Prevalence and clinical characteristics of tori and jaw exostoses in a teaching hospital in Jordan

Faleh A. Sawair, PhD, FDSRCS (Eng), Mohammad H. Shayyab, MSc, MFDRCS (Ire), Mohammad A. Al-Rabab'ah, PhD, MRDRCS (Ed), Takashi Saku, PhD.

ABSTRACT

الأهداف: معرفة الخصائص السريرية ومدى انتشار النتوءات والناميات العظمية الفكية (OBOs): النتوء الحنكي (TP)، نتوء الفك السفلي (TM) والناميات العظمية الأخرى في المجتمع الأردني.

الطريقة: أجريت فحوص سريرية ل618 مريض (354 ذكر و264 امرأة)، أعمارهم تتراوح ما بين 10 و82 عام، في مستشفى الجامعة الأردنية – عمان – الأردن في الفترة ما بين الأول من نوفمبر و31 ديسمبر من العام 2008 للكشف عن وجود هذه النتوءات العظمية OBOs.

النتائج: كان هنالك 239 شخص (38.7%) لديه على الأقل إحدى هذه النتوءات العظمية. كان لدى ما يقرب من ثلث العينة (34.6%) نتوء حنكي (TP) أو نتوء الفك السفلي (TM) أو كليهما. يقدر معدل انتشار النتوء الحنكي (TP) كان (15.4%)، نتوء الفك السفلي (25.7%) (TM)، والناميات العظمية الأخرى (14.4%) وكانت في معظمها في العقد الخامس من العمر وفي المرضى الذين يعانون من عادة صريف الأسنان أو تآكل الأسنان. كان النتوء الحنكي أكثر شيوعاً في النساء ولكن الفروق بين الجنسين في انتشار نتوء الفك السفلي والناميات العظمية الأخرى لم تكن ذات دلالة إحصائية. معظم النتوءات الحنكية كانت كبيرة في الحجم (71.6%)، مغزلية (41.1%) أو منبسطة (40%) في الشكل وتقع في منطقة الأضراس والضواحك (45.3%). كانت غالبية نتوءات الفك السفلي متوسطة أو كبيرة في الحجم (84.9%)، على جانبي الفك (81.1%)، تتألف من عقدة واحدة (69.2%)، وتقع في منطقة الضواحك (65.4%). أما بالنسبة للناميات العظمية الأخرى فكان هنالك (7.1%) لديهم ناميات شدقية في الفك السفلي، و (10%) ناميات شدقية في الفك العلوي و (2.4%) ناميات حنكية. لوحظ إحصائياً وجود ارتباط ملموس بين الوجود المتزامن للنتوءات والناميات العظمية.

خاتمة: لوحظ انتشاراً عالياً نسبياً للنتوءات والناميات العظمية الفكية (OBOs) في عينة الدراسة وهذا من شأنه التأثير على معالجة هؤلاء المرضى وخاصة عند التركيبات السنية المتحركة والجراحة اللثوية.

Objectives: To determine the prevalence and clinical characteristics of oral bony outgrowths (OBOs); torus palatinus (TP), torus mandibularis (TM), and exostoses in Jordanian dental patients.

Methods: This cross-sectional study was conducted between November 1 and December 31, 2008 at the University of Jordan Hospital, Amman, Jordan. Clinical examinations of 618 patients (354 men and 264 women), 10-82 years of age, were conducted to determine the presence of OBOs.

Results: There were 239 subjects (38.7%) who had OBOs. Nearly one-third (34.6%) had TP, TM, or both. The prevalence rates were 25.7% for TM, 15.4% for TP, and 14.4% for exostoses. The OBOs were mostly noted in patients in their fifth decade of life, with attrition, clenching, or bruxism. Women had more TP, but gender differences were not statistically significant in cases of TM and exostoses. Most TP were large in size (71.6%), spindle (41.1%), or flat (40%) in shape, and located at the premolar-molar region (45.3%). The TM were mostly medium to large in size (84.9%), bilateral (81.1%), composed of single node (69.2%), and located at the premolar region (65.4%). Of the studied subjects, 7.1% had mandibular buccal exostosis, 10% had maxillary buccal, and 2.4% had palatal exostoses. Statistically significant associations were noticed between the concurrent existence of OBOs.

