The effect of palatine tonsil size on occlusion among 10- 12 years students in erbil city

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Background and objectives: The effect of the palatine tonsil size in the development of dental intra-arch and inter-arch abnormalities is often brought up in the literature, but it remains controversial. Data on the possibility of a relationship between enlarged tonsils and the occurrence of malocclusions are subjective. The purpose of this study was to seek an association between the space occupied by the palatine tonsils and the dental arch measurements.

Methods: A cross-sectional study was performed in Erbil city on a group of primary school students aged (10-12) years old. A tonsillar examination was performed for each student and graded according to the standardized tonsillar hypertrophy grading scale. A sample size of (300) students, (160) male and (140) female was randomly selected. Dental impressions were taken for each student. Data were analyzed with SPSS program version 22. Comparisons of qualitative variables according to tonsillar grade and gender and the relation of tonsillar grade according to gender were made using the chi-square test. The strength of the association between tonsillar grade and qualitative variables was evaluated with a phi coefficient (ϕ). The strength of the association between tonsillar grade and quantitative variables was assessed by Spearman's rank correlation coefficient (rho). The association between gender and quantitative variables was evaluated by *t*-test. The significance threshold was set at $P \leq 0.05$.

Results: Results showed that there was a significant and positive relation between Angle's molar relationship, overjet, and palatine tonsil size but no significant difference in palatine tonsil size according to males and females.

Conclusions: Early evaluation of the size of the palatine tonsils by the pedodontist would help prevent orthodontic abnormalities caused by upper airway obstruction during childhood.

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Introduction

The role of the palatine tonsils in the development of dental intra-arch and inter-arch abnormalities is often brought up in the literature, but it remains controversial.[1] In the literature, there are only a few articles that discuss the direct effect of palatine tonsils' size on dental malocclusion. Enlargement of tonsils is one of the main causes of respiratory disorders during sleep, and children with enlarged tonsils may have a larger anterior and lower facial height, more proclined upper incisors, retrognathic mandible, retroclined lower incisors and a large overjet .[2] Upper airway obstruction caused by enlarged tonsils results in reduced airflow. Such limitation is caused by a mechanical blockage that obstructs the airflow, leading to mouth breathing, as it has lower resistance to the air passage.[3] Airway obstruction, resulting from the nasal cavity or pharynx blockage, leads to mouth breathing, resulting in postural modifications such as

lowered tongue position, incompetent lips, anterior and posteroinferior rotation of the mandible, and a change in head posture. These modifications occur to stabilize the airway.[4] Since there is a lot of controversy about the relation between tonsil size and intradental and interdental malocclusion; that is why; this study is going to investigate the possible relation between tonsil size and malocclusion.

Methods

The sample included 300 students (160 boys and 140 girls) with the age range of 10 - 12 years. The sample was proportional to all six municipalities of Erbil city. The researcher started training in the ear, nose, and throat (ENT) department of Erbil teaching hospital for one month to get information about the process of clinical examination of the nose and throat and become familiar with the classification of tonsil grades. The researcher started examining the nose and throat of the students. The students' palatine tonsils were examined in the upright position with the heads slightly moved backwards and supported by the wall. The researcher was standing in front of the students and was asking each student to open their mouth widely and pronounce the /ah/ sound continuously so that the tonsils rotate medially and are in the correct size. The researcher was depressing students' tongues using a tongue depressor which was placed on the dorsum surface of the tongue without causing a gag reflex. The tonsils were subdivided into five groups according to their size using palatine tonsil hypertrophy classification according to the criteria of Brodsky and Koch [5] as shown in table 1.

