Lateral Incisors Ratio as a Substitute for Bolton Index

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ABSTRACT

Aim: An appropriate occlusal relationship, when there is a significant tooth size discrepancy between the lower and upper dental arches, is impossible. In this way, it is necessary to assess the Bolton's anterior and overall ratios. But it seems too difficult to Measure 24 teeth for each patient routinely. In this research our aim was to find an appropriate substitute for the Bolton ratio.

Material and Methods: One hundred pairs of dental casts were selected and the mesiodistal width of each tooth was measured by a sharpened gauge. Then correlation between lateral ratio (mesiodestal width of lower lateral incisors/ upper lateral incisors) and Bolton's anterior ratio (AR) and overall ratio (OR) was evaluated by paired T test and regression models.

Results: Mean overall ratio was 91:3 %, anterior ratio 79.0% and lateral ratio 88.4%correspondingly. No significant difference was found between males and females. A well correlation was found between LR and AR (r=0.70) and OR.

Conclusion: Strong correlation between LR and AR and OR was established. Mean value of 88.4% for LR was correspondent to normal Bolton ratios. (IJO 2006; 1: 53 - 57)

Key words: Lateral incisors ratio, tooth size discrepancy, occlusal relationship.
(Received: Nov.11,2005; Revised and accepted Feb.28,2006)

Introduction:

In some patients orthodontic treatments results in a nonco-ordinate occlusal relationship even if there is a good intra-arch alignment and appropriate molar relationship. Gilpatrick [1] found that cumulative tooth material of upper arch must be 8-12 mm more than lower arch and non equal size of counterpart teeth in two quadrant of each dental arch can be a potential cause of discrepancies. Neff [2] and - some years later - Lundstrom [3] offered indices for inter - maxillary tooth size relationship.

Bolton [4] in 1958 in a study on 55 dental casts with excellent occlusion found that an identical ratio is necessary to obtain a good occlusal harmony. He showed [5] that anterior ratio (sum of mesio-distal width of six lower anterior teeth divided to the same sum in upper anterior teeth) should be about 77 % and over all ratio (sum of mesio-distal width of twelve lower teeth divided to the sum of mesio-distal width of twelve upper teeth) of each dental arch 91 %.

Stifter [6] confirm these results; but Lavelle [7] showed that these ratios are different between sexes and dental malocclusions as did Arya [8] and Sperry [9] some years later.

Crosby and Alexander [10] in 1989 did not accept these finding

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and they showed large variation for Bolton ratios in each malocclusion group.
Freeman and his colleagues [11] recommended calculating Bolton index for all patients. Because of great range of these indices among them.
Rudolph and his coworkers [12] in 1998 focused on labio lingual dimension of incisors and its effect on anterior relationship of dental arches. They found that Bolton analysis is not enough to predict the occlusal relations after treatment.
Smith and his coworkers [13] have shown that the most discrepancy in tooth size among patients are related to lower second bicuspids and then upper lateral incisors, upper first bicuspids and central incisors.
The main goal of this study was to look for a simple and practical method to assess the inter maxillary tooth - size discrepancy.In practice lateral incisors seem to be good indicators for overall tooth size relationship due to their variation in size.

Materials and Method:

In this retrospectie study dental casts of patients referred to Mashad dental school and a private office were evaluated and 100 casts were selected to fit the following criteria:
1- All teeth anterior to first molars were erupted.
2- Dental casts had good quality with no defect, no dental proximal caries or tooth fracture.
3- Hypoplastic teeth or any other dental anomalies were excluded.
4- No previous orthodontic treatment.
5- To minimize occlusal or inter proximal attrition younger patients were selected.
Mesiodistal width of twelve teeth in each dental arch was measured by sharpened Boley gauge with accuracy of 0.1mm.
Laterals ratio (LR) was calculated by dividing the mesio distal width of lower lateral incisor to the upper one, Anterior and over all ratios in each patient was measured too.
SPSS statistical software was used to compare the correlations of these ratios in different sexes and dental malocclusions.

