

Masseter muscle thickness and dental arch widths

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Abstract

Aim: The purpose of this study was to evaluate the relationship between the ultrasonographic thickness of masseter muscle and the width of dental arches.

Materials and Methods: The sample comprised of 44 persons (22 males, 22 females), who did not undergo orthodontic treatment and they had at least 28 teeth with CL 1 occlusion. The thickness of the masseter muscle was measured ultrasonographically with the muscles both in relaxation and under contraction. Maxillary and mandibular inter-molar and inter-canine width were measured with a digital caliper for the distance between the palatal surfaces of the permanent first molar and cingulums of canines.

Results: There was a significant association between mandibular inter-molar width and sex ($PV=0.037$). Masseter muscle thickness in both sides and either in relaxation or contraction showed a direct significant association with sex ($PV=0.001$). Maxillary inter-molar and inter-canine and mandibular inter-canine width showed a direct significant association with masseter thickness during contraction in right side ($PV=0.037$), whereas in relaxation no statistically significant relationship was found ($PV=0.07$).

Conclusions: The findings of this study indicated that the thickness and functional capacity of the masseter muscle may be considered as one of the factors influencing the width of the maxillary dental arch and inter canine mandibular dental arch width.

Key Words: Masseter muscle, Dental arch width, Ultrasonography
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Various studies have proven an association between the functional capacity of the masticatory muscles and craniofacial morphology.

Individuals with a short facial configuration in comparison with individuals with a long facial configuration have a higher electromyography activity.¹

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Also in their in vivo studies they found a negative relation between masticatory muscles and having a high electromyography activity.²

Kiliardis et al 1991³ and Radshir et al. 1995⁴ presented the same reports of association between masticatory muscle thickness and craniofacial width which seems that individuals with thick masticatory muscles (masseter and internal pterygoid) have thicker facial configuration.⁴⁻⁶ We expect there is a similar association between masticatory muscle and dental arch width.

Other studies on dry skulls of modern Japanese males showed that the lower molars were more lingually inclined in skulls with a long facial configuration.⁷ However, the role of the masticatory

muscles in transverse width of the dental arches is not clear.

Masseter muscle is an important muscle of the face, which is located on the external branch of maxilla and it brings the mandible up, so that it can help the teeth to be close for mastication.⁸

One of the methods of measuring the thickness of masticatory muscles is the sonographic method, which is performed by use of ultrasonic waves of more than 20 kilometers frequency. The basis of image formation in ultrasonic devices is resonance and return of waves from body organs. One of the benefits of ultrasonic would be its low cost and that the patients don't receive any dangerous Rays and working with it is easier and recursive.⁹ The purpose of this study was to determinate the relation between the thickness of masseter muscle which is estimated by ultrasonic methods and the widths of dental arches.

Introduction

Various studies have proven an association between the functional capacity of the masticatory muscles and craniofacial morphology.

Individuals with a short facial configuration in comparison with Individuals with a long facial configuration have a higher electromyographic activity.¹ Also a negative relation between masticatory muscles thictiness and increase in electromyographic activity.²

Kiliardis et al 1991³ indicated and Radshir et al. 1995⁴ presented the same reports of association between masticatory muscle thickness and craniofacial width which seems that individuals with thick masticatory muscles (masseter and internal petrygoid) have wider facial configuration.^{4,6} We expected that there was a similar association between masticatory muscle and dental arch width.

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Methods and material

The sample of the present study comprised of 44 students of Islamic Azad University of Khorasgan (22 males and 22 females) who did not underwent orthodontic therapy and they had at least 28 teeth and their occlusion was CLI and they didn't have transverse vertical problems such as posterior cross-bite ultrasonic images were taken from their masseter muscle in both sides in both positions of relaxation and contraction.

The unit which used was Hitachi (EUBUOS) with linear array probe (7.5 M H2), the imaging and measurings were performed for three times and the average was measwred. The patients sot in an upright position and their heads were in a natural position.

For measurement of maxillary and mandibular arch width, alginate impressions were taken from all subjects and models were cast in dental stone. Inter-molar and inter-canine width were measured with an electronic caliper for the distance between the palatal surfaces of the first permanent molars and cingulumes of canines. For estimating the association between the thickness of masseter muscle and the width of dental arch we used Pearson correlation.