Conclusion: A relatively high prevalence of OBOs was noted, and this should be taken into consideration when planning periodontal surgery and prosthodontic treatment.

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From the Department of Oral and Maxillofacial Surgery, Oral Medicine, Oral Pathology and Periodontology (Sawair, Shayyab), and Department of Conservative Dentistry (Al-Rabab'ah), Faculty of Dentistry, University of Jordan, Amman, Jordan, and Department of Tissue Regeneration (Saku), Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan.

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Address correspondence and reprint request to: Dr. Faleh Sawair, Associate Professor, Department of Oral and Maxillofacial Surgery, Oral Medicine, Oral Pathology and Periodontology, Faculty of Dentistry, University of Jordan, Amman, Jordan. Tel. +962 (6) 5355000 Ext. 23595. Fax. +962 (6) 5339289. E-mail: sawair@ju.edu.jo

Tori are benign exostoses that develop at the midline of the hard palate (torus palatinus [TP]), or the lingual aspect of the mandible (torus mandibularis [TM]).[1] Elsewhere, jaw exostoses have no precise designation, and may arise as multiple nodules at the buccal aspect of the maxilla or mandible (buccal exostoses[BE]), or the palatal aspect of the maxilla (palatal exostoses [PE]).[2] These oral bony outgrowths (OBOs) are composed of hyperplastic mature compact bone, or an outer layer of compact bone engulfing a center of cancellous bone, covered by a thin mucosa.[3] Etiological factors of OBOs include genetic and environmental factors, such as occlusal forces, and nutrition.[4-6] These OBOs are clinically significant. Although they are generally asymptomatic, surgical intervention may be required in some cases of chronic trauma, or when OBOs interfere with oral function, or prosthodontic treatment.[7] Presence of TM was marked as an indicator of parafunctional activity and temporomandibular dysfunction.[8] Emergency endotracheal intubation was found very difficult in patients with TM.[7] On the other hand, positive correlations were found between the presence of tori and denser skeletal mass, bone density, and lower risk of developing osteoporosis.[9] In addition, TP presence was connected to a well-developed maxilla, and a lower rate of third molar agenesis.[3] Interestingly, bone harvested from OBOs might be used for alveolar ridge augmentation during implant and periodontal surgeries.[7]

The prevalence rates of tori in populations with different ethnic origins varied from 0-66% for TP, and from 0-85.7% for TM.[4,5,10] Racial differences appear significant, with Mongoloids having a higher prevalence rate than Caucasians,[5] and Caucasians having a higher prevalence rate than blacks.[11] The prevalence rate also varied between 8.1% and 56% for PE,[2,12] and between 0.09% and 23.2% for BE.[2] Most BE were encountered on the maxilla.[2] The prevalence of BE and PE is currently unknown in the Arab ethnic group. Salem et al[13] reported a 1.4% frequency of TP in 6-12 years old Saudi schoolchildren, and Yildiz et al[10] reported a 30.9% prevalence rate of TP in 5-15 years old Turkish schoolchildren. Al Quran and Al-Dwairi[7] studied the prevalence of TP and TM in 338 edentulous Jordanian patients, 30 years of age and older. They reported prevalence rates of 8% for TP, and 9.8% for TM. However, we believe that this could be an underestimation of the prevalence of tori in this population, since loss of teeth has been reported to alter alveolar bone metabolism, and to influence the prevalence of tori.[6] This study aims to determine the prevalence and clinical characteristics of tori in dentate Jordanian population. The prevalence and location of BE and PE, and their concurrence with tori will be also investigated. The results may serve as baseline data for further epidemiological studies on OBOs, and for comparison with data reported in other surveys.

Methods. This cross-sectional study was conducted on 618 volunteers chosen randomly from subjects who attended the Department of Dentistry, University of Jordan Hospital, Amman, Jordan, for dental treatment between November 1 and December 31, 2008. The purpose of the study was explained, and patients who agreed to participate were interviewed and assessed for the presence, or absence of tori, BE, and PE by clinical inspection and palpation. Edentulous patients were excluded from the study. Questionable tori or exostoses were recorded as not present. Tori were measured, and graded as small (<3 mm), medium (3-6 mm), and large (>6 mm), and its location, in relation to the maxillary and mandibular teeth was recorded. The shape of TP was classified as flat, nodular, spindle, or lobular according to Jainkittivong et al.[1] The side placement of TM as unilateral or bilateral, and the form whether it is composed of single, or multiple nodes were recorded. Patients were also questioned on the history of parafunctional habits (PFHs), such as clenching or bruxism, and were examined for the presence of dental attrition. Attrition severity was scored on a 3-grade scale (none, mild-moderate, severe).[14] Subjects who had tori or exostoses were asked on their awareness of its presence. Clinical examinations and assessments were carried out by one examiner.

