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Mesiodistal width of permanent teeth and Bolton index in normal occlusion versus class 1 crowding

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Abstract:

Aim: Malocclusion may be caused by tooth size discrepancy and it is impossible to achieve perfect treatment results without regarding this etiologic factor .The aim of present study was to determining and comparing the mesiodistal width of permanent teeth in normal occlusion group and patients with class 1 crowding malocclusion in Hamedan .

Material and Method: Based on Andrews normal occlusion criteria among 3335 students of Hamedan pre-university schools , 32 persons were selected as normal group .In matched sex and range of age , 32 patients with class 1 crowding malocclusion were selected from a private office . Orthodontic dental casts of all samples were prepared . Mesiodistal width of all teeth (except 2nd molars) , overbite , overjet and Bolton indices were measured 3 times . Student t test and Mann whiteny u test were used for analysis .

Results: In crowding group the mesiodistal width of all teeth except for the first molars , were significantly greater than normal group specially in upper lateral incisors and lower premolars . Maxillary tooth material was 5.3 millimeter (p=0.0005) and mandibular tooth material was 5.4 millimeter (p=0.0036) greater in crowding patients . In crowding patients , overjet was significantly less and overbite was significantly more than normal group (p=0.0001) .

There was not significant difference in Bolton index between 2 groups .

Conclusion: It seems there is more crowding tendency in cases with large teeth . According to results , Bolton discrepancy (tooth size discrepancy) cannot be considered as a frequent factor in developing class 1 crowding . (IJO 2006; 1: 66 - 69)

Key words: Orthodontics , Occlusion , Malocclusion , Crowding
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Introduction

The goals of orthodontics are to establish a stable occlusal relationship with physiologic function and acceptable esthetics . It is impossible to achieve these goals without correct diagnosis of malocclusion and its etiologic factors. Malocclusion may be caused by tooth size discrepancy and precise analysis of tooth size is important to achieve perfect treatment results [1]. J. V. Black (1902) was one of the first fellows that regarded tooth size and according to a wide group he determined mean size of each permanent tooth [2] .Young in 1923 reported that tooth size discrepancy can produce overbite problems . Bolton in 1958, considering 55 ideal occlusion, described a ratio between upper and lower tooth material as Bolton index and resulted that any deviation can cause malocclusions such as increasing or decreasing in overjet , overbite , spacing or crowding in one arch [2] . Crosby et al (1989) after evaluating different malocclusions (cl 1 , cl 1 surgery , cl 2 div 2 , cl 2 div 1) reported there was no difference in Bolton index between these groups [3] . Howe et al in 1983 evaluated tooth size in patients with severe crowding versus non-crowded ones and founded no difference between 2 groups [4] . Freeman et al in 1996 evaluated patients of post-graduate students and reported 30 % tooth size discrepancy in these cases [5] .

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Table.1. mean , SD , min. , max. , phi coefficient of 28 variables in 2 groups

variable	Normal group					CI 1 crowding					P value
	mean	SD	Min.	Max.	Phi	mean	SD	Min.	Max.	phi	
U.R. M^1	9.77	0.57	8.68	11.24	0.967	9.95	0.53	8.91	11.29	0.948	0.21
U.R. P^2	6.39	0.31	5.69	7.04	0.939	6.75	0.44	5.61	7.76	0.958	*0.000
U.R. P^1	6.76	0.37	6.06	7.69	0.974	7.10	0.45	6.33	7.97	0.983	*0.001
U.R. C	7.50	0.50	6.63	8.48	0.976	7.81	0.43	6.80	8.58	0.957	*0.017
U.R. I^2	6.65	0.63	5.37	8.21	0.993	7.17	0.43	6.35	8.02	0.978	*0.000
U.R. I^1	8.50	0.48	7.51	9.42	0.984	8.91	0.59	8.01	10.92	0.994	*0.003
U.L. I^1	8.41	0.50	7.38	9.50	0.989	8.81	0.50	7.80	10.45	0.986	*0.002
U.L. I^2	6.63	0.62	5.52	8.64	0.956	7.17	0.58	6.17	8.64	0.991	*0.000
U.L. C	7.54	0.48	6.68	8.55	0.986	7.80	0.41	6.86	8.64	0.979	*0.023
U.L. P^1	6.79	0.38	5.91	7.71	0.972	7.06	0.44	6.30	8.55	0.984	*0.013
U.L. P^2	6.38	0.37	5.66	7.38	0.953	6.72	0.46	4.74	7.75	0.921	*0.002
U.L. M^1	9.79	0.58	8.75	11.18	0.949	9.95	0.55	8.56	11.60	0.950	0.365
L.R.. M^1	10.73	0.72	9.19	12.20	0.988	11.07	0.58	9.93	12.45	0.990	*0.043
L.R. P^2	6.87	0.36	5.88	7.78	0.956	7.28	0.41	6.65	8.00	0.970	*0.000
L.R. P^1	6.80	0.45	6.06	7.98	0.981	7.24	0.35	6.68	8.27	0.981	*0.000
L.R. C	6.52	0.47	5.52	7.68	0.983	6.82	0.34	5.80	7.45	0.978	*0.004
L.R. I^2	5.76	0.40	5.02	6.79	0.952	6.17	0.35	5.44	6.96	0.986	*0.000
L.R.I^1	5.26	0.35	4.49	5.99	0.969	5.59	0.29	5.01	6.18	0.976	*0.000
L.L. I^1	5.21	0.33	4.54	5.89	0.974	5.58	0.31	5.04	6.22	0.979	*0.000
L.L. I^2	5.76	0.45	4.72	6.97	0.993	6.15	0.34	5.48	6.73	0.984	*0.000
L.L. C	6.51	0.45	5.71	7.71	0.980	6.81	0.38	6.01	7.72	0.969	*0.004
L.L. P^1	6.73	0.43	5.98	7.78	0.988	7.27	0.43	6.43	8.23	0.984	*0.000
L.L. P^2	6.74	0.34	5.97	7.36	0.955	7.15	0.38	6.26	8.07	0.910	*0.000
L.L. M^1	10.70	0.75	9.08	12.23	0.992	10.96	0.65	9.70	12.78	0.941	0.146
Overjet	1.59	0.70	0.50	4.00	0.937	2.52	1.74	0.50	8.00	0.986	*0.000
Overbite	2.90	1.02	1.13	5.50	0.970	2.33	1.51	0.32	5.77	0.992	*0.000
Ant. Ratio	77.4	2.30	69.3	81.4	----	77.9	2.47	72.4	82.3	----	0.434
Total ratio	91.7	1.85	84.1	94.5	----	92.5	2.16	87.6	95.6	----	0.103