Results:

76 female and 24 male in the range of 12 to 31 years were selected. The mean age of subjects was 17.5 years.
Mean of over all ratios (OR) was 91.3%, anterior ratio (AR) 79.0% and lateral's ratio (LR) 88.4%. (Table 1)
Mean of OR in females was 91.5 and in males 90.4 which was not significantly different. AR had no significant differ-

Table .1. Statistical Values of Lateral's, Anterior and Overall ratios

	MBean	SD	S.E. M	CV	Range	Minimum	Maximum
O.R	91.3	3.2	0.32	3.5	13.7	83.4	97.1
A. R	79.0	3.7	0.37	4.7	2.7	66.0	91.8
A. R	79.0	3.7	0.37	4.7	2.7	66.0	91.8

Table .2. Statistical Values of Lateral's, Anterior and Overall ratios

O. R	Mean	SD	S.E. M	CV	Range	Minimum	Maximum
Male	90.4	3.2	0.65	3.5	13.5	83.4	96.9
Female	91.5	3.1	0.36	3.4	13.0	84.1	97.1
A. R	Mean	SD	S.E. M	CV	Range	Minimum	Maximum
Male	78.1	3.9	0.80	5.0	19.4	66.0	85.4
Female	79.3	3.7	0.4	4.7	19.7	72.1	91.8
L. R	Mean	SD	S.E. M	CV	Range	Minimum	Maximum
Male	87.8	7.6	1.6	8.7	33.3	66.7	100.0
Female	88.6	7.7	0.88	8.7	34.0	75.0	109.0

Table .3. Statistical Values of Lateral's, Anterior and Overall ratios in different groups of malocclusions

O. R	Mean	SD	S.E. M	CV	Range	Minimum	Maximum
CL 1	92.3	3.1	0.46	3.4	12.4	84.7	97.1
CL 2	89.6	3.0	0.49	3.4	12.4	83.4	95.8
CL 3	92.0	2.5	0.56	2.7	8.1	87.9	96.0
A. R	**Mean**	**SD**	**S.E. M**	**CV**	**Range**	**Minimum**	**Maximum**
CL 1	80.2	3.7	0.55	4.6	18.3	73.5	91.8
CL 2	77.3	3.3	0.55	4.3	21.0	66.0	87.0
CL 3	79.3	3.6	0.80	4.5	12.2	72.1	84.3
L. R	**Mean**	**SD**	**S.E. M**	**CV**	**Range**	**Minimum**	**Maximum**
CL 1	89.8	7.6	1.2	8.5	32.7	75.0	107.7
CL 2	85.7	7.5	1.3	8.8	33.3	66.7	100.0
CL 3	90.0	6.8	1.5	7.6	27.5	81.5	109.0