Statistical analysis was performed using the Statistical Package for Social Sciences for Windows version 16.0 (SPSS Inc., Chicago, IL, USA). Frequency distributions were obtained, and chi-square test, t-test, and ANOVA test were used to compare differences between groups. Statistical significance was set at $p<0.05$.

Results. Of the 618 patients studied, there were 354 (57.3%) men, and 264 (42.7%) women. The patients were 10-82 years of age (mean 33.6 ± 13.1 years). There were 239 (38.7%) patients who had OBOs, and 214 patients (34.6%) who had TP, or TM, or both. More patients (159 [25.7%]) had TM than TP (95 [15.4%]) or exostoses (89 [14.4%]). Only 2 patients (0.8%) of those who had OBOs were aware of its existence.

Association with patients' factors (**Table 1**). Significantly, more women had TP than men, however, gender differences were not significant in the case of TM and exostoses. The prevalence rates of OBOs increased linearly with increasing age, peaked in the fifth decade, and then decreased. Patients who had dental attrition or PFHs had significantly more prevalent OBOs.

Table 1 - Prevalence of oral tori and exostoses in relation to gender, age group, attrition, and parafunctional habits (N=618).

Variable	Present TP (n= 95)		*P*-value*	Present TM (n= 159)		*P*- value*	Present exostoses (n=89)		*P*-value*
	n	(%)		n	(%)		n	(%)	
Gender									
Men (n=354)	42	(11.9)	0.005	101	(28.5)	0.07	56	(15.8)	0.30
Women (n=264)	53	(20.1)		58	(22.0)		33	(12.5)	
Age									
10-19 (n=90)	7	(7.8)	0.001	9	(10.0)	0.000	6	(6.7)	0.001
20-29 (n= 183	24	(13.1)		37	(20.2)		17	(9.3)	
30-39 (n=149)	24	(16.1)		46	(30.9)		31	(20.8)	
40-49 (n=111)	30	(27.0)		45	(40.5)		26	(23.4)	
50-59 (n=52)	3	(5.8)		17	(32.7)		6	(11.5)	
≥ 60 (n=33)	7	(21.2)		5	(15.2)		3	(9.1)	
Attrition									
No (n= 349)	36	(10.3)	0.000	54	(15.5)	0.000	29	(8.3)	0.000
Mild to moderate (n= 259)	51	(19.7)		103	(39.8)		56	(21.6)	
Severe (n=10)	8	(80.0)		2	(20.0)		4	(40.0)	
PFHs									
No (n=533)	70	(13.1)	0.000	130	(24.4)	0.04	67	(12.6)	0.001
Yes (n=85)	25	(29.4)		29	(34.1)		22	(25.9)	

TP - torus palatinus , TM - torus mandibularis, *P** - *p*-value of Chi-square test, PFHs - parafunctional habits

Table 2 - Size, location, and shape of torus palatinus in relation to gender and age of patients.

Features	Age (years) Mean ± SD	Men N=42		Women N=53		Total N=95	
		n	(%)	n	(%)	n	(%)
Size							
Small	49.1 ± 14.6	3	(7.1)	5	(9.4)	8	(8.4)
Medium	42.8 ± 16.0	13	(31.0)	6	(11.3)	19	(20.0)
Large	32.9 ± 10.4	26	(61.9)	42	(79.2)	68	(71.6)
P-value	$p^{\dagger}$=0.000			p^{*}=0.06			
Location							
Anterior region	43.6 ± 23.6	3	(7.1)	2	(3.8)	5	(5.3)
Premolar region	39.7 ± 11.7	14	(33.3)	17	(32.1)	31	(32.6)
P-M region	34.2 ± 10.9	19	(45.2)	24	(45.3)	43	(45.3)
Molar region	32.6 ± 16.2	6	(14.3)	10	(18.9)	16	(16.8)
P-value	$p^{\dagger}$=0.11			p^{*}=0.85			
Shape							
Flat	31.2 ± 12.8	15	(35.7)	23	(43.4)	38	(40.0)
Lobular	44.4 ± 13.7	5	(11.9)	3	(5.7)	8	(8.4)
Spindle	38.3 ± 13.0	18	(42.9)	21	(39.6)	39	(41.1)
Nodular	40.9 ± 8.2	4	(9.5)	6	(11.3)	10	(10.5)
P-value	$p^{\dagger}$=0.01			p^{*}=0.67			
Total	**36.2 ± 13.2**						