The students with the following criteria were excluded: Allergic Rhinitis, Thumb sucking, Lip biting,
Tongue thrust habit, Previous or current orthodontic treatment, Tonsillectomy, Snoring, Trauma (dental or nasal), Nasal polyp, Deviated nasal septum, Extracted tooth/ teeth, and inflammatory tonsillitis.
The oral examination was done for each selected student and the following inter-arch parameters were documented: Angle canine relationship, Angle molar relationship, Open bite, Deep overbite, Normal overbite, Posterior crossbite without lateral deviation (PCWOL), Posterior crossbite with lateral deviation (PCWL), and Normal transverse occlusion (NTO).
Upper and lower dental impressions were taken for each student and dental casts were made to measure the following intra-arch
parameters using vernier:
1- Sagittal dimension
a) Overjet (mm): the horizontal distance between the maxillary central incisors and the mandibular central incisors.
To measure the overjet, the tip of the vernier touched the lower incisor labial surface perpendicular to it, tangent to the upper incisor incisal border. The distance between the upper incisor border and the lower incisor labial surface was measured with the vernier.[6] It is shown in Figure 1, A.
b) Total length of the maxillary arch (mm): the distance between the tangent line to the labial surfaces of the maxillary central incisors and a tangent to the distal surfaces of the maxillary second deciduous molars or the second permanent premolars was used.[7] It is shown in Figure 1, B.
c) Total length of the mandibular arch (mm): the distance between the tangent lines to the labial surfaces of mandibular central incisors and a tangent to the distal surfaces of the mandibular second deciduous molars or the second permanent premolars.[7] It is shown in Figure 1, C.
2- Vertical dimension
a) Overbite (mm): A point was marked at the lower incisor labial face, tangent to the upper incisor incisal border. The distance between them was measured to obtain the overbite.[6] It is shown in Figure 2, A.
b) Total depth of the palatal vault (mm): distance between the line joining the tips of the mesiobuccal cusps of the maxillary first permanent molars and a point along the median raphe (greatest palatal depth) was measured using a plastic ruler, which was placed on the tips of the mesiobuccal cusps of the maxillary first permanent molars.[7] The ruler had a hole at its center, and the vernier passed through the hole to the median raphe, as shown in Figure 2, B.

Table 1: Palatine tonsil hypertrophy classification according to the criteria of Brodsky and Koch.

Grade	Definition
0	Tonsils are limited to the tonsillar fossa
1	Tonsils occupying up to 25% of the space between the anterior pillars in the oropharynx
2	Tonsils occupying 25%-50% of the space between the anterior pillars
3	Tonsils occupying 50%-75% of the space between the anterior pillars
4	Tonsils occupying 75%-100% of the space between the anterior pillars

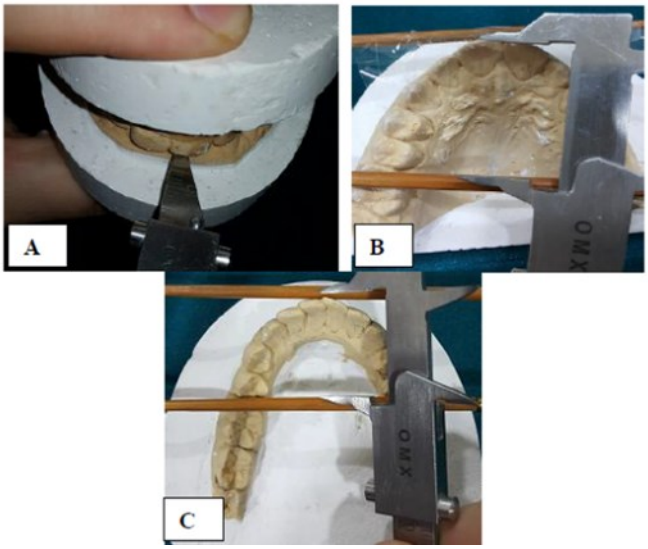

Figure 1: Sagittal dimensions; A, Overjet, B, Total length of the maxillary arch, C, Total length of the mandibular arch.

