The Effect Of Facial Vertical Dimension Changes On The Value Of Facial Harmony In Malocclusion Class II Skeletal In RSGM USU

(Pengaruh Perubahan Dimensi Vertikal Wajah Terhadap Nilai Harmoni Wajah Pada Maloklusi Kelas II Skeletal di RSGM FKG USU)

Muslim Yusuf, Siti Bahirrah, Bernadetta Sembiring

Department of Orthodontic, Faculty of Dentistry, University of Sumatera Utara, Medan, Indonesia
E-mail: dethaberna@gmail.com

Abstract

Treatment of Class II malocclusion have impact in relation to the vertical dimensions of the skeletal and facial soft tissues mainly to the facial balancing and proportion which relate to patient facial harmony. The aim of this study was to determine the changes and differences in facial vertical dimensions to the total value of facial harmony in skeletal Class II after treatment with extraction and non-extraction of the maxillary first premolar based on Arnett and Bergmann at the Orthodontic Specialist Clinic of RSGM, Universitas Sumatera Utara. The sample consisted of initial and final cephalometry of 36 patients with age 18-35 years old, skeletal Class II malocclusion $ANB > 4°$, divided into extraction of maxillary first premolar and non-extraction group. Cephalometric tracing with the required points, then the photos are processed into image J software. Then the data that obtained is tested statistically with Pearson's Correlation Test and T-Test Independent. There was a significant change between MP-SN and Pog-Imd (P=0,036) in the first premolar extraction group, but there was not a significant change in the non-extraction first premolar group. There was a significant difference in the face harmony value at point G-A between the extraction and non-extraction groups (P=0,038). There was a significant difference on the face harmony value in the treatment of malocclusion Class II orthodontic with maxillary first premolar extraction.

Keywords: ClassII; Skeletal; Verticaldimension; Facial harmony.

Abstrak

Perawatan maloklusi Klas II memberi pengaruh terhadap hubungan dimensi vertikal skeletal dan jaringan lunak wajah, yang berdampak terhadap keseimbangan dan proporsi wajah yang berkaitan dengan harmonisasi wajah pasien.Tujuannya adalah untuk mengetahui pengaruh perubahan dimensi vertikal wajah terhadap nilai harmoni wajah pada perawatan maloklusi Kelas II skeletal dengan pencabutan dan tanpa pencabutan berdasarkan analisis Arnett dan Bergman di RSGM FKG USU. Sampel penelitian berupa foto sefalometri 36 pasien usia 18-35 tahun, Klas II skeletal dengan $ANB > 4°$ pada kelompok pencabutan dan tanpa pencabutan. Analisis sefalometri untuk menentukan titik-titik yang diperlukan. Hasil pengukuran dianalisis dengan *software* Image J, data yang diperoleh diuji statistik untuk menentukan signifikansi menggunakan Uji Korelasi Pearson dan Uji T-independen. Terdapat hubungan yang signifikan antara perubahan dimensi vertikal wajah dengan Pog-Imd dengan nilai p=0,036 pada kelompok ekstraksi. Tidak terdapat perubahan yang signifikan pada dimensi vertikal dan nilai harmoni wajah pada kelompok non ekstraksi. Terdapat perbedaan bermakna dari nilai harmoni wajah pada titik G-A antara kelompok ekstraksi dan non ekstraksi (p=0,038).Terdapat pengaruh yang signifikan terhadap perubahan nilai harmoni wajah pada perawatan maloklusi Kelas II skeletal dengan pencabutan premolar pertama.

Kata kunci: Klas II, skeletal, vertikal dimensi, wajah

INTRODUCTIONS

One malocclusion that disrupt aesthetic, psycho-logical and social is CLASS II skeletal maloc-clusion which is the most common anomaly with prevalence of 15% to 30% of population.[1,2] Class II skeletal malocclusion affects the relationship of ske-letal vertical dimensions and facial soft tissue.[2,3] The

pattern of facial vertical growth plays an important role in achieving facial balance. Long or short faces can be caused by the hard and soft tissues that form the face, so that excessive vertical dimension growth leads to *gummy smile*, incompetent lips, and long faces. Short vertical dimensional growth leads to incisive became invisible, lips are too close, and the face is short. Both types of face are considered not aesthetic and are included in orthodontic problems.

