The difference in the ratio of the maxillary anterior teeth mesiodistal to the golden proportion value after class I malocclusion treatment with Edgewise standard fixed appliance

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ABSTRACT

INTRODUCTION: The purpose of this study is to evaluate the ratio of maxillary anterior teeth to the golden proportion ratio using phimatrix software on frontal intra oral photometry of the post standard edgewise orthodontics patients with Class I malocclusion. METHODS: This study is using a retrospective analitist descriptive method. Sample divided at two groups of 13 patients with extraction of first premolar and 19 patients without first premolar extraction. RESULT: Evaluation is done by measuring the maxillary anterior teeth ratio using phimatrix software on frontal intra oral photometry of the post standard edgewise orthodontics patients with Class I malocclusion to the golden proportion, then proceed with statistical t-test. CONCLUSION: The conclusion of this study shows that the maxillary anterior teeth post standard edgewise orthodontic treatment in class I dento-skeletal patients with or without the first premolar extraction whose treated in orthodontic resident's clinic Padjadjaran University shows a significant differences with the golden proportion.

Keywords: Golden Proportion, Maxillary Anterior Teeth, Standard Edgewise, Frontal Intra Oral Photometry.

INTRODUCTION

The aim of orthodontic treatment is to correct and to achieve mastication, tooth and surrounding tissues, optimally and obtain harmonious facial aesthetics (Sarver, 2003).[1] The high demand of orthodontic treatment indicates an increase in public health care awareness, including oral health awareness.

Orthodontist know specifically about aesthetics, although over time, the extent of aesthetics are affected by many individual factors. Facial aesthetics seems to be more important nowadays especially for an orthodontist in orthodontic treatments, that a universal standard of facial aesthetics is needed.

Studies on Sundanese Young Adult in Bandung Raya towards the interest and demand for orthodontic treatments indicates that facial aesthetic factor was the main motive of getting and orthodontic treatment. The aesthetic reasons mentioned above is an orderly, ideally curved, non protrusive teeth that support overall appearance and improve teen's confidence (Thahar. B, 1998).[2]

Facial aesthetics are a condition in which the face appears balanced, proportional, and appropriate in the face-forming component, consists of hard and soft tissue. The face-forming components are structured of hard tissue such as bones and tooth that support soft tissue around them. In some cases, tooth greatly affect facial aesthetics, for its position and alignment supports soft tissues around it, such as lips and gingiva (Sarver, 2003).[1]

Patients who visit dentists for an orthodontic treatment have various malocclusion, but mostly they are after aesthetic corrections. The

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perceptions of facial beauty is different to every human being with an unequal standard to each individual. Facial beauty is considered as an observable facial quality, or the observer's judgments depends on personal perception and feelings, where every person has a different satisfaction level. This needs to be observed because orthodontic treatment can change an important smile aesthetic that is the anterior tooth alignment (Ackerman dan Ackerman, 2002).[3]

Despite the standard result of relative occlusion is relatively well achieved, the aesthetics results is usually more subjective, so there needs to be a universal reference. Uribe (1995) described that patients who have had an orthodontic treatment with normal jaw relationship result and good dental occlusion not necessarily deliver an ideal smile aesthetics.[4] To overcome this problem a lot of o experts apply golden proportion as a simple reference to assess result of restoration, prostheses and to evaluate facial proportion with optimal aesthetics (Marquardt, 2009).[5]

Golden proportion has long been used as a tool to assess aesthetics, in every aspect and to be applied in dental aesthetics. If golden proportion is used for dental aesthetics, it will result in constant ratio of mesial-distal width projection of anterior tooth seen from the observer's point of view as a comparison ratio 1,618:1 and not from the actual mesial-distal tooth measurement (Snow, 2003).[6]

In Faculty of Dentistry Universitas Padjadjaran's clinic, fixed orthodontic treatments are done with Standard Edgewise appliances. The lack of fixed orthodontic appliances are shown in the usage of standard bracket, so for a better result, such as artistic positions, is obtained in the last steps of treatment. Based on the explanation above, author is interested in doing a study on golden proportion of the anterior maxillary tooth structure of dentoskeletal class I malocclusion treatment with Standard Edgewise fixed orthodontic appliances by measuring the maxillary anterior tooth ratio. The aim of this study is to find out the maxillary anterior tooth ratio discrepancy over orthodontic treatment results with standard edgewise fixed orthodontic treatment without extractions in Resident's clinic of Dentistry Unpad using the golden proportion, and to find out the maxillary anterior tooth ratio discrepancy over or-

thodontic treatment results with standard edgewise fixed orthodontic treatment with and without extractions in Resident's clinic of Dentistry Unpad using the golden proportion.

