to the lower second molar, and side of the lower third molar impaction, have little or no significance.

Keywords: Wisdom teeth, Impaction , Mesioangular

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INTRODUCTION

Wisdom teeth may erupt into the correct dental position and become functional, or, conversely, they may emerge in non-functional or only partly functional positions and are then termed impacted'. This phenomenon can affect any tooth, but the impaction rate is much more frequent in mandibular third molars and the prevalence is influenced by age, gender, ethnicity and the skeletal face type. [1] One of the oldest and most significant classifications for impacted third molars is by Pell GJ and Gregory GT in 1933. [2] Any tooth may become impacted, but the most frequently impacted teeth are third mandibular molars [3,4] due to their particular topography. Impacted mandibular molars are directly or indirectly associated with numerous disorders in the mouth, [5,6] which is why extraction of third molars

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is considered prophylactic with or without symptoms, as a result of expected complications. [7] Oral hygiene measures fail to completely clean the dental plaque from the difficult, inaccessible areas of teeth, and as a result dental caries develop. [8-9] In addition to this, the pressure exerted by the impacted third molars on the second molars make the second mandibular teeth more prone to distal caries. [10] Partially erupted mesioangular and horizontally impacted teeth accumulate plaque against the distal surface of the second molars, thereby predisposing to distal cervical caries. [11-15] The caries process usually affects the distal aspect of the second molar (Figure 1), and this has been strongly associated with impacted mandibular third molars, especially mesioangular impactions. We analysed the correlation between the incidence of distal caries on the mandibular second molar and the eruption status of the mandibular third molar and proposed guidelines for performing preventive extraction of mandibular third molars. Nowadays, the prophylactic removal of an asymptomatic mandibular molar in adults is questionable [16-19] and clinical decision-making about extraction should be based on the relative benefits and harms for the patient. [20] However, at present the evidence base for the benefit of timely surgical removal of wisdom teeth is still developing [21] and the purpose of this paper is to present the risk factors associated with distal caries (DC) in the mandibular second molar. Very little detail has been reported in the literature on the fate of the second mandibular molar, and this paper addresses this knowledge gap and provides original data. Partially erupted, mesioangular impacted mandibular third molars that are in contact with the second molar around the amelocemental junction put the second molar at risk of developing distal cervical caries (Figure 1), [22-25] which is a carious lesion that forms on the distal cervical root surface of the second molar. To date, although few studies have been conducted on the relationship between the incidence of distal caries of the mandibular second molar and the eruption status of the mandibular third molar, increasing numbers of published studies have reported dental decay development in the tooth immediately next to the impacted wisdom tooth. Nevertheless, the American Association of Oral and Maxillofacial Surgeons (AAOMS) [26] indications for therapy for third molars are listed as follows: pain, pericoronitis, nonrestorable carious tooth, facilitation of the management of or limitation of the progression of periodontal disease. The objectives of the study were a) to predict the prevalence of distal caries in mandibular second molars due to impacted third molar teeth, b) to predict the most common type of third molar impaction associated with cervical caries of second molar teeth, c) to predict the most common age group with the highest prevalence of distal caries involving second molars and d) to predict the gender variation in the prevalence of distal caries involving second molar teeth.

MATIRIAL AND METHODS:

This retrospective cross-sectional study included OPGs from the records of military personnel with other insured patients registered at the dental department of the Royal Medical Services. A total of 431 patients were included in the study from January 2017 to May 2021. Dental charts were completed from radiographs retrieved from the computer software (Carestream® CS 8100 by Carestream® Dental LLC Atlanta, GA, USA) that was used in the dental department to take OPGs were subsequently entered into an excel spreadsheet. Descriptive analysis of the data was performed, and results were displayed as frequency tables and graphs. Each OPG was analysed by a minimum of three investigators. OPGs with impacted third molar teeth were identified. Of these OPGs with impacted third molar teeth, the prevalence of distal cervical caries in mandibular second molars were assessed. An excel spreadsheet was designed to enter the data. The data obtained were analysed concerning age group and gender, and the specific types of impacted third molar causing distal caries in second molars were identified and recorded. Age, the DMFT (decayed/missed/filled teeth) index and the eruption