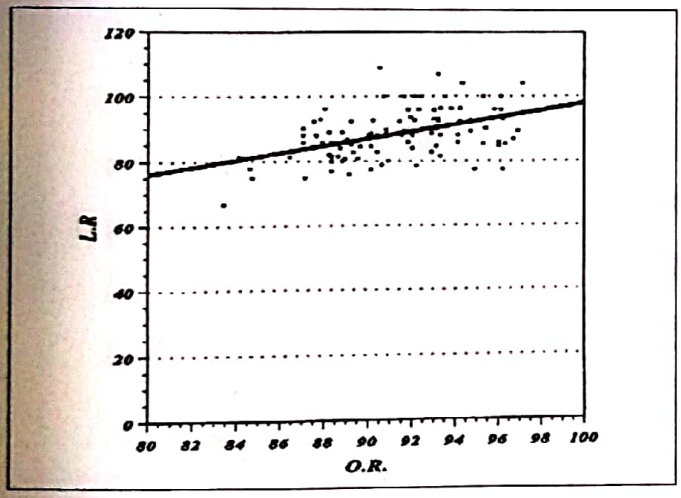

Fig 1. Correlation between Lateral's, and Overall, ratios
R=0.45 p < 0.0001

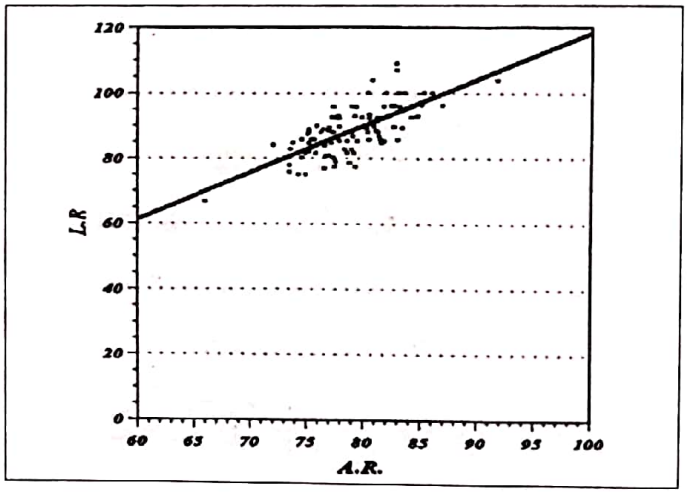

Fig 2. Correlation between Lateral's, and Anterior, ratios
R=0.70 p<0.0001

ence between sexes. The mean value for females was 79.3 % and for males 78.1 % mean value of LR for females was 88.6% and 87.8% for males which had no significant differences as shown by unpaired T test. (Table 2)

These ratios in CI II dental malocclusions was significantly lesser than

CI I and CI III malocclusions. (Table 3)

Regression analyses have shown a good correlation between LR and OR(r =0.45, P>0.001) and LR and AR (r=0.70 P<0.0001) these correlations was independent from sex and malocclusion as was shown by Pearson correlation coefficient. (Figures 1-6)

Discussion:

The major goal of this study was to assess a new method for predicting tooth size discrepancy between upper and lower dental arches.

Mean values of our subjects were similar to those of Bolton although there were differences in anterior ratios.

Qiong Nie and Jiuxiang Lin[14] found the following sequence for overall and anterior ratio in malocclusions: C1 III> C1 I > C1 II which is somehow similar to our findings for over all ratios.

We found these ratios nearly equal in C1 I and C1 III malocclusions and lesser in C1 II. This sequence was similar for laterals ratio.

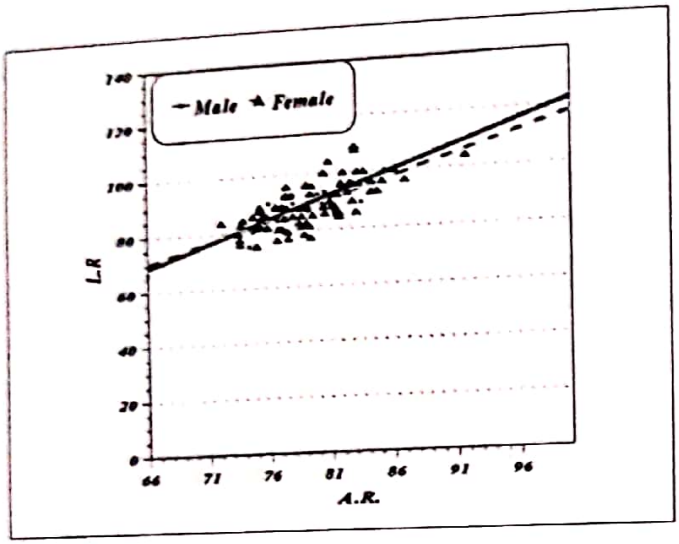

Fig 3. Correlation between LR and AR in males and females.
Males: r=081 p<0.0001 females: r=0.67 p<0.0001

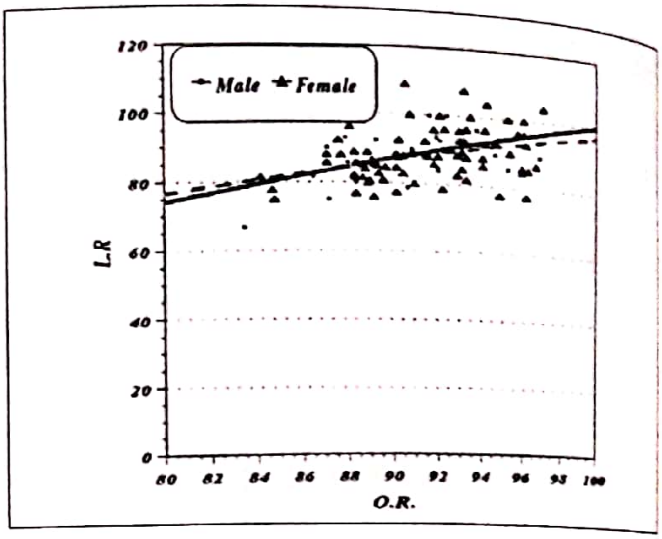

Fig 4. Correlation between LR, and OR in males and females
Males: r=0.55 p<0.005 females: r=0.42 p<0.002