p^{*} - value of Chi-square test, $p^{\dagger}$ - value of ANOVA test, P-M region - premolar to molar region

Features of TP (**Table 2**). Large TP were the most common particularly in women, however, the gender difference in size did not reach statistical significance. A statistically significant reverse relationship was noted between TP size and age of patients. The TP was mostly located at the premolar-molar region, and was mostly spindle, or flat in shape. Although TP location and shape were independent of gender, a linear increase in the mean age of subjects was noticed as TP location moved anteriorly, and as the shape changed from flat to spindle, to nodular to lobular.

Features of TM (**Table 3**). The TM was mostly medium

to large in size, and small TM was more prevalent in women. Regardless of gender, most TM was located at the premolar region. Most TM were bilateral (81.1%), and composed of single nodes (69.2%).Unilateral uninodular TM were more prevalent in men, while bilateral uninodular TM were more prevalent in women (p=0.02) Unilateral TM (18.9%) was mostly located at the left side (63.3%). The clinical characteristics of TM were not significantly affected by the age of the patients.

Features of exostoses (**Table** 4). Forty-four patients (7.1%) had mandibular BE, 62 (10%) had maxillary BE, 15 (2.4%) had PE, and 80 patients (13%) had BE, whether in the mandible, or maxilla, or both. Of the 89 patients who had exostoses, 26 (29.2%) presented with both maxillary and mandibular exostoses. When found in only one jaw, exostoses were more common in the maxilla than in mandible (ratio = 2.5:1). Although age had no significant influence, exostoses were more common in the maxilla in men, but nearly equally distributed between the maxilla and mandible in women (p=0.001). All mandibular and vast majority (78.9%) of the maxillary exostoses were found at the buccal aspect of the jaws, independent of age and gender of the patients.

Table 3 - Size, location, side and number of nodes of torus mandibularis in relation to gender and age of patients.

Feature	Age (years) Mean ± SD	Men (n=101)		Women (n=58)		Total (N=159)	
		n	(%)	n	(%)	n	(%)
Size							
Small	37.6 ± 13.7	8	(7.9)	16	(27.6)	**24**	**(15.1)**
Medium	34.7 ± 10.5	46	(45.5)	19	(32.8)	**65**	**(40.9)**
Large	37.9 ± 11	47	(46.5)	23	(39.7)	**70**	**(44.0)**
P-value	$p^{\dagger}$=0.22		p^{*}=0.004				
Location							
Incisors	35.3 ± 18.3	3	(3.0)	1	(1.7)	**4**	**(2.5)**
Canines	36.8 ± 10.9	29	(28.7)	18	(31.0)	**47**	**(29.6)**
Premolars	36.3 ± 11.1	67	(66.3)	37	(63.8)	**104**	**(65.4)**
Molars	40.5 ± 16.9	2	(2.0)	2	(3.4)	**4**	**(2.5)**
P-value	$p^{\dagger}$=0.89		p^{*}=0.89				
Side and form							
Uni-single	35.6 ± 10.9	21	(20.8)	2	(3.4)	**23**	**(14.5)**
Uni-multiple	42.0 ± 11.0	4	(4.0)	3	(5.2)	**7**	**(4.4)**
Bi-single	36.2 ± 11.5	49	(48.5)	38	(65.5)	**87**	**(54.7)**
Bi-multiple	36.8 ± 11.4	27	(26.7)	15	(25.9)	**42**	**(26.4)**
P-value	$p^{\dagger}$=0.60		p^{*}=0.02				
Total	36.5 ± 11.3						

p^{*} - value of Chi-square test, $p^{\dagger}$ - value of ANOVA test, Uni - unilateral, Bi - bilateral

Table 4 - Location of exostoses in the maxilla and mandible in relation to gender and age of patients.