and impaction status of mandibular third molars at the time caries was diagnosed were recorded. The following patient parameters were recorded: age (20s, 30s, 40s), gender (male or female), the mesial angulations of the mandibular third molars (≤0°, 0°-20°, 21°-40°, 41°-60°, 61°-80°, or ≥80°) categorised using Winter's method [27], the degree of impaction of mandibular third molars, and the distance between the distal surface cementoenamel junction [CEJ]) of the mandibular second molar and the mesial surface (CEJ) of the mandibular third molar. Using the Shiller classification, [28] the mesial angulation of the third molar was calculated by measuring the angle of the intersectionmade by the mandibular occlusal plane and the occlusal surface of the third molar.(Figure 2). Concerning inclusion criteria for the study, all Jordanian nationals seeking dental care between 2017 and 2021 in the age group 21 to 45 years with normal eruption patterns of second molar teeth were included in the study. Patients who had already extracted third molars or had associated pathologies like cysts or tumours were excluded from the study. Patients with developmental disorders like microdontia, the presence of fourth molars, impacted second molars, supernumerary teeth or odontomas and patients with implants were also excluded from the study group. The data were tabulated independently in electronic form before the statistical analysis with the help of IBM SPSS® Statistics for Windows, version 28 (IBM Corp, Armonk, USA). This study was approved by the ethical committee of the Royal Medical Services.

RESULTS AND DISCUSSION

Statistical analysis: The categorical data were expressed in frequency and percentage, and the scale data were expressed in mean and standard deviation. A Chi-square of independence test was used for bivariate association. In addition, binary logistic regression was used to investigate factors associated with distal caries of the lower second molar. Moreover, the strength of the association was measured by Cramer's V and Odds ratio, the alpha level set at <0.05 was deemed statistically significant and SPSS® Ver28 was used to analyse the data.

Data management: Before conducting inferential statistics, several steps were taken to check the data flow in terms of missing, outrange and undefined values for both quantitative and qualitative variables. Additionally, a normal distribution shape was constructed for scale variables (age and DMFT). There were no missing or undefined values and the scale variables were normally distributed. The assumptions of Chi-square were tested as well, and finally, the assumptions of binary logistics regression were checked. The results show the data were free of any violation of the assumptions.

Study findings: A total of 431 patients with dental problems who visited the dental care clinic at King Hussein Hospital were enrolled in the study. Of these, 264 (61.3%) were male patients, compared to 167 (38.7%) female patients, with a mean age of 38.12±6.69 years. More than half of the sample (298,69.1%) were non-smokers, Compared to 133 (30.9%) smokers. The vast majority (395, or 91.6%) had no medical illness and the DMFT mean was 6.11±1.3. See (Table 1). Regarding participants' dental complaints, the prevalence of distal caries of the lower second molar found to be 79 (18.3%), with 50 (23.5%) on the left side and 29 (13.3%) on the right side of the second lower molar. More than half of the sample patients were found to have fully erupted angulation of the lower third molar and 86 (20.0%) had partially erupted mesioangular. Also, the results showed that most of the patients (301, or 69.8%) had above contact of the mesial cusp of the lower third molar concerning the amelocemental junction (ACJ) of the lower second molar. In addition, the vast majority of patients chose preventive measures (353, or 81.9%), while 11 (2.5%) chose extraction. See Table 1.

