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Effect of inter-premolar width on buccal corridor area show during posed smile

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Abstract

Introduction: Orthodontic diagnosis and treatment planning is in a period of remarkable change, away from a previous focus on dental occlusion and hard tissue relationship and towards a greater emphasis on soft tissue adaptation and proportions. The re-emergence of the soft tissue paradigm in clinical orthodontics has made smile analysis and designing, key elements in treatment planning. Hence the purpose of this study was to establish the correlation between one of the many variables effecting smile; the inter-premolar width with the buccal corridor area show of a patient during posed smile.

Material and Methods: 147 dental casts and frontal photographs were obtained and measured for the inter-premolar width and buccal corridor area show. SPSS version 10 was used to calculate mean and SD for age (in years), inter-premolar width and the inter-commissure width of subjects. Frequencies and percentages were calculated for gender. Pearson correlation coefficient was determined for the inter-premolar width with the buccal corridor area show. **r** value was determined between -1.0 and +1.0

Results: The p value for inter-premolar width and buccal corridor area show during posed smile was < 0.05 being significant.

Conclusions: It was concluded from the study that there is a statistically significant relationship between inter-premolar width and the buccal corridor area show during posed smile.

Key words: Soft tissue paradigm; smile; divine proportions

Introduction

Orthodontic diagnosis and treatment planning is in a period of remarkable change, away from a previous focus on dental occlusion and hard tissue relationship and towards a greater emphasis on soft tissue adaptation and proportions. The twentieth century, considered as the 'Edward Angle's era of orthodontics stressed on the ideal relationship of teeth and gave the concept of ideal occlusion primarily with a secondary goal of skeletal jaw relationship.[1] It was assumed that if the hard tissues were correct, the overlying soft tissues were presumed to be correct.

With the advancements in the field of orthodontics and advent of modern diagnostic techniques it became evident that even an excellent dental occlusion can be unsatisfactory if it is achieved at the expense of proper facial proportions. This led to the paradigm shift focusing on ideal soft tissue proportions rather than ideal occlusion being the goal of treatment even if it did not achieve the so called ideal Angle's Class I dental occlusion. Treatment planning now focuses on achieving ideal soft tissue relationships and placing teeth and jaws as needed to achieve this goal.[2]

Ideal soft tissues render balance in a face and confer beauty. Beauty is the phenomenon of experiencing pleasure through the perception of balance.[3] There is a universal standard for facial beauty regardless of race, gender, age and other variables named as the 'divine proportion' which is also found in numerous phenomenon, geometrical propositions and human architectural constructions.[4] The divine proportion is a ratio that is a law of

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equilibrium which presents a relationship between mathematics and beauty to create harmony and also gives the illusion of perfection.

The re-emergence of the soft tissue paradigm in clinical orthodontics has made smile analysis and designing key elements in treatment planning. Conclusively, smile is an integral constituent of the facial attractiveness of a person. Smile is considered the universal friendly greeting in all cultures. A wide attractive smile expedites easy psychosocial adjustability of the patient in the community around.[5,6] Gender, age and income among other factors have influenced people's perception of attractiveness of smiles.[7,8] The growing importance of the smile can be evaluated from the fact that most orthodontic patients assess the results or out come of their orthodontic treatment by improvement in their smiles and the overall increase in the facial esthetics.[9]

Many features are said to increase the pleasing effect of a smile or they render beauty to a smile e.g. consonance in a smile (Fig 1), appropriate gingival display (Fig 2), harmonious gingival scaffolding, colorful gingiva, minimal buccal corridors, appropriate incisal show during smiling and so on. All these add perfection to a smile. Many studies have been conducted with results confirming the above mentioned facts.[10-14] Having minimal buccal corridors is a preferred esthetic feature for both men and women.[14] Many hard and soft tissue factors influence the buccal corridor area show during posed smile e.g. lower anterior facial height ratio, inter-premolar width (Fig 3), inter-commissure width (Fig 4), arch form (Fig 5) and lip length etc (Fig 6).[14]

Figure 1. Consonant and non consonant smiles

A. Consonant smile with parallelism between the curvature of the maxillary incisal edge and the upper border of the lower lip.