METHOD

This study is a retrospective descriptive analysis with study populations of post standard edgewise fixed orthodontic treatment patients at Resident's clinic of Dentistry UNPAD in 2000-2009. Samples were taken from the population with an inclusion criteria of Dento-skeletal class I malocclusion, patient aged between 14-35 years old, male and female, complete number of anterior teeth, normal tooth size (without shape or size anomalies), without any tooth restoration nor protheses within six maxillary anterior teeth, without any missing tooth nor agenesis (except for third molars), have a complete medical record and intra oral photometry in good condition.

Materials that are used for this research are patients' frontal intra oral photometry of before and after treatment with the 3R photo size. This study used electronic digital caliper, Phimatrix software (downloaded from the web) as the research tools.

RESULT

The sample of this study were thirty two patients, divided into two groups: 19 patients without extraction and 13 patients with extractions of two maxillary premolars and two mandibular premolars, as shown in the Table 1.

Table 1 Sample Distribution by Type of Treatmen

Type of Treatment	Amount
Extraction	13
Without Extraction	19
Total	32

Measurement was done with frontal intra oral photo using a few reference lines (Phimatrix software). Then, six measuring variable of frontal intra oral photometry mesio-distal six maxillary anterior teeth sized was determined to obtain a ratio of I2/c, I1/I2 on the left and the right side. The data was then processed to get the ratio val-

ue of the anterior tooth as shown in the table 4.2 dan table 4.3 using the t-test to test the average similarity using the golden proportion (1,618) that results in the right I2/C and left I2/C ratio in with extraction group are 1,461 and 1,452 with a standard deviation of 0,083 and 0,194; t calculate is more than t table (-t(n-1),(□) < t calculate < t(n-1);(□)) showed a different result. For the right I2/C and the left I1/I2 ratio, t calculate was -1,00 and -0,16 less than t table = 2,18 (-t(n-1),(□) < t calculate < t(n-1);(□)), more information on table 2.

Tabel 2 The Average Ratio of Maxillary Anterior Teeth After Treatment With Extractions Compared to The Golden Proportion

No	Ratio	After	GP	N	SD	t-total	t -tab	Significance
1	I2/C Ka	1.522	1.618	13	0.347	-1	2.18	-
2	I1/I2 Ka	1.461	1.618	13	0.083	-6.83	2.18	-
3	I1/I2 Ki	1.612	1.618	13	0.15	-0.16	2.18	-
4	I2/C Ki	1.452	1.618	13	0.194	-3.09	2.18	-

Table 3   The Average Ratio of Maxillary Anterior Teeth After Treatment Without Extractions Compared to The Golden Proportion

No	Ratio	After	GP	N	SD	t-total	t -tab	Significance
1	I2/C Ka	1.373	1.618	19	0.208	-5.13	2.18	-
2	I1/I2 Ka	1.546	1.618	19	0.117	-2.68	2.18	-
3	I1/I2 Ki	1.658	1.618	19	0.175	0.99	2.18	-
4	I2/C Ki	1.39	1.618	19	0.293	-3.4	2.18	-

Note: * = Significatly different

Table 4.4 Maxillary Anterior Teeth Ratio

	right I2/C	right I1/I2	left I1/I2	left I2/C
With Extraction	1.522	1.461	1.612	1.452
Without Extraction	1.373	1.546	1.658	1.390
Standard	1.618	1.618	1.618	1.618

Diagram 1 Ratio between right I2/C. right I1/I2, left I1/I2, and I2/C on The Class I Dento-Skeletal Malocclusion Samples, With Extraction and Without Extraction Groups Compared to the Golden Proportion
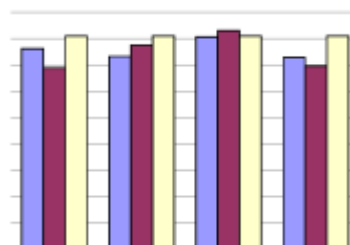
Legends: Blue = with extraction, Pink = without extraction, White = Standard