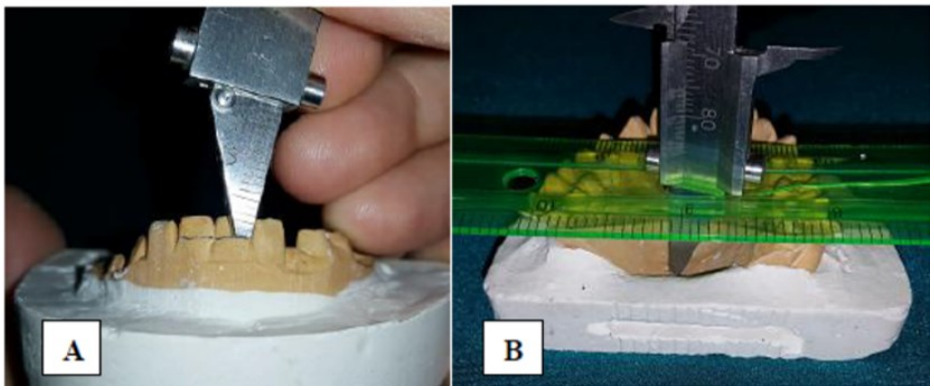

Figure 2: Vertical dimensions; A, Overbite, B, Total depth of the palatal vault

3- Transversal dimension

a) Maxillary inter-canine width (mm): Obtained by placing the tips of the vernier on the maxillary canines and measuring the distance between the cusp tip of the canine on one side to the cusp tip of the contra lateral canine. [7] This is shown in Figure 3, A.

b) Mandibular inter-canine width (mm): Obtained by placing the tips of the vernier on the mandibular canines and measuring the distance between the cusp tip of the canine on one side to the cusp tip of the contra lateral canine.[7] This is shown in Figure 3, B.

c) Maxillary inter-first molar width (mm): obtained by measuring the distance between the tips of the mesiobuccal cusps of the maxillary right and left first permanent molars using vernier.[7] This is shown in Figure 3, C.

d) Mandibular inter-first molar width (mm): obtained by measuring the distance between the tips of the mesiobuccal cusps of the mandibular right and left first permanent molars using vernier.[7] This is shown in Figure 3, D.

e) Maxillary inter-first premolar width or inter-first deciduous molar width (mm): obtained by measuring the distance between the tips of the mesiobuccal cusps of the maxillary right and left first premolars or the first deciduous molars using vernier.[7] This is shown in Figure 3, E.

f) Mandibular inter-first premolar width or inter-first deciduous molar width (mm): obtained by measuring the distance between the tips of the mesiobuccal cusps of the mandibular right and left first premolars or the first deciduous molars using vernier.[7] This is shown in Figure 3, F.

g) Ratio of mandibular first molar width/ maxillary first molar width (%)

h) Ratio of mandibular first premolar width/ maxillary first premolar width or ratio of mandibular first deciduous molar width/ maxillary first deciduous molar width (%).

4. Vertical and transversal dimensions

The ratio of the depth of the palatal vault/ maxillary inter-first molar width (%).