B. Non-consonant smile with no parallelism between the curves

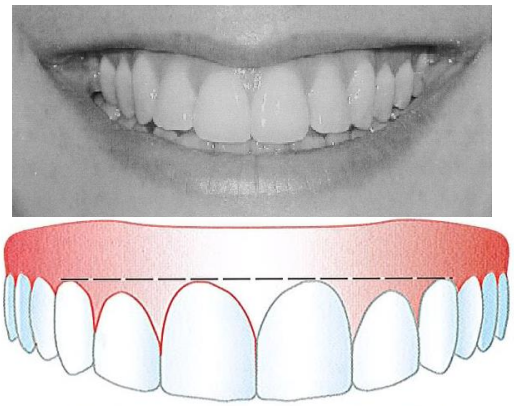

Figure 2. Appropriate gingival show during smile

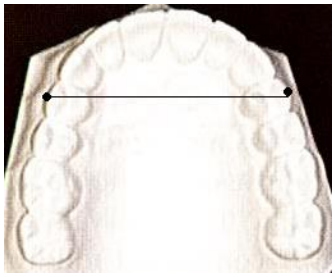

Figure 3. Inter- premolar width

Figure 4. Inter-commissure width

Narrow arch form

Broad arch form

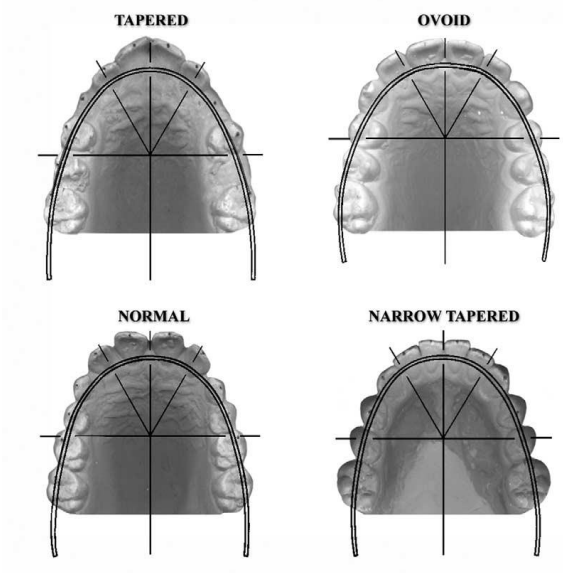

Figure 5. Arch forms

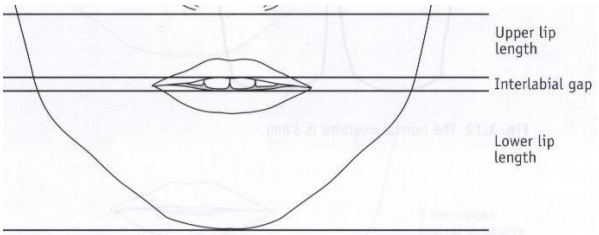

Figure 6. Lip lengths

Hence the purpose of this study was to establish the correlation between inter-premolar width and the buccal corridor area show of a patient during posed smile, since inter-premolar width is a treatment variable amenable to change by orthodontic treatment.

Material and Methods

Patients in which permanent dentition was present up to second molars were included (excluding third molars). Periodontally compromised patients requiring surgery for its correction, orthognathic patients, cleft lip and palate patients and patients having severe facial asymmetry were excluded from the sample.

Pictures were taken in the same environment for every patient with the same lighting conditions keeping the distance of 90 cm from he camera constant, in natural head position, ısing Sony DSC-W55, Effective 7.2 mega-›ixels, 3 x zoom lens. The camera was fixed in ›osition with a tripod and all photographs vere taken in colour. The pictures were then ransferred to computer software (Adobe ›hotoshop version 7, Adobe system, San Jose, Ɛalifornia) and editing was done to tandardize all. The pictures were cropped to nclude only the peri-oral region. Pictures vere standardized to 5×3 inches, with 7.2 Mega pixel resolutions. Inter-pupillary listance and the inter-commissure width at est were measured on the frontal ›hotographs and were compared. Ideally hey should be equal.[7] The buccal corridor area were quantified. All readings were recorded on data collection form.

The impressions were taken in alginate (CA37®, CAVEX Holland) and were subsequently poured in orthodontic plaster (Elite, Zhermach Germany) and casts were made out of them. The inter-premolar width was measured on the dental casts by using the vernier caliper in 0.1 mm units. These measurements were recorded and correlated with buccal corridor show during posed smile by using the Pearson correlation coefficient.

Data was analyzed on statistical package for social sciences (SPSS version 10). Descriptive statistics were used. Mean ± S.D was calculated for age (in years), inter-premolar width and the inter-commissure width of subjects. Frequencies and percentages were calculated for gender. Pearson correlation coefficient was determined for inter-commissure width, inter-premolar width with the buccal corridor area show. **r** value was determined between -1.0 and +1.0

Results

The study was conducted on 147 participants, in which there were 40 (27.2%) males and 107 (72.8%) females as shown in (Fig 7). The mean age of the participants was 15.725 ± 5.467 with a minimum age of 9 years and a maximum age of 38 years (Table I).