Table 5 The Difference of Maxillary Anterior Teeth Ratio After Treatment With Extraction and Without Extraction

No	Ratio	With Extraction	Without Extraction	SD	t-cal	t-tab	Significance
1	I2/C Ka	1.522	1.373	0.27	1.51	2.04	-
2	I1/I2 Ka	1.461	1.546	0.1	-2.25	2.04	-
3	I1/I2 Ki	1.612	1.658	0.17	-0.78	2.04	-
4	I2/C Ki	1.452	1.39	0.26	0.67	2.04	-

Note : * significantly different

The test result showed that the right I1/C and the left I2/C ratio on the with extraction sample group has a ratio value corresponding to the golden proportion.

On the without extraction sample group it was obtained a ratio between the right I2/C; the right I1/I2 and the left I2/C with the ratio value respectively 1,373□ 0,208; 1,546□ 0,117; and 1,390□ 0,293 showed a significantly different result, where the t calculate is more than t table (-t(n-1),(□) < t calculate < t(n-1);(□)). As for the left I1/I2 ratio with an average value of 1,658 □ 0,175 with t calculate 0,99 is less than t table = 2,18 ; (-t(n-1),(□) < t calculate < t(n-1);(□)) but not significantle different. More information on table 3

The test result showed that the ratio of left I1/I2 on the patient without extraction group characteristically not significaly different that shows a ratio value corresponding to the golden porportion.

The measurement result of the mesio-distal six maxillary anterior teeth sized frontal intraoral photometry using Phimatrix above, shown the average ratio of right I2/C with extractions is 1,522, the average ratio of right I1/I2 with extractions is 1,461, the average ratio of left I2/C with extractions is 1,612, the average ratio of left I1/I2 with extractions is 1,452, the average ratio of right I2/C without extractions is 1,373,the average ratio of right I1/I2 without extractions is 1,546, the average ratio of leftI2/C without extractions is 1,658, the average ratio of left I1/I2 without extractions is 1,390. More detailed information is shown on Table 4.

To understand the difference between the average ratio after treatment with the golden proportion on both groups as shown on table 5.
Table 5 showed Similarity test of two averages for right I2/C; left I2/C and left I1/I2 ratio and t calculate was 1,51; -,078 and 0,67 less than t table meaning there's no sigfinicantly diferrence between anterior tooth ratio with and without extraction.

The right I1/I2 ratio is sigfinicantly different meaning that there's a significant difference between the right I1/I2 ratio of group with extraction with the average of 1,461 compared to the mean in the group without extraction, 1,546, where t calculate -2,25 is more than the t table

2,04.

DISCUSSION

The golden proportion evaluation on six maxillary anterior teeth is an important aspect for clinicians to understand in orthodontic. Tooth position plays an important role in shaping the aesthetic of the anterior teeth (Kokich, 1993).[7] This study aims to evaluate the golden proportion of six maxillary anterior teeth of a class I dento-skeletal malocclusion patients treated with Standard Edgewise FIxed Orthodontic appliances in Resident's Clinic Dentisty UNPAD.

The treatment of Class I dento-skeletal malocclusions can be done with extraction and without extraction. In this study, the analysis of ratio difference between the right and left side I1/I2 and I2/C, then compared to the golden proportion.

The results showed that in the extraction group, the average ratio of right I2/C and right I1/I2 resepctively 1,522 and 1,461, as for the average left I2/C and left I1/I2 respectively 1,452 and 1,612 and statistically the numbers above showed that the right I2/C and left I1/I2 ratio has the corresponding ratio to the golden proportion. Whereas the without extraction group, as shown on Table 4, has the average ratio of right I2/C, right I1/I2, left I2/C, left I1/I2 respectively 1,373, 1,546, 1,658, 1,390.