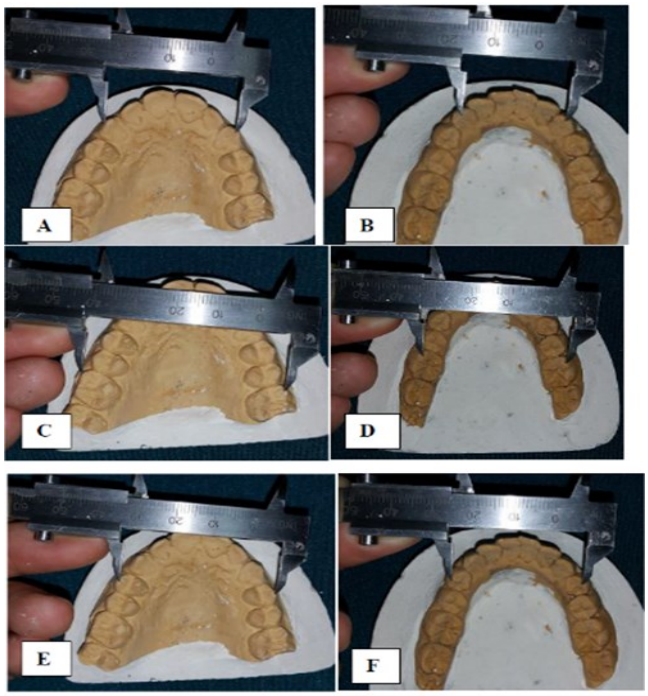

Figure 3: Transversal dimensions; A: Maxillary inter-canine width, B: Mandibular inter-canine width, C: Maxillary inter-first molar width, D: Mandibular inter-first molar width, E: Maxillary inter-first premolar width, F: Mandibular inter-first premolar width.

Statistical Analysis

Data processing and statistical analysis were undertaken using Statistical Packages for Social Sciences (SPSS) program version 22.

Results

Three hundred students, 160 students males (53.3%) and 140 females (46.7), were included in this study.

According to the palatine tonsils grade, five groups were distributed throughout the sample, as shown in table 2. Accordingly, G1 tonsils had the highest percentage (49.7%) with a sample size of 149 students, while G4 had the lowest percentage (5.7%) with a sample size of 17 students.

Correlation between age and tonsillar grade

Table 4 shows a non-significant negative correlation between the age of the patients and their tonsil grades (P-value = 0.396; Rho = -0.049).

The correlation coefficient between quantitative dental arch parameters and tonsillar grade

For the assessment of quantitative dental arch parameters which is shown in table 5, Spearman's rank correlation test is used. In the sagittal dimension, there was no significant correlation between the dental variables (total lengths of the maxillary and mandibular arches) and tonsillar grade, while there was a significant and positive correlation between overjet and tonsillar grade (Rho= 0.165, P= 0.004). However, in the vertical plane, there was no significant correlation between the dental variables (overbite and Total depth of the palatal vault) and tonsillar grade.

Transversely, none of the dental variables was significantly related to tonsillar grade. The combination of vertical and transverse dimensions shows a ratio of the total depth of the palatal vault to maxillary inter-first molar width that was non-significantly correlated to tonsillar grade (P = 0.145).

In (table 2) we can see normality test for data distribution that is conducted for each group, and mostly all of them can be seen underly-

Table 2: Distribution of the palatine tonsils grade throughout the sample

Tonsil Grades	Frequency	%
G0	24	8.0
G1	149	49.7
G2	61	20.3
G3	49	16.3
G4	17	5.7

Table 4: Correlation coefficient between age and tonsillar grade (n = 300)

Parameter	Grade (0, 1,2,3,4)	
	Rho	P-value
Age	- 0.049	0.396

Table 5: Correlation coefficient between quantitative dental arch parameters and tonsillar grade (Spearman's rank correlation test) (n = 300)

Variable	Grade (0, 1,2,3,4)	
	Rho	P-value
Sagittal dimension		
Overjet (mm)	.1650	.0040
Total length of the maxillary arch (mm)	.1020	.0790
Total length of the mandibular arch (mm)	.0200	.7320
Vertical dimension		
overbite (mm)	.0930	.1090
Total depth of the palatal vault (mm)	.0810	.1630
		Transversal dimension
Maxillary intercanine width (mm)	.0020	.9750
Mandibular intercanine width (mm)	.0840	.1470
Maxillary interfirst molar width (mm)	-0.066	.2530
Mandibular interfirst molar width (mm)	-0.004	.9510
Maxillary interfirst premolar width or interfirst deciduous molar width (mm)	-0.083	.1520
Mandibular interfirst premolar width or interfirst deciduous molar width (mm)	0.036	.5370
Ratio of mandibular first molar width/ maxillary first molar width (%)	0.094	0.091
Ratio of mandibular first premolar width/ maxillary first premolar width or ratio of mandibular first deciduous molar width/ maxillary first deciduous molar width (%)	.0970	.0930
Vertical and transversal dimensions		
Ratio of the depth of the palatal vault/maxillary interfirst molar width (%)	.0840	.1450

Relation between qualitative dental arch parameters and tonsillar grade

For assessing qualitative dental arch parameter, the Chi-Square test is used which is illustrated in table 6. In this assessment, comparison according to tonsillar grade show a significant difference from Angle's molar relationship (P = 0.012). The strength of the associate assessed by the phi coefficient (□) was equal to 0.222.