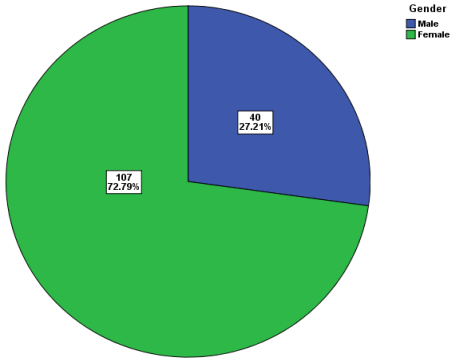

Figure 7: Gender distribution of participants

Table I: Age distribution of participants

	N	Minimum	Maximum	Mean	Std. deviation
Age	147	9.0	38.0	15.725	5.4666

The buccal corridor area show on frontal smile was measured, the minimum being 0 mm and maximum being 4.50 mm. The mean buccal corridor area show was 1.799 with standard deviation of 0.9904 mm as given in (Table II).

Table II: Buccal corridor area show (in mm on frontal smile)

	N	Minimum	Maximum	Mean	Std. deviation
Buccal corridor area show (in mm on frontal smile)	147	.00	4.50	1.799	.9904

The mean inter-premolar width in this study was 40.8707 with a standard deviation of 2.9782 mm. the range of inter-premolar width was 35 to 57 mm as given in (Table III).

Table III: Inter-premolar width (mm)

	N	Minimum	Maximum	Mean	Std. deviation
Inter-premolar width (mm)	147	35.00	57.00	40.8707	2.9782

The results show that the correlation between buccal coridor area show (in mm on frontal smile) and inter-premolar width is significant with a correlation coefficient of -0.187 (P-value < 0.05). The negative correlation means as the inter-premolar width increases the buccal corridor area show (in mm on frontal smile) decreases (Table IV).

Table IV: Correlation of buccal corridor area show (in mm on frontal smile) with Inter-premolar width (mm)

	Buccal corridor area show (in mm on frontal smile)	
	Pearson correlation	**Sig. (2-tailed)**
Inter-premolar width (mm)	-.187(*)	.023

* Correlation is significant at the 0.05 level (2-tailed).

The analysis to see the relationship of buccal corridor area show (in mm on frontal smile) with Inter-premolar width (mm) reveals that the mean buccal corridor area shown (in mm on frontal smile) is significantly higher when the inter-premolar width is less or equal to normal as compared with more than normal limits (2.40±0.7368 vs. 1.731±0.9946, P-value < 0.013) as given in (table V).

Table V: Relationship of buccal corridor area shown (in mm on frontal smile) with inter-premolar width (mm)

	Inter-premolar width (mm)	N	Mean	Std. deviation	p value
Buccal corridor area show (in mm on frontal smile)	less and equal to normal	15	2.400	.7368	0.013
	more than normal	132	1.731	.9946	

Discussion

A pre-treatment sample was selected for this study since it exemplified typical orthodontic patients requiring treatment. Since a pre-treatment sample was used, these subjects varied greatly. The variety in the sample provided a range of smiles and dentofacial discrepancies that was ideal in correlating the hard tissue structures to the resulting smile configurations. In this study more female subjects were present as the sample was not collected on the basis of gender.

As already mentioned, minimization of buccal corridor area show during posed smile is an integral component of problem list and hence treatment planning and treatment goals.[15] The narrower the inter-premolar width was, the larger the buccal corridor area show. This was in accordance with the results of the former studies.[11]

Two groups were made in which one was normal or sub normal and the other was more than normal in comparison to the established norms of inter-premolar widths. These were made according to the norms established by data from Moyers.[16]

Some studies showed slightly different results from this study by showing that with the variation in the inter-premolar widths there was no effect on the buccal corridor area show during posed smile. In the study by Laurie McNamara and co workers[17] no statistically significant difference was found between the buccal corridor area show of patients with increased or decreased inter-premolar or inter-molar widths. This study had smiles analyzed through video framing which differed from the present study in which static images for smile analysis were used. The age distribution in McNamara's study sample was between 10-15 years with a mean age of 12.5 years that differed from the present sample.

When the means of inter-premolar widths were compared with the findings by Yang[14] our values were slightly lower as compared to his values of 46.82 mm for mean value of inter-premolar widths. Similarly our findings for the inter-premolar widths were slightly higher than the mean found in the sample by McNamara.[17] His mean was 37.9 mm with a standard deviation of 2.1 mm.