Table 1: Study participants' socio-demographic details

Variable	Category	Frequency	Percentage	Mean (SD)
Gender	Male	264	61.3	
	Female	167	38.7	
Medical history	Medically free	395	91.6	
	Having disease	36	8.4	
Smoking status	Non-smoker	298	69.1	
	Smoker	133	30.9	
Age/years				38.12±6.69
DMFT				6.11±1.3

Dental characteristics:			
Distal caries of lower second molar	Absent	352	81.7
	Present	79	18.3
Side of caries of lower second molar	Left	50	23.5
	Right	29	13.3
Angulation of lower third molar	Fully erupted	232	53.8
	Partially erupted horizontally	35	8.1
	Partially erupted vertically	72	16.7
	Partially erupted mesioangular	86	20
	Partially erupted distoangular	6	1.4
Contact of mesial cusp of lower third molar in relation to ACJ of lower second molar	No contact	5	1.2
	Below contact	125	29.0
	Above contact	301	69.8
Treatment modality	Preventive and follow-up	353	81.9
	Restoration treatment	67	15.5
	Extraction of lower third molar	1	0.2
	Extraction of both lower second and third molars	10	2.3

the lower third molar and distal caries of the lower second molar, a bivariate association was conducted by using the Chi-square of independence test. The results in Table 2 show a statistically significant association between two variables $X^2(4) = 52.072$, $p<0.001$, indicating that 48.1% of cases of dental caries of the lower second molar have a partially erupted mesioangular of the lower third molar. This association was moderate in strength, evidenced by Cramer's V=0.348.

Table 2: Association between angulation of lower third molar and distal caries of lower second molar

Variable	Categories	Caries of lower second molar		Chi-square value	P-value
		Absent n (%)	Present n (%)		
Angulation of lower third molar	**Fully erupted**	**205 (58.2)**	**27 (34.2)**	**52.072**	**<0.001**
	Partially erupted horizontally	**27 (7.7)**	**8 (10.1)**		
	Partially erupted vertically	**67 (19.0)**	**5 (6.3)**		
	Partially erupted mesioangular	**48 (13.6)**	**38 (44.2)**		
	Partially erupted distoangular	**5 (1.4)**	**1 (1.3)**		

Predictors for distal caries of the lower second molar: Seven predictors, namely, gender, smoking status, DMFT, age, medical history, angulation of the lower third molar and contact of the mesial cusp of the lower third molar, and the side of caries of the lower second molar were entered into a binary logistic regression to predict caries of the lower second molar. The omnibus test of the regression model showed a statistically significant result ($X2=73.181$, $p < 0.001$), indicating that the model with a full set of predictors is relatively better than a null model. Moreover, the data were fit to conduct a regression analysis, as evidenced by the Hosmer-Lem show test ($X2=5.403$, $p=0.724$), and the after mentioned predictors collectively explained about 25.4% of the variation in lower second molar caries. The results in Table 3 show that for one score increase in the patients' DMFT, the odds ratio of lower second molar caries would likely increase 1.126 times or 12.6%. In addition, those presenting with partially erupted horizontally and partially erupted mesioangular are OR=5.583 ($p=0.010$) and

OR=12.858 (p <0.001) times more likely for lower second molar caries compared with fully erupted patients. Gender, smoking status, age, medical history, and contact of the mesial cusp of the lower third molar and the side of caries of the lower second molar were not significant predictors for lower second molar caries. However, below contact of the mesial cusp of the lower third molar was a marginally significant predictor (p=0.056).

Table 3: Binary logistic regression to predict lower second molar caries

Predictors	B	SE	Wald test	Sig	Odds ratio
Gender	-0.121	0.332	0.134	0.715	0.886
Smoking	0.427	0.329	1.680	0.195	1.532
DMFT	0.118	0.032	13.823	*<0.001*	1.126
Age	0.007	0.010	0.442	0.506	1.007
Medical history	-0.585	0.612	0.915	0.339	0.557
Fully erupted	Reference	---	---	---	---
Partially erupted	1.720	0.667	6.656	*0.010*	5.583
Horizontally Partially erupted	-.343	0.540	0.403	0.526	0.710
vertically Partially erupted mesio- angular	2.554	0.498	26.307	*<0.001*	12.858
Partially erupted disto- angular	0.253	1.149	0.049	0.825	1.288
Below contact of mesial cusp of the lower third molar	-2.206	1.154	3.655	0.056	0.110
Above contact of mesial cusp of the lower third molar	-1.702	1.094	2.422	0.120	0.182
Side of caries of lower second molar	0.204	1.160	0.031	0.860	1.226

As our main interest variable was a significant predictor for lower second molar caries, this study tried to explore whether there is an association between the mode of treatment and lower third molar angulation. The results of the Chi-square in Table 4 show that 30.0% of partially erupted horizontally and 60.0% of partially erupted mesioangular patients chose extraction of the lower third molar and both lower seconds, respectively, with a statistically significant association $X^2(12) = 55.59$, $p<0.001$, Cramer's V=0.207.