The golden proportion concept is the concept of curve and teeth evaluation to determine the size of the tooth. In theory, any two objects that have an aesthetic harmony should have a ratio of 1,618:1 (Ricketts, 1982).[8] Theoretically, in the field of dentistry, certain tooth groups are proportionate to each other according to their ratios. The width of the first incisor is a golden proportion against the width of the second incisor. SImilarly, the width second incisor is the golden proportion to the width of the canine. Other studies have suggested that this proportion is seen from the size of the teeth seen from anterior (Patnaik VVG, 2003).[9] Many authors stated the importance of achieving proportion in a harmonious smile to the face and suggested using the golden proportion and a standard (Sarver DM, 2004).[10]

The existence of the six anterior teeth ratio discrepancy with the golden proportion might

be cause by several factors. One is the precision of the mesiodistal angulation of six maxillary anterior teeth after orthodontic treatment determind by the completion stage of artistic positioning with rectangular wire and bracket position (Almeida-Pedrin, 2006).[11] It was assumed to be so because usually the width of the central and lateral incisors and symmetrical on the contralateral side (Kokich, 1993) that if the anterior teeth ratio results in either with extraction or without extraction are not symmetrical, it is most likely due to a difference in bending within the artistic positioning.[7]

In addition to artisitic positioning, the placement of bracket is also a important thing to be noted, especially on the anterior teeth. The anatomy of the anterior teeth varies in crown height and incisal margin (Sarver and Yanosky, 2005) where this greatly affects the bracket placement.[12]

In table 2, the group with extraction was shown that the right I2/C and left I1/I2 ratio is not significantly different meaning that both ratios are not significantly different to the golden proportion (1,618). As for the table 3, the gorup without extraction shown that only left I1/I2 not significantly different meaning he ratio of left I1/I2 is not significantly different to the golden proportion (1,618).

The results above are also supported by theories in which the most frequent angular errors occur in the second incisor, the canines, and the second premolar (Casko JS, et al., 1998).[13] Holdaway and some orthodontists discussed about angulation brackets, and concluded that the principle of artistic use of anterior teeth positioning is important, especially in the maxillary second incisors (Holdaway, 1952), which if not artistically done properly, may affect the value of the golden proportion.[14]

It's also important for orthodontist to pay more attention in taking patient photos both extra oral and intra oral. In this study, evaluation is done with clinical photography, using secondary frontal intra oral photometry data that were taken by different operators, and the results might vary.

Table 2 and 3, tested using two-point similarity test resulted in showing no significant properties to the right I2/C, left I1/I2, and left I2/C ratio with t calculate respectively 1,51 ; -,078 and 0,67. Whereas the right I1/I2 ratio is significant, it means that there;s a significant difference between the right I1/I2 ratio of with extraction group with an average 1,461 compared to the mean of the without extraction group taht is 1,546.

Hypothesis I there is a difference of maxillary anterior teeth ratio in sample with extraction compared to the golden proportion. Hypothesis test resulted in t calculate of right I2/C: -1,00; right I2/I1: -6,83; left I1/I2: -0,16; left I2/C: -3,09 compared with t table 2,18 where t calculate < t table meaning there is no difference in the ratio of right I2/C and left I1/I2 to golden proportion in class I dentoskeletal malooclusion patient with extraction post fixed treatment in resident's clinic Dentistry UNPAD, and supported by table 2. In conclusion, Hypothesis I is not rejected.

Hypothesis II there is a difference of maxillary anterior teeth ratio in sample without extraction compared to the golden proportion. Hypothesis test resulted in t calculate of right I2/C: -5,13; right I2/I1: -2,68; left I1/I2: 0,99; left I2/C: -3,40 compared with t table 2,18 where t calculate < t table meaning there is no difference in the ratio of left I1/I2 to golden proportion in class I dentoskeletal malooclusion patient with extraction post fixed treatment in resident's clinic Dentistry UNPAD, and supported by table 2. In conclusion, Hypothesis II is not rejected.

Hypothesis III there is a difference of maxillary anterior teeth ratio in sample with and without extraction. Hypothesis test resulted in t calculate of combined right I2/C: 1,51; right I2/I1: -2,25; left I1/I2: -0,78; left I2/C: 0,67 compared with combined t table 2,04 where t calculate < t table meaning there is no difference in the ratio of left I1/I2 to golden proportion in class I dentoskeletal malooclusion patient with extraction post fixed treatment in resident's clinic Dentistry UNPAD, and supported by table 2. In conclusion, Hypothesis III is not rejected.