As the result indicates, significant difference was found between lesser than normal inter-premolar widths and the buccal corridor area show and normal or increased inter-premolar widths and their effect on the same. Patients having increased buccal corridor area show can benefit from increasing the inter-premolar width via expansion mechanics. This is one of the main stay of the non-extraction treatment protocol proponents also, who believe that expanding the maxillary arch can give patients a wide and vibrant smile. But it depends from case to case and expansion without a reason is unjustified and should only be reserved for patients with decreased inter-premolar widths, cross-bites in the posterior segments and patients having skewed and narrow

arches with increased buccal corridor area show during posed smile.

Many types of appliances can be used e.g. Hyrax, W-arches and quadhelix (preferable in the mixed dentition), jack screws with bite plates that can cater for expansion as well as vertical pattern of a patient, Damon arches and over lays etc.

Conclusions

There is significant effect of increased or decreased inter-premolar width on the buccal corridor area show during posed smile (p value is < 0.05). This study gave a comprehensive view of Inter-premolar width as a main factor effecting buccal corridor area show during posed smile, so Individual patients should be managed carefully by selecting the appropriate mechanics best suited for these individuals, as a result of which better results can be achieved.

References

1. Sarver DM, Proffit WR. Special considerations in diagnosis and treatment planning. In: Graber TM, Vanarsdall RL, Vig KWL (edi). Orthodontics: Current principles and techniques. 4th ed. St Louis: Mosby 2005:3-70.
2. Proffit WR. Malocclusion and dentofacial deformity in contemporary society. In: Proffit WR, Fields HW, Sarver DM (edi). Contemporary orthodontics. 4th ed. St Louis: Mosby 2007:3-23
3. Jahanbin A, Basafa M, Alizadeh Y. Evaluation of the divine proportions in the facial profile of young females. Indian J Dent Res 2008;4:19
4. Jefferson Y. Facial beauty establishing a universal standard. Int J Orthod Milwaukee 2004;15:9-22
5. Jan HU. Restore a wide radiant smile without dental extractions. Pak Oral Dental J 2005;25:65-8.
6. Desai S, Upadhyay M, Nanda R. Dynamic smile analysis: Changes with age. Am J Orthod Dentofacial Orthop 2009; 136:3-10
7. Geron S, Atalia W. Influence of sex on the perception of oral and smile esthetics with different gingival and incisal plane inclination. Angle Orthod. 2005;75:778-84
8. Kerosuo K, Al Enezi S, Kerosuo E, Abdulkarim E. Association between normative and self perceived orthodontic treatment need among Arab high school students. Am J Orthod Dentofacial Orthop. 2004;125:373-78
9. Isiksal E, Hazar S, Akyalcin S. Smile esthetics: Perception and comparison of treated and untreated smiles. Am J Orthod Dentofacial Orthop 2006;129:8-16
10. Sarver DM, Ackerman MB. Dynamic smile visualization and quantification: Part 2. Smile analysis and treatment strategies. Am J Orthod Dentofacial Orthop 2003;124:116-27
11. Krishnan V, Daniel ST, Lazar D, Asok A. Characterization of posed smile by using visual analog scale, smile arc, buccal corridor measures, and modified smile index. Am J Orthod Dentofacial Orthop 2008;133:515-23
12. Jornung J, Fardal O. Perception of patient's smiles. A comparison of patient's and dentist's opinions. J A D A 2007;138;12:1544-53
13. Moore T, Southard KA, Casko JS, Qian F, Southard TE. Buccal corridors and smile esthetics. Am J Orthod Dentofacial Orthop 2005;127:208-13
14. Yang H-II, Nahm DS, Baek SH. Which hard and soft tissue factors relate with the amount of buccal corridor space during smiling? Angle Orthod 2008;78:5-11
15. Johnson D R, Gallerano R, English J. The effects of buccal corridor spaces and arch form on smile esthetics. Am J Orthod Dentofacial Orthop 2005;127:343-50
16. R William, Proffit WR and Sarver DM. Treatment planning. Optimizing benefit to the patient. Contemporary treatment of dentofacial deformity. 1st ed. St Louis: Mosby 2003:172-245
17. McNamara L, McNamara J, Ackerman M and Baccetti T. Hard and soft tissue contributions to the esthetics of the posed smile in growing patients seeking orthodontic treatment. Am J Orthod Dentofacial Orthop 2008;133:491-9