The remaining parameters (Angle's canine relationship, Open bite, Deep bite, Normal overbite, Posterior crossbite without lateral deviation, posterior crossbite with lateral deviation and normal transverse occlusion) showed non-significant relation to the tonsillar grade.

Angle Class I canine relationship had the highest percentage (37%) among students with G1 tonsil size and the lowest percentage (4.33%) among students with G0 and G4 tonsil size. Angle Class II canine relationships are found mostly in G1 tonsil size (11.3%) and the lowest percentage in G4 tonsil size (1.33%), while the highest percentage of Angle Class III canine relationship is found in students with G0 and G1 tonsil size (1.33%) and the lowest percentage (0%) in G4 tonsil sized students.

Angle Class I molar relationship scored the highest percentage (38%) among students with G1 tonsil size and the lowest percentage (4%) among students with G4 tonsil size. Angle Class II molar relationship scored the highest percentage (10.3%) among students with G1 tonsil size and the lowest percentage (1.33%) among students with G4 tonsil size. Angle Class III molar relationship was found with the highest percentage (1.67%) among students with G0 tonsil size and the lowest percentage (0.33%) among students with G3 and G4 tonsil size.

Table 6: Association between qualitative dental arch parameters and tonsillar grade

Parameter		Tonsil Grade											
		G0		G1		G2		G3		G4		Chi-Square test	
		N	%	N	%	n	%	n	%	N	%	φ Phi( )	P
Angle Class canine relationship													
Canine	I	13	4.33	111	37.0	44	14.67	32	10.67	13	4.33	0.222	0.063
	II	7	2.33	34	11.3	14	4.67	16	5.33	4	1.33		
	III	4	1.33	4	1.3	3	1.00	1	0.33	0	0.00		
Angle Class molar relationship													
Molar	I	13	4.33	114	38.0	47	15.67	33	11.00	12	4.00	0.255	0.012
	II	6	2.00	31	10.3	11	3.67	15	5.00	4	1.33		
	III	5	1.67	4	1.3	3	1.00	1	0.33	1	0.33		
Open bite	No	23	7.67	144	48.0	57	19.00	46	15.33	17	5.67	0.089	0.695
	Yes	1	0.33	5	1.7	4	1.33	3	1.00	0	0.00		
Deep bite	No	17	5.67	129	43.0	52	17.33	37	12.33	15	5.00	0.147	0.168
	Yes	7	2.33	20	6.7	9	3.00	12	4.00	2	0.67		
Normal overbite	No	8	2.67	28	9.3	13	4.33	14	4.67	2	0.67	0.129	0.286
	Yes	16	5.33	121	40.3	48	16.00	35	11.67	15	5.00		
PCWOL	No	22	7.33	145	48.3	58	19.33	46	15.33	16	5.33	0.090	0.657
	Yes	2	0.67	4	1.3	3	1.00	3	1.00	1	0.33		
PCWL	No	23	7.67	147	49.0	58	19.33	48	16.00	16	5.33	0.103	0.532
	Yes	1	0.33	2	0.7	3	1.00	1	0.33	1	0.33		
NTO	No	3	1.00	6	2.0	6	2.00	4	1.33	2	0.67	0.124	0.332
	Yes	21	7.00	143	47.7	55	18.33	45	15.00	15	5.00		

Discussion

This study revealed a non-significant negative correlation between the age of the students and tonsillar grade (P= 0.396; rho= - 0.049): the older the student, the lower the grade. This phenomenon is physiologically normal because the volume of the palatine tonsils normally decreases with age. Kozak has shown that atrophy of the tonsils begins after age ten years, and ends at adulthood.[8]

In a similar study by Diouf et al., which included 80 subjects of both genders with their age ranging between 6-12 years, there was a significant negative correlation between the age of the patients and the tonsillar grade (P= 0.009; rho= - 0.29).[1] This difference may be due to the wider age range they included in their study while the tonsils of the students in this study were closer to being at their maximum size.