Table 4: Association between mode of treatment and lower third molar angulation

Variable	Categories	Caries of lower second molar		Chi- square value	P- value
		Absent n (%)	Present n (%)		
Angulation of lower third molar	Fully erupted	205 (58.2)	27 (34.2)	52.072	<0.001
	Partially erupted horizontally	27 (7.7)	8 (10.1)		
	Partially erupted vertically	67 (19.0)	5 (6.3)		
	Partially erupted mesio-angular	48 (13.6)	38 (44.2)		
	Partially Erupted distoangular	5 (1.4)	1 (1.3)		

Predictors for distal caries of the lower second molar Seven predictors, namely, gender, smoking status, DMFT, age, medical history, angulation of the lower third molar and contact of the mesial cusp of the lower third molar, and the side of caries of the lower second molar were entered into a binary logistic regression to predict caries of the lower second molar. The omnibus test of the regression model showed a statistically significant result (X2=73.181, p < 0.001), indicating that the model

with a full set of predictors is relatively better than a null model. Moreover, the data were fit to conduct a regression analysis, as evidenced by the Hosmer-Lemeshow test (X2=5.403, p=0.724), and the after mentioned predictors collectively explained about 25.4% of the variation in lower second molar caries. The results in Table 3 show that for one score increase in the patients' DMFT, the odds ratio of lower second molar caries would likely increase 1.126 times or 12.6%. In addition, those presenting with partially erupted horizontally and partially erupted mesioangular are OR=5.583 (p=0.010) and OR=12.858 (p <0.001) times more likely for lower second molar caries compared with fully erupted patients. Gender, smoking status, age, medical history, and contact of the mesial cusp of the lower third molar and the side of caries of the lower second molar were not significant predictors for lower second molar caries. However, below contact of the mesial cusp of the lower third molar was a marginally significant predictor (p=0.056).

Table (4) Association between mode of treatment and lower third molar angulation

Variable	Categories	Treatment modality				Chi-square value	P-value
		Preventive and follow-up n(%)	Restoration treatment n(%)	Extraction of lower third molar n(%)	Extraction of both lower second and third molar		
Angulation of lower third molar	Fully erupted	205(58.1)	26(38.8)	1(100)	0(0.0)	55.59	<0.001
	Partially erupted horizontally	27(7.6)	5(7.5)	0(0.0)	3(30.0)		
	Partially erupted vertically	66(18.7)	5(7.5)	0(0.0)	1(10.0)		
	Partially eruptedmesio-angular	50(14.2)	30(44.8)	0(0.0)	6(60.0)		
	Partially erupted disto-angular	5(1.4)	1(1.5)	0(0.0)	0(0.0)		