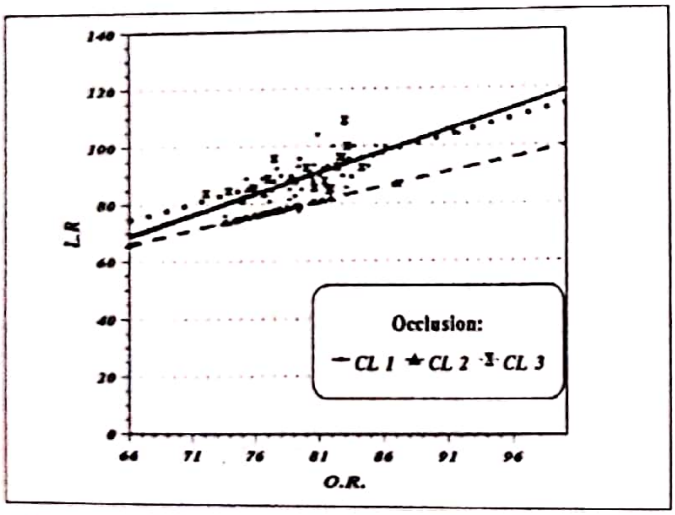

Fig 5. Correlation between LR and OR in different groups of malocclusions
Cl I:r=0.34 p<0.013 Cl II: r=0.50 p<0.001 Cl III: r=0.30 p<0.102

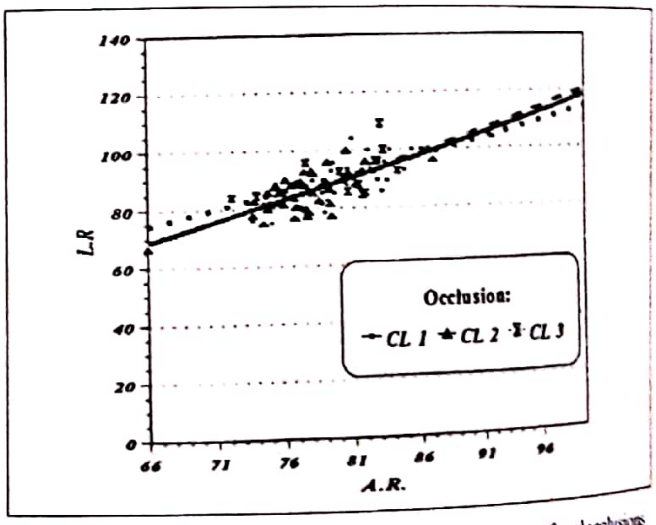

Fig 6. Correlation between LR and AR in different groups of malocclusions
Cl I:r=0.71 p<0.0001 Cl II: r=0.68 p<0.0001 Cl III.
r=0.62 p<0.002

Strong correlation of LR and AR (r = 070 P<0. 0001) means that we can use the first one as an appropriate substitute for the latter. There was a good but less strong correlation between LR and OR (r = 0.45 P<0.0001)

Laterals ratio at 88.4% was corresponded to normal Bolton ratios with a SD of 7.6 % in this study. No Significant sex difference makes these values suitable for both males and females.

Obviously disadvantages of Bolton analysis as was shown previously remains also as an important notice in application of lateral's ratio.

Conclusions:

Our goal to launch this study was to evaluate the ratio of mesiodistal width of lower lateral incisors to upper lateral incisors as a substitute for Bolton analysis.

In our 100 subjects we found:

1- Strong correlation between LR, AR, and OR.

2- Mean value of 88.4 % for laterals ratio is corresponded to normal Bolton ratios.

3- No sex difference was found for these ratios.

4- Ratios were equal in Cl I and Cl III malocclusions but significantly lesser in Cl II.

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