In the assessment of the quantitative dental arch parameters and tonsillar grade, sagittally, there was a significant and positive correlation (P = .0040, rho= 0.165) between the overjet and the tonsillar grade; the greater the tonsillar grade, the larger overjet was found.

The increase in the grade corresponds to that of the space occupied by the tonsils between the anterior pillars of the oropharynx. Patients with this type of obstructive tonsillar hypertrophy can have low tongue position, enabling them to perform substitute mouth breathing and upper arch constriction, making them more susceptible to an increase in overjet.[9]

However, this result is not similar to that of Diouf et al., which found no significant relation between tonsillar grade and the overjet (p = 0.819), and this difference may be due to the difference between the sample size and the age of the included cases in their study.[1]

In another study by Lopatienė and Babarskas, about Malocclusion and upper airway obstruction on 49 subjects with age ranging from 7- 15 years, the results showed that overjet of 0-3.5 mm was detected in 87.5% of healthy children, in 36.1% of children with 1st or 2nd degree adenoids, and in 37.5% of subjects with other nasal or nasopharyngeal pathologies. Overjet of 3.5-6 mm was found in 28.1% of children with 1st or 2nd degree adenoids and in 18.7% of subjects with a deviated nasal septum or chronic rhinitis. Overjet of over 6 mm was detected in 12.5% of healthy children, in 36.1% of patients with 1st or 2nd degree adenoids, and in 43.7% of subjects with other nasal or nasopharyngeal anomalies.[10]

In assessing of qualitative dental arch parameters in the sagittal dimension, Angle's molar relationship showed a significant difference according to the tonsillar grade. Grade 1 students were significantly more likely to have Class I molar relationship than were students of another grade (P = 0.012). This result was in agreement with that of Diouf et al., which also found a statistically significant relation between Angle's molar relationship and the tonsillar grade (p-value = 0.015).[1] This result means that when a person has normal-sized palatine tonsil, Angle's molar relationship will be more towards normalcy. The relation of open bite, deep bite and the posterior crossbite did not show any significant relation with the tonsillar grade, i. e., tonsillar hypertrophy didn't cause open bite, deep bite, or posterior crossbite, and this result was also found by Souki et al., who stated that there was no significant association between the type of the obstruction (adenoids/tonsils obstructive hyperplasia or the presence of allergic rhinitis) and malocclusions (class II, anterior open bite and posterior crossbite).[11]

These results were inconsistent with that found by Nunes and Di- Francesco, who researched one hundred fourteen children ranging in age from 3 to 12 years. They didn‘t find a statistically significant association between the vertical relationship (normal overbite, open bite, and deep bite) and the site of pharyngeal lymphoid tissue

obstruction due to tonsil and adenoid enlargement (P = 0.83). They also observed a high prevalence (mean, 36.8%) of posterior crossbite in all groups, but this result didn't show a statistically significant association between a dental occlusion transverse relationship and the degree of tonsil enlargement (P = 0.81).[12]

While a study by Oulis et al., which was conducted on 120 children who displayed hypertrophied adenoids with or without enlarged tonsils, showed that 47% of the children examined, had developed a posterior crossbite. The presence of crossbite was high in children with severe airway obstruction, particularly in those with hypertrophied adenoids and tonsils.[13]

Conclusions

Within the limitation of this study, it was concluded that:

1. Significant and positive relation between Angle's molar relationship, overjet and palatine tonsil size.
2. Direct relation between the severity of malocclusion and tonsil grading.

Conflict of interest

The author reported no conflict of interests.

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