There are several numerical analyses used to analyze soft tissue profiles, one of which Arnett ET's analysis has been widely adopted by orthodontist and maxillofacial surgeons in diagnosis and treatment planning. The facial balance, diagnosis and treatment plan are developed again by Arnett, by combining it from the clinical face analysis, both hard tissue and soft tissues.[4,5] Changes in vertical dimensions occurred in orthodontic treatment is important to consider because extrusion or intrusion can affect the aesthetic and *Temporomandibular joint*.

The treatment of patients who have completed the growth period, can be done by camouflage the orthodontic treatment, by extracting or without it.[6,7] Wyatt states that premolars extraction followed by anterior tooth retraction in a class II skeletal malocclusion treatment can lead to condyles displacement to the posterior and discus displacement to the anterior. Changes in the vertical dimension can affect the aesthetic smile due to changes in the maxillary molar position, the occlusal plane inclination, and craniofacial growth.[8,9]

However, there are still limited study about relationship between vertical dimension correction in this case SN. MP on soft tissue analysis in the event of harmonization. Based on the background, the purpose of this research is to know the effect of facial vertical dimension change on the value of facial harmony in the class II skeletal malocclusion before and after treatment without extracting maxillary first premolars, knowing the effect of facial vertical dimension change on the value of facial harmony in class II skeletal malocclusion before and after treatment with maxillary first premolars extraction based on Arnett and Bergmann, and knowing the difference in the facial vertical dimensions and the value of facial harmony in the class II skeletal malocclusion on Repeal before and after treatment of class II skeletal malocclusion in RSGM FKG USU.

MATERIAL AND METHODS

The study is analytical study with cross-sectional design. The population in this study was patients lateral cephalometric radiograph in RSGM orthodontic specialist Clinic FKG USU which has completed orthodontic treatment from 2008-2019. The sample inclusion criteria in the study were patients diagnosed with a class II skeletal malocclusion with ANB > 4° and completed treatment, male and female patients aged 18-35 years, there are radiographic photos before and after treatment, complete number of teeth before treatment regardless the absence of third molar, no congenital/agenesis tooth loss, no supernumerary tooth or anomaly, no interproximal grinding and tooth extraction before. The exclusion criteria are patient with history of cleft lip and palate. The instrument on this study *is* tracing box, acetate tracing paper (thickness 0.003 inches, 8x10 inches, Ortho Organizer), 4h pencil and eraser (Faber - CASTELL), NIKON D90 DSLR camera and NIKON DX AF-S NIKKOR 18-105 mm lens, excell UFO 260 tripod, protractor (Ormco), black cardboard, tape and scissors, software Image J 1.52 A; 2018 and Cephalometry radiograph before and after treatment. The study location is conducted at the Orthodontic specialist Clinic of RSGMP FKG USU. Data analysis before and after the treatments are using T paired test if data is distributed normally. Otherwise Wilcox on test is used. Then following by Pearson's correlation test to see correlation between variables if distributed data is normal. If the data is not distributed normally then used the correlation test Spearman.

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RESULTS

This study is analytical study with cross sectional design, conducted to know and evaluate the effect of changes in the facial vertical dimension on the value of facial harmony based on Arnett and Bergmann after treatment of class II skeletal malocclusion in RSGM FKG USU. The subject in this study was the patients lateral cephalometric radiograph in orthodontic clinic of RSGM FKG USU which has completed the treatment from 2008 to 2019.