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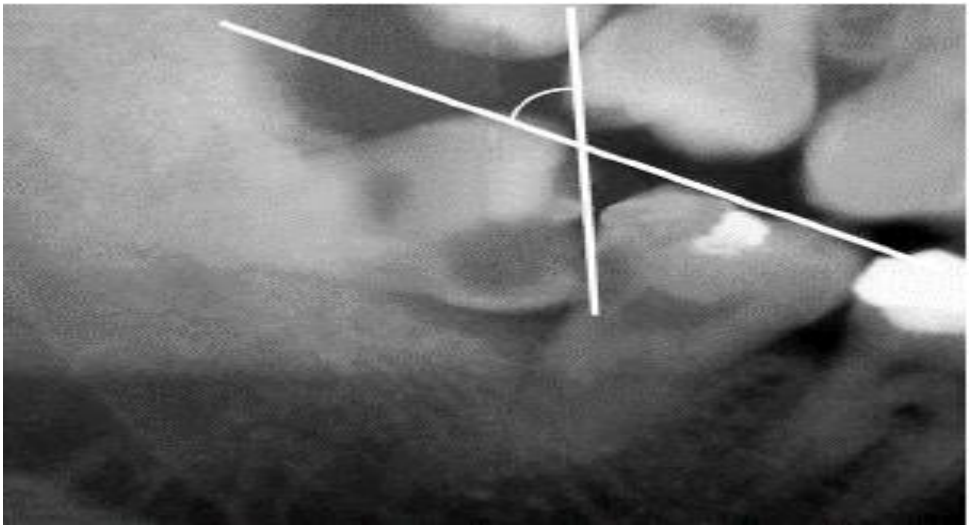
CONCLUSION

Our study concluded that there was a strong correlation between distal caries of the lower second molar and the degree of angulation of the lower third molar, with the highest mesioangular impaction of the lower third molar. Other demographic variables like gender, smoking, age, medical history, and contact of the mesial cusp of the lower third molar concerning the lower second molar and side of the lower third molar impaction had little or no elected in partial mesioangular eruption and partial horizontal eruption, respectively. Preventive measures were more often associated with full eruption and partial vertical eruption, respectively, whereas restorative treatment was highest with partially erupted mesioangular impaction of the lower third molar. insignificance than these variables. Regarding cusp of the lower third molar had relatively higher treatment option modalities, the extraction of both significance, although below contact of the mesial were more often lower second and third molars .

Figure 1

Figure 2



Shiller classification.
The mesial angulation of the third molar was calculated by measuring the angle of the intersection made between the mandibular occlusal plane and the occlusal surface of the third molar.

REFERENCES

1. **Breik O, Grubor D.** The incidence of mandibular third molar impaction in different skeletal face types. Aus Dent J 2008; 53: 320–324.

2. **Pell GJ, Gregory GT.** Impacted mandibular third molars: Classification and 1] modified technique for removal. The Dental Digest. 1933;39(9):330-38.

3. **Lima CJ, Silva LC, Melo MR, et al**. Evaluation of the agreement by examiners according to classifications of third molars. Med Oral Patol Oral Cir Bucal 2012;17: e281–e286.

4. **Nazir A, Akhtar MU, Ali S**. Assessment of different patterns of impacted mandibular third molars and their associated pathologies J Adv Med Dent Sci Res 2014; 2:14–22).

5. **Alamgir W, Mumtaz M, Kazmi F, et al**. Cause and effect relationship between mandibular third molar impactions and associated pathologies. Int J Adv Res2015; 3:762–767.

6. **Khawaja NA, Khalil H, Parveen K, et al**. A retrospective radiographic survey of pathology associated with impacted third molars among patients seen in Oral & Maxillofacial Surgery Clinic of College of Dentistry, Riyadh. J Int Oral Health 2015; 7:13–17.

7. **Daley TD.** Third molar prophylactic extraction: a review and analysis of the literature. Gen Dent 1996; 44:310–320).

8. **Choo A, Delac DM, Messer LB**. Oral hygiene measures and promotions: review and considerations. Australian Dent J. 2001;46(3):166-73.

9. **Thomas Peppera,Thomas Konarzewskia,et al** Treatment of mandibular third molars and pericoronitis in British military personnel: influence of guidelines from the National Institute for Health and Clinical Excellence, British Journal of Oral and Maxillofacial Surgery (2016) .

10. **Melek Tassoker, DDS, PhD** What Are the Risk Factors for External Root Resorption of Second Molars Associated with Impacted Third Molars? A Cone-Beam Computed Tomography Study J Oral Maxillofac Surgery 77:11-17, 2019

11. **T. Pepper, P. Grimshaw1, T. Konarzewski, et al**, Retrospective analysis of the prevalence and incidence of caries in the distal surface of mandibular second molars in British military personnel Br J Oral Maxillofac Surgery (2016), http://dx.doi.org/10.1016/j.bjoms.2016.