Independent test were to show an association between:

- 1-Maxillary and mandibular arch width with masseter muscle thickness.
- 2-Masseter muscle thickness with sex.
- 3-Width of inter-molar and canine with sex.

Results

Inter canine width showed no association with sex according to independent T-test (Table 1). There was a significant association between mandibular inter-molar width and sex (Table 2). Masseter muscle thickness in both sides and either in relaxation or contraction showed a direct, significant association with sex. The masseter muscle was thicker in males. Maxillary inter-molar and inter-canine width showed a direct significant association with masseter thickness during contraction, in the right side, whereas in relaxation no statistically significant relationship was found (Table 1). In the left side there was no association between maxillary inter-molar and inter-canine width and masseter muscle thickness in either relaxation or during contraction (Table 1).

In the mandible, inter canine width was related to masseter thickness in relaxation and contraction in the right side, where as there was no association between inter canine width and masseter thickness in the left side. Mandibular inter molar width was related to masseter thickness in relaxation and contraction in the right side, whereas there was no association between inter-canine width and masseter thickness in the left side. Mandibular inter-molar width was not related to masseter thickness either in relaxation or during contraction. (Table 1)

Discussion

Association between masseter muscle, biting force and morphology of the face has been accepted.¹⁰ Toxeen and Beek in 1999 reported that the power of biting in males is more than females. And the thickness of masseter muscle in males is more than females but on the other hand the facial height of males is less than females.¹¹

In order to assign the significant effect of functional and non-functional matrix in growth and development of the head and face, the importance of the function of masticatory muscles will be necessary for the development of dental arch especially on transverse aspects.^{12,13}

As the result of this study shows the thickness of masseter muscle on both sides in relaxation and contraction in males are more than females according to Radshir and Kiliardis³ and Toxeen¹¹ and Bake¹⁴. The findings of this study indicated that the thickness and functional capacity of the masseter muscle may be considered as one of the factors influencing the width of the maxillary and mandibular dental arch width.

Table 1: Comparison of inter canine & molar arch width in male & female subjectse.

	Mean	S.D	Min	Max	t.test		
					t	P value	
Inter canine width in maxilla	Male	28/8	2/6	22/6	33/4	1/01	0/16
	Female	28/03	2/2	22/6	31		
Inter canine width in mandible	Male	23/1	1/2	21/1	26/6	1/41	0/082
	Female	22/5	1/7	19/3	27/7		
Inter molar width in maxilla	Male	43	3/34	37	53/3	1/52	0/066
	Female	41/5	2/8	35	46/5		
Inter molar width in mandible	Male	37/6	2/7	31/7	44	1/83	0/037
	Female	36/2	2/7	3/02	41/1		

Table2: Comparison of masseter muscle thickness in both side in rest and during contraction in male & female

		Mean	S.D	Min	Max	t.test
		t				
Right side in rest	Male	12/15	1/7	9/5	16/1	3/37
	female	10/3	1/9	7/9	14/36	
Left side in rest	Male	11/8	1/7	9/3	15/5	3/91
	female	10/14	2/03	7/1	14/26	
Right side during contraction	Male	15/2	1/8	12/2	19/23	4/07
	female	13/06	1/7	11/1	16/84	
Left side during contraction	Male	14/74	1/9	11/9	18/9	3/8
	female	12/42	2/14	9/13	17/25	

Kiliaridis and Lana Gogia Kaki in 2003², determined the association between the masseter muscle and the width of maxillary arch and their result shows that the width of maxillary arch in female has direct relation with the thickness of masseter muscle in both position of relaxation and contraction. But there was no association shown in male group. The results of this study showed a difference between two sides indicated right side being more powerful this physiologic asymmetry in human face.

The correlation of inter-canine width and the thickness of masseter muscle on right side in relaxation and contraction was significant.

Conclusion

The findings of this study indicated that the thickness and functional capacity of the masseter muscle may be considered as one of the factors influencing the width of the maxillary dental arch (inter-molar and inter-canine) and inter-molar mandibular dental arch width.

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