Group measurements data without and with the extraction of maxillary premolars has been tested with *Shapiro-Wilk* normality. The results of this study used Pearson correlation test for normal distributed data (P < 0.05) and used Spearman correlation test (P <0.05) for data that was not normally distributed. Statistical test results showed no significant changes in MP-SN with facial harmony (P > 0.05) in the group without extraction (table 1). There

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is a correlation in the direction that is directly proportional with moderate strength (30%<R<49) between MP-SN – Pog-Imd and MP-SN – G-Pog. Weak correlation (10% < R < 29%) Between MP-SN – Pog-B, MP-SN – Or-Pog and MP-SN – G-A. There is negative relationship with moderate strength between MP-SN-Pog-LLA, MP-SN-POG-NTP, MP-SN-SN-Pog. There is a negative rela-

tionship with lower strength between MP-SN – Or-A (table 1). The average VA-LUE and SD in each variable of facial vertical dimension changes to the value of facial harmony in class II skeletal malocclusion before and after treatment without the first premolars extraction can be seen in table 1.

Table 1. Facial vertical dimension changes on facial harmony landmarks without maxillary first premolar extraction

Vertical Dimension	X±SD	Landmark	X±SD	r	p-value
MP-SN	0,27±1,86	Pog-IMd	1,49±3,50	0,380	0,120
		Pog-LLA	-0,63±1,88	-0,463	0,053
		Pog-B	0,23±1,29	0,203	0,420
		Pog-NTP	1,01±5,31	-0,319	0,197
		SN-Pog	0,61±4,17	-0,328	0,184
		ULA-LLA	0,97±1,93	-0,139	0,581
		Or-A	-0,35±3,38	-0,021	0,934
		Or-Pog	-0,83±5,43	0,111	0,660
		G-A	-1,43±4,18	0,074	0,770
		G-Pog	-1,17±6,90	0,375	0,125
		GSn-Pog	0,58±4,69	-0,265	0,924
		B-A	0,46±3,11	-0,199	0,591

Correlation tests on this study used Pearson correlation test due to normal distributed data (P < 0.05). Statistical test results showed there is a significant correlation between MP-SN with Pog-IMd (p = 0,036), and the strength of its relationship indicates the positive direction which means the higher MP-SN value then Pog IMD value also higher (unidirectional) and has a moderate strength (49.7%) (Table 2). Pearson correlation test is commonly used to determine the correlation of various skeletal analyses. There is positve correlation with moderate strength (30%< R < 49%) Between MP-

SN -Pog-Imd and MP-SN – Or-A. Weak correlation (10%< r < 29%) Between MP-SN – Pog-B, MP-SN – Or-Pog, MP-SN – G-A and MP-SN – G-Pog. There is a negative correlation with moderate strength between MP-SN – G-Sn-Pog. Weak correlation of MP-SN – Pog-NTP and MP-SN – ULA-LLA (table 2).

Mean and SD values of each variable from facial vertical dimension changes to the value of facial harmony of in the class II skeletal malocclusion before and after the treatment of the first premolars revocation can be seen in table 2.

Table 2. Facial vertical dimension changes on facial harmony landmarks with maxillary first premolar extraction

Vertical Dimension	X±SD	Landmarks	X±SD	r	p-value
MP-SN	-0,44±1,86	Pog-IMd	0,85±2,93	0,497	0,036 *
		Pog-LLA	-0,26±1,86	-0,262	0,293
		Pog-B	-0,04±0,97	0,142	0,574
		Pog-NTP	0,026±4,23	-0,129	0,610
		SN-Pog	-0,05±3,33	-0,311	0,210
		ULA-LLA	0,92±1,92	-0,226	0,366
		Or-A	1,31±3,84	0,032	0,899
		Or-Pog	1,10±5,58	0,211	0,401
		G-A	1,74±4,62	0,023	0,929
		G-Pog	1,57±7,59	0,151	0,549
		GSn-Pog	-1,02±3,35	0,326	0,187
		B-A	0,31±2,96	-0,348	0,157

*p<0,05=significant

The relationship between the group with and without extraction of first premolars was carried out using T Test test. The T-independent test analysis shows there is a meaningful difference in the value of facial harmony at the G-A point between group with extraction and without extraction (P = 0.038). While the other landmark does not indicate any difference (p > 0.05) (table 3). The Mann-Whitney test results indicate there was no difference in group with and without extraction on B-A and GSn-Pog (p > 0.05).