12. **V. Toedtling, P. Coulthard and G. Thackray** Distal caries of the second molar in the presence of a mandibular third molar – a prevention protocol BDJ, Vol 221 NO. 6, September 23 2016

13. **Kamran Bokhari Syed, Fatima Saeed Alshahrani, et al**. Prevalence of Distal Caries in Mandibular Second Molar Due to Impacted Third Molar Journal of Clinical and Diagnostic Research. 2017 Mar, Vol-11(3).

14. **Andreescu Claudia, Horia Mihail Barbu, et al**, Relationship Between Third Mandibular Molar Angulation and Distal Cervical Caries in the Second Molar, The Journal of Craniofacial Surgery, Volume 00, Number 00, Month 2018

15. **Jose´ Cristiano Ramos Glo´ria, Carolina Castro Martins, et al** Third Molar and Their Relationship with Caries on the Distal Surface of Second Molar: A Meta-Analysis J. Maxillofacial. Oral Surgery.DOI 10.1007/s12663-017-1032-9 The Association of Oral and Maxillofacial Surgeons of India 2017

16. **Mettes TD, Ghaeminia H, Nienhuijs ME, Perry J, van der Sanden WJ, Plasschaert A (2012).** Surgical removal versus retention for the management of asymptomatic impacted wisdom teeth. Cochrane Database Syst Rev 13:CD003879.

17. **Mettes TG, Nienhuijs ME, van der Sanden WJ, Verdonschot EH, Plasschaert AJ (2005).** Interventions for treating asymptomatic impacted wisdom teeth in adolescents and adults. Cochrane Database Syst Rev 18(CD00387).

18. **Tolstunov L**. Third molar uncertainty. J Oral Maxillofac Surg 2013;71:239

19. **Fonseca GM**. Consideraciones sobre la extraccion profilactica de terceros molares no erupcionados asintomaticos. Int J Med Surg Sci 2014; 1:21–30.

20. **Dhanrajani P, Smith M**. Lower third molars. Natl J Maxillofac Surg 2014; 5:245–246.

21. **Mettes T G, Ghaemina H, Nienhuijs M E L, Perry J, van der Sanden W J M, Plasschaert A**. Surgical removal versus retention for the management of asymptomatic impacted wisdom teeth. Cochrane Database Syst Rev 2012; 6: CD003879.

22. **Van der Linden W, Cleaton-Jones P, Lownie M**. Diseases and lesions associated with third molars. Review of 1001 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995; 79:142–5.

23. Current clinical practice and parameters of care: the management of patients with third molar (syn: wisdom) teeth. Faculty of Dental Surgery of the Royal College of Surgeons of England. Available from: http://www.rcseng.ac.uk/fds/publications-clinicalguidelines/ clinical guidelines/documents/3rdmolar.pdf [September 1997].

24. **Knutsson K, Brehmer B, Lysell L, Rohlin M.** Pathoses associated with mandibular third molars subjected to removal. Oral Surgery Oral Med Oral Pathol Oral Radiol Endod 1996; 82:10–7.

25. **McArdle LW, Renton TF**. Distal cervical caries in the mandibular second molar: an indication for the prophylactic removal of the third molar? Br J Oral Maxillofac Surg 2006; 44:42–5.

26. **Carlson EHR, editor**. Parameters and pathways: clinical practice guidelines for oral and maxillofacial surgery. AAOMS Parcare 07 (Version 4.0). New York: Elsevier; 2007

27. **Winter GB**. Principles of exodontia as applied to the impacted mandibular third molar: a complete treatise on the operative technic with clinical diagnoses and radiographic interpretations. St Louis: American MedicalBook Company; 1926.

28. **Shiller WR.** Positional changes in mesioangular impacted mandibular third molars during a year. J Am Dent Assoc 1979; 99:460-4.