Features	Age (years) Mean ± SD	Men		Women		Total	
		n	(%)	n	(%)	n	(%)
Location							
Mandible/buccal	34.6 ± 13.2	5	(8.9)	13	(39.4)	**18**	**(20.2)**
Maxilla	36.5 ± 11.4	35	(62.5)	10	(30.3)	**45**	**(50.6)**
Mandible and maxilla	36.2 ± 8.7	16	(28.6)	10	(30.3)	**26**	**(29.2)**
P-value	$p^{\dagger}$=0.82		p^{*}=0.001				
Total	**36.0 ± 10.9**	**56**	**(100)**	**33**	**(100)**	**89**	**(100)**
Location in maxilla							
Buccal	36.2 ± 9.8	40	(78.4)	16	80.0	**56**	**78.9**
Palatal	38.4 ± 15.1	7	(13.7)	2	10.0	**9**	**12.7**
Buccal/palatal	34.7 ± 9.0	4	(7.8)	2	10.0	**6**	**8.5**
P-value	$p^{\dagger}$=0.77		p^{*}=0.89				
Total	**36.4 ± 10.4**	**51**	**(100)**	**20**	**(100)**	**71**	**(100)**

p^{*} - value of Chi-square test, $p^{\dagger}$ - value of ANOVA test

Table 5 - Concurrence of the 3 bony projections; torus palatinus (TP), torus mandibularis (TM), and exostoses.

Concurrence	TP			TM			Exostoses			Total	
	Absent n (%)	Present n (%)	*P*-value*	Absent n (%)	Present n (%)	*P*-value*	Absent n (%)	Present n (%)	*P*-value*	n	(%)
TP						0.000			0.01		
Absent	-	-	-	404 (77.2)	119 (22.8)		456 (87.2)	67 (12.8)		523	(84.6)
Present	-	-		55 (57.9)	40 (42.1)		73 (76.8)	22 (23.2)		95	(15.4)
TM			0.000						0.000		
Absent	404 (88.0)	55 (12.0)		-	-	-	424 (92.4)	35 (7.6)		459	(74.3)
Present	119 (74.8)	40 (25.2)		-	-		105 (66.0)	54 (34.0)		159	(25.7)
Exostoses			0.01			0.000					
Absent	456 (86.2)	73 (13.8)		424 (80.2)	105 (19.8)		-	-	-	529	(85.6)
Present	67 (75.3)	22 (24.7)		35 (39.3)	54 (60.7)		-	-		89	(14.4)

*p** - value of chi-square test

Concurrence of tori and exostoses (**Table 5**). Ninety-two patients (14.9%) had concurrent OBOs, 80 patients (12.9%) had 2 concurrent OBOs, and 12 patients (1.9%) had 3 OBOs. Significant associations were noticed between the concurrent existence of OBOs. Forty patients (6.5%) had concurrent TP and TM, 22 patients (3.6%) had concurrent TP and exostoses, 54 patients (8.7%) had concurrent TM and exostoses and 12 patients (1.9%) had 3 OBOs. Fifty out of the 95 subjects (52.6%) with TP had concurrent TM, or exostoses, or both, 82 (51.6%) patients with TM had concurrent TP, or exostoses, or both, and 64 (71.9%) patients with exostoses had concurrent TP, or TM, or both.

Discussion. The prevalence of TP and TM found in this study is different from that reported in some Asian countries. The TP prevalence rate was lower than that reported in Thailand (60.5%)[1] and Malaysia (24.4%),[15] but higher than that reported in India (9.5%).[4] The prevalence of TM reported here is close to that found in Japan (26.6%)[4] and Thailand (29.9.2%),[5] but much higher than that reported in Malaysia (3%)[15] and India (1.4%).[4] In contrast to these Asian populations, TM was more prevalent than TP in this population. This latter observation was previously reported in Nigeria, and thought to be peculiar to Africans.[11] Although difficult to compare, the prevalence rate of 7.8% for TP reported here in our region for subjects 10-19 years old, is significantly lower than that reported for Turkish schoolchildren (30.9%),[10] but higher than that reported for Saudi schoolchildren (1.4%).[13]

Interestingly, the prevalence rates of TP and TM in dentate Jordanian patients reported in this study are nearly 2 times higher than that reported previously in edentulous Jordanian patients.[7] The reported significant relationships between exostoses and the number of functioning teeth and masticatory force[4,8] could explain this difference. Exostoses might perform a buttressing function reinforcing the alveolar process against excessive occlusal forces.[4] The reduction of muscular force following edentulism leads to the remodeling and obliteration of exostoses in some patients.[4] Therefore, patients who have higher occlusal stresses, such as those with clenching or bruxism were expected to have more prevalent OBOs, as was shown in this study. For that reason as well, it was expected to find a significant association between exostoses and tooth attrition.