* significant difference

U.R. , U.L , L.R. , L.L. , means upper right , upper left , lower right , lower left respectively.

I^1 , I^2, C , P^1 , P^2 , M^1 are equal to central incisor , lateral incisor , canine , 1st premolar , 2nd premolar , 1st molar respectively .

The aim of present study was to determine and compare the mesiodistal width of permanent teeth in normal occlusion group and patients with class 1 crowding malocclusion in Hamedan .

Materials and Method

According to statistical analysis , 32 cases were selected for each group with the age between 17 - 20 . The inclusion criteria for normal occlusion group that were selected among 3335 students in pre-university schools of Hamedan were :
1 - symmetric face and harmonic upper - middle -lower face relation , 2 - full intact permanent dentition without proximal caries , 3 - normal occlusion according to 6 keys of Andrews , 4 - without crowding or maximum crowding less than 1 mm , 5 - without history of orthodontic or surgical treatment . In matched sex and range of age , 32 patients with class 1 crowding malocclusion were selected from a private office .The inclusion criteria were :
1 - similar with normal group in definitions 1 , 2 and 5 , 2 - skeletal and molar class 1 , 3 - crowding more than 4 mm .
Orthodontic dental casts of all samples were prepared . With the aid of digital boley gauge , 28 variables (mesiodistal width of 24 teeth (except 2nd molars) , overbite , overjet and Bolton indices) were measured 3 times . For each variables mean , standard deviation , maximum , minimum and Phi coefficient were calculated then student t test and Mann Whiteny u test were used for statistical analysis .

Results

In present study, sex and age of 2 groups was similar . There were 16 boys and 16 girls in each group with mean age 18y,9m±1y,2m for normal and 18y,3m±1y,3m for crowding group .
The mesiodistal width of each tooth in crowding group was significantly greater than normal group except in first molars (table 1) . Also in crowding group total teeth materials of upper arch was 5.3 millimeter (p=0.0005) and of lower arch was 5.4 millimeter (p=0.0036) more than normal group. In crowding patients, overjet was significantly less and overbite was significantly more than normal group (p=0.0001).
There was not significant difference in Bolton index between 2 groups (table 2).

Discussion

The range of Phi coefficient was between 0.939-0.993 in normal and 0.921-0.992 in crowding group that indicates the high reproducibility of findings .
In this study the mesiodistal width of teeth of crowding group was greater than normal group , it means crowding is more probable in one who has large teeth . This result was achieved by Doris et al. in 1981 . They found larger teeth in cl 1 or 2 crowding patients [6] . Howes et al. in 1983 did not find any difference in tooth size between patients with and without crowding , they resulted that the arch dimensions is a main factor in crowding [4]. Crosby et al (1989) after evaluating 109 patients with different malocclusions (cl 1 , cl 1 surgery , cl 2 div 2 , cl 2 div 1) reported there was no difference in tooth material and Bolton index among these groups [3] .
It seems tooth size has no significant difference among different malocclusions, however in class 1 malocclusion when compared with normal occlusion , the teeth have significantly larger sizes .
In present study, Bolton indices (anterior and total ratio) were not different between 2 groups . It indicates tooth size discrepancy (Bolton discrepancy) cannot be considered as an important cause of crowding . Also these ratios were not different with standard of Bolton`s except for total ratio of crowding group that diverse variations in lower second premolar can cause this result . In spite of larger tooth size in crowding cases it was not shown that tooth size discrepancy be a frequent factor . The size of teeth is under control of multiple factors : genetics , race , duration of fetal period , birth weight , mother `s hormonal condition during pregnancy , ... whereas the relationship between upper and lower

Table.2. Anterior and total ratio in 2 groups compared with Bolton `s standard

	Anterior ratio	SD	Total ratio	SD
Bolton standard	77.2	1.7	91.3	1.9
Normal group	77.4	2.3	91.7	1.8
CL1 crowding	77.9	2.4	92.5	2.1
Pvalue Bolton-Normal	0.574		0.343	
Pvalue Bolton-Crowd	0.109		*0.006	

tooth size can be independent of these factors [7,8] .

Conclusion

1 - Patients with crowding have larger teeth than normal . In these cases tooth material in upper arch was 5.3 mm and in lower arch was 5.4 mm more than normal group , then it seems there is more crowding tendency in cases with large teeth .

2 - According to results , the relationship between lower and upper tooth material in both groups were normal , then Bolton discrepancy (tooth size discrepancy) cannot be considered as a frequent factor in developing class 1 crowding .

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