Tabel 3. Vertical dimension and facial harmony landmarks differences between groups with extraction and without extraction

Groups	Vertical dimension and landmarks	X±SD	*p-value*
Without extraction	MP-SN	0,27±1,86	0,264
With extraction		-0,44±1,86	
Without extraction	Pog-IMd	1,49±3,51	0,556
With extraction		0,85±2,93	
Without extraction	Pog-LLA	-0,63±1,88	0,557
With extraction		-0,26±1,88	
Without extraction	PogB	0,23±1,29	0,489
With extraction		-0,036±0,97	
Without extraction	Pog-NTP	1,01±5,31	0,542
With extraction		0,03±4,23	
Without extraction	SN-Pog	0,61±4,17	0,601
With extraction		-0,05±3,33	
Without extraction	ULA-LLA	0,97±1,93	0,942
With extraction		0,92±1,92	
Without extraction	Or-A	-0,35±3,38	0,177
With extraction		1,31±3,83	
Without extraction	Or-Pog	-0,83±5,43	0,299
With extraction		1,10±5,58	
Without extraction	G-A	-1,43±4,18	0,038*
With extraction		1,74±4,62	
Without extraction	G-Pog	-1,17±6,90	0,265
With extraction		1,57±7,59	

*p<0,05=significant

DISCUSSIONS

The aim of orthodontic treatment is to improve the quality of life of individuals by improving dental function, dentofacial jaw and aesthetic.[10] To achieve aesthetically good face required a soft tissue that is harmonious between the teeth and the bone structure.[11] The skeletal class II malocclusion affects the relationship between skeletal vertical dimensions and facial soft tissues.[12] There are some soft tissue profile analyses including the analysis proposed by Arnett et al. , which combines clinical face analysis, hard tissue and soft tissues[4,5] Purpose in this study is to know the changes and difference in the facial vertical dimension to the value of facial harmony in the class II skeletal malocclusion before and after treatment in case with and without the maxillary first premolars extraction according to Arnett and Bergmann.

Pearson's correlation test results in this study showed no significant changes (P. < 0.05) between the vertical dimensions to the total value of facial harmony in the Class II skeletal malocclusion before and after treatment without maxillary first premolar extraction. Other study results by Alhajeri et al., which review changes in vertical dimensions with linear calculations indicating no significant change in the class II Division 1 malocclusion Group in adult patients with no premolars extraction due to the mechanical differences on using intermaxillary elastics for the space closure and for correcting the molar relationship into the molar relationship of Class 1 Angle.[13] Other study results by Perovic et al., stating that the class II Division 1 malocclusion Treatment with no premolar extraction would make changes to lower jaw's lip and incisive teeth.[14] Similar to the

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results of this study, there is a change in upper jaw's lip and incisive teeth because mechanical forces from orthodontic therapy in group without first premolar extraction only reposition the teeth, which cause the change of soft tissue only. This study showed by a positive correlation among others, namely the greater the angle of MP-SN, then Pog-IMD distance become greater and the greater the angle between MP-SN, then Pog-LLA distance become greater, but this difference is not statistically significant.

Pearson's correlation test result showed significant changes (P = 0,036) between the vertical dimension to the total value of facial harmony in class II skeletal malocclusion before and after treatment with maxillary first premolar extraction. It can be seen from the greater the angle of the MP-SN then Pog-IMD distance is also greater and with moderate strength (49.7%) (Table 3). The results of this study shows that extraction of maxillary first premolar can change facial harmony in class II skeletal malocclusion, this can be happened because accordance with the study conducted by Kirjavainen et al., on orthodontic treatment of Class II Division 1 Malocclusion with extracting four premolars where the upper and lower lips undergo retrusion as well as lip thickness and the depth of the chin remains unchanged.[15] and another reason is study results by Kumari et al., stating that there is increased vertical facial dimensions based on cephalometry in orthodontic treatment with the removal of premolars, wherein the removal of premolars can cause vertical loss of the occlusion dimension, as already described in other studies.[12] The results of this study were also supported by previous research by Beit et al., which states that the first premolars extraction in class I malocclusion treatment will affect the vertical skeletal after the orthodontic treatment is analyzed using cephalometry radiograph.[16]