The effect of occlusal stress could also explain the relationship between the age and exostoses found in this study. The peak incidence in the middle phase of life is consistent with previous reports.[1,6] The prevalence and degree of expression of tori might be related to the masticatory demand that increases with increasing age, and possibly, subsides after the fifth decade of life due to reduction in the number of teeth.[4] This dynamic growth and remodeling might also explain the association between TP size and age observed in this study, and by other studies.[1] In transition from the fourth to the sixth decade of life, the dominant size of TP changed from large, to medium, to small. Although not statistically significant, the location of TP also moved forward from the molar region anteriorly, as the patients became older in age. With age, the majority of lost teeth are molars, and consequently the chewing load and strain in the alveolar arch is expected to increase on the anterior teeth.[4] The size, shape, and location of TP and TM recorded in the examined subjects have important prosthodontic considerations. The high prevalence of medium to large variants of TP and TM, and the dominant premolar-molar location substantiates the need for modification of the design, or surgical intervention before any removable partial dentures can be constructed. In agreement with previous reports,[1] spindle, and flat variants of TP were

the most commonly noticed in this study. These forms may pose less potential for prosthodontic complications, compared to the nodular form. The bilateral nature of most cases of TM would impose more challenge toward prosthodontics treatment should the cross arch stability be sought.[7] Surgical management would also be more elaborate for bilateral TMs. The BE or PE may interfere with oral hygiene methods and insertion of dentures, and may complicate periodontal surgery.[2,12] The prevalence of BE and PE reported in this study amounted to almost one-half of that reported in some Asian populations.[2] In our study, the prevalence of PE (2.4%) was much less than that reported in the literature (8.1-56%).[2,12] Interestingly, while BE was reported to be less prevalent than PE,[2] it was much more common than PE in Jordanian subjects. Although exostoses were reported more in men compared to women,[12] in this study, mandibular exostoses were significantly more prevalent in women, and maxillary exostoses were significantly more prevalent in men.

The information on the concurrence of tori and exostoses is very limited due to the scarcity of reported cases. The statistically significant concurrence of OBOs found in this study support the findings in some previous studies.[1,2] The concurrence rate of TM and TP (6.5%) in this investigation is within the range reported by previous studies (3-28.1%).[1,2,15] In this study, the probability of finding a TM in a person with a TP was approximately twice as high as in a person without TP, and vice versa. The occurrence of the 3 OBOs together found in the current study (1.9%), is much less than that reported by Jainkittivong and Langlais[2] in the -Thai population (11.5%). The results of this study indicated that patients who have BE or PE should be investigated for the presence of oral tori, nearly 3 quarters of patients with exostoses may have TP, or TM, or both. Concurrence of OBOs further complicates prosthodontic treatment, and may support the suggestion of the occurrence of a multiple exostoses syndrome[2] in this group of patients.

Despite these findings, the study is not without limitations. The sample size was small and sample selection was an additional limitation. It was a cross-sectional, epidemiologic study, and we selected only one area in Jordan due to limitation of time and funds. Therefore, broad generalizations of the findings are not possible, and further study incorporating a nationally representative sample is needed to confirm the results.

In conclusion, the prevalence of OBOs in the Jordanian population was relatively high; more than one-third of the total subjects studied presented with oral tori, or exostoses. The OBOs were significantly associated with age. The involved dentate patients were asymptomatic; almost all of them were unaware of its existence in their mouths. Although their etiology is multifactorial, in addition to genetic susceptibility, masticatory forces and PFHs, such as clenching or bruxism could be important factors in its development and growth. The existence of these bony anomalies should be considered when planning periodontal surgery, or removable prosthodontic treatment for these patients.

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