CONCLUSION

This study aims to evaluate the results of Standard Edgewise fixed orthodontic on maxillary anterior teeth through frontal intraoral photometry of class I dentoskeletal patients with and without extractions in Resident's clinic Dentistry UNPAD in

the year 2000-2009 to fulfill the golden proportion ratio, by measuring all four ratios. In conclusion, the result of standard edgewise fixed orthodontic treatment on maxillary anterior teeth of the sample group with extraction, there was a significant difference in the mean ratio of right I1/I2 and the mean left I2/C ratio to the golden proportion, as for the mean ratio of right I2/C and left I1/I2 there is no significant difference to the golden proportion. This difference is probably due to inappropriate artistic positioning.

The result of standard edgewise fixed orthodontic treatment on maxillary anterior teeth of the sample group without extraction, there was a significant difference in the mean ratio of right I2/C, right I1/I2 and the mean left I2/C ratio to the golden proportion, as for the mean ratio of left I1/I2 there is no significant difference to the golden proportion. This difference is probably due to inappropriate artistic positioning.

The result of standard edgewise fixed orthodontic treatment on maxillary anterior teeth of both sample group, with and without extraction, there was no significant difference in the mean ratio of right I2/C, left I1/I2 and the mean left I2/C ratio to the golden proportion, as for the mean ratio of left I1/I2 there is significant difference to the golden proportion. This difference is probably due to inappropriate artistic positioning.

REFERENCES
1. Sarver DM. 2003. Dynamic Smile Visualization and Quantification: Part I. Evolution of concept and dynamic records for smile capture. Am. J Ortho Dentofac Orthop. Vol. 124(1). h. 4-11
2. Thahar B. 1998. Hubungan penampilan Kelainan Dentomaksilofasial dengan Harga diri dan Motivasi untuk perawatan ortodonti remaja Lanjut di Bandung. Disertasi Doktor. Universitas Padjadjaran
3. Ackerman MM, Ackerman JL. 2002. Smile Analysis and Design in the Digital Era. J Clin Orth. Vol. 36(4). h. 221-236
4. Uribe F, Nanda R. 2005. Individualized Orthodontic Diagnosis. Dalam Biomechanics and Esthetics Strategies in Clinical Orthodontics. Elsevier Saunders Co; h. 38-72
5. Marquardt S. Golden proportion. [online] [cited 4 August 2009] Avalaible from: http://www.beautyanalysis.com
6. Snow SR. Applications of the Golden Percentage in Smile Design And Esthetic Treatment Success [online] Avalaible from: http://www.contemporaryestheticsonline.com/issues/articles/2006_09_01.asp
7. Kokich V. 1993. Esthetics and Anterior Tooth Position: An Orthodontic Perspective Part III: Mediolateral Relationships. J Esthetics Dentistry. Vol. 5 (5). h. 200-207
8. Ricketts RM. 1982. The biologic significance of the divine proportion and Fibonacci series. Am J Ortho Dentofac Orthop. Vol. 81(5). h. 351-370
9. Patnaik VVG, Singla R, Bala S. 2003. Anatomy of 'A Beautiful Face and Smile'. J Anat Soc India.Vol. 52 (1). h. 74-80
10. Sarver DM. 2004. Principles of Cosmetic Dentistry in Orthodontics: Part 1.Shape and proportionality of anterior teeth. Am J Ortho Dentofac Orthop. Vol. 126 (6). h. 749-753
11. Almeida-Pedrin RR, Pinzan A, Almeida RR, Ursi W, Almaeda MR. 2006.Panoramic Evaluation of Mesiodistal Axial Inclinations of Maxillary Anterior Teeth in Orthodontically Treated Subjects. Am J Ortho Dentofac. Orthop. Vol. 130(1). h.56-60
12. Sarver D.M and Yanosky M. 2005. Princples of Cosmetic Dentistry in Orthodontics: Part 2. Soft Tissue Laser Technology and Cosmetic Gingival Contouring. Am J Orthod Dentofac Orthop. Vol. 127 (1). h. 85-90
13. Casko JS, Vaden JL, Kokich VG. 1998. Objective Grading System for Dental Casts and Panoramic Radiographs. Am J Ortho Dentofac Orthop. Vol. 114 (5). h. 589-599
14. Holdaway RA. 1952. Bracket angulation as applied to the edgewise appliance .Vol 22 (4). h. 227-236