The indication for the first premolars extraction is that the crowded teeth in the anterior is severe or there is a lip protrusion. The available space after extraction is usually used to reduce the crowded condition and retracting the incisor.[17] Orthodontic treatment with the removal of premolar teeth, which during the space closure, molar tooth will be extruded because there is mechanical pressure from the orthodontic, so it caused an increased facial vertical dimension. If the extrusion of the posterior teeth continues then it will compensate for the increased anterior facial height, then the MP-SN value will be retained.[15]

The results of this study correspond to the results of previous research studies by Janson et al., which states that when orthodontic treatment of Clas II

Division 1 malocclusion with the removal of premolars is done then it will retract the lower and the upper teeth so it will normalize over jet and lip retrusion hence a good aesthetic state can be achieved.[16] Similarly, the lip thickness and skeletal relationship of the Maxilla-mandibula may also affect bottom face profile after completing the orthodontic treatment.[17]

The results of this study are in accordance with the study conducted by Aggarwal et al., where there is an increase in the distance between the Pog' soft tissues with the mandibular central incisor on harmony facial evaluations, as well as the distance between point B' soft tissues with Pog' soft tissues is also significantly increased.[18] Research conducted by Janson et al., state that the treatment purpose of the Class II malocclusion are not only corrects the distallization of the maxillary molar and stimulates the development of maxillary jaw, but also restores the ideal position of the mandibular incisor, thus improving the relationship between the mandibular and the maxilla. This study also showed that there is clockwise mandibular rotation when maxillary first molar was moving toward the mesial and the lower teeth are protuding.[19] Similarly, this study found one positive correlation, namely the greater theMP-SN angle then POG-IMD distance is also greater and the greater MP-SN angle then POG-B distance is also greater.

To assess the vertical dimension difference to the total value of facial harmony in the class II skeletal malocclusion before and after treatment with and without the maxillary first premolars extraction, then T-independent test is conducted, the result showed that there is difference in facial harmony value at point G-A between the group with and without extraction (P = 0.038) While the other point does not indicate any difference (p > 0.05) (table 4).

This result shows that there is a changes in maxillary area due to facial harmony and can affect the facial soft tissues because there is a results of previous research by Alhajeri et al., states that a class II Division 1 malocclusion treatment treated with no premolars extraction significantly increases the face height of the anterior portion (Na-Me distance).[14] Previous study results conducted by Al-Nimri et al., stated that class II Division 1 treatment case with premolars tooth extraction in orthodontic treatment is commonly performed in cases with hyperdivergent facial, where this pattern related to changes occurring in the development of vertical facial skeletal. Treatment without premolars extraction is usually used in mild cases where it does not involve the development of the skeletal vertical dimension.[20] According to Janson et al., Class II Di-vision 1 malocclusion treatment withbonded orthodontic wi-

thout tooth extraction only corrects anteroposterior discrepancies through distallization of teeth in maxilla only, but for cases with two premolars extraction, not only correcting in anteroposterior direction but can also protruded the mandibular incisor and the positioning the mandibular anteriorly to compensate maxillary condition, so the treatment results can affect the facial soft tissues.[19]

Conclusion: 1. There is not a change in the facial vertical dimension to the total value of facial harmony in the class II skeletal malocclusion before and after treatmentin case without the maxillary first pre- molars extraction based on Arnett and Bergmann. 2. There is a change in the facial vertical dimension to the total value of facial harmony in the class II skeletal malocclusion before and after treatment in case with maxillary first premolars extraction based on Arnett and Bergmann. 3. There is difference in the value of the facial harmony at point G-A between the group with and without extraction in facial vertical dimensions to the total value of the facial harmony in the class II skeletal malocclusion based on Arnett and Bergmann.

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