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Original Research Article

Assessment and comparison of palatal rugae pattern in clinically obvious ND non obvious asymmetrical patients

Akansha Chauhan [1], Rohit Khanna [1], Tripti Tikku [1], Sneh Lata Verma [1], Rana Pratap Maurya [1,*], Kamna Srivastava [1]

[1] *Dept. of Orthodontics and Dentofacial Orthopedics, Babu Banarasi Das College of Dental Sciences, Lucknow, Uttar Pradesh, India*

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ABSTRACT

Introduction: Various types of appliances have been tried by the Orthodontists for the fixed orthodontic treatment. Irrespective of the appliance used the main goal of retraction of anterior teeth in extraction cases is to keep the vertical dimension stable so as not to allow downward and backward rotation of mandible. The aim of this study was to compare changes in mandibular rotation following fixed orthodontic treatment on subjects who have undergone extraction of all first premolars.

Materials and Methods: Pre and post treatment lateral Cephalogram of 25 subjects were taken (13 females and 12males), aged 18-25 years and the tracings were done using Nemoceph software. Parameters assessed were facial height (anterior and posterior), mandibular plane angle (FMA & SN-GoGn), and Jarabak ratio. Student t-test was used to make statistical comparison.

Results: Mean difference of SN-GoGn (0.15 ±0.07), FMA (0.23 ±0.52), Anterior facial height (0.18±0.01) and posterior height (0.45±0.01) and Jarabak ratio (0.47±0.32) did not show statistically significant difference between pre and post treat ment.

Conclusion: Mandibular plane did not alter during treatment. When adequate mechanics is followed during treatment desirable treatment outcome with insignificant alteration of mandibular plane can be achieved.

1. Introduction

Various types of appliances have been tried by the orthodontist for retraction of maxillary anterior teeth in extraction cases.[1] The main goal of retraction of anterior teeth in extraction cases is to keep the vertical dimension stable so as not to allow downward and backward rotation of mandible. If mandibular plane angle opens during treatment for subjects with skeletal class II malocclusion having retrognathic mandible, it may appear more retrog- nathic with downward and backward rotation of mandible. In vertical grower, downward and backward rotation of mandible may also exaggerate open bite thus worsening the aesthetics. Any unfavourable changes in post treatment mandibular angle affects aesthetics and balance Premolar extractions are routinely done during fixed orthodontic treatment for improving the profile of the patient. Orthodontic mechanics should be such as so not to alter the mandibular angle in adult patients undergoing all 1^{st} premolar extraction.

The aim of this study was to compare changes in mandibular rotation following fixed ortho- dontic treatment on subjects who have undergone extraction of all first premolars.

* *Corresponding author.*
E-mail address: ranapmaury@yahoo.co.in (R. P. Maurya).

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2. Sample selection

Sample selection was done solely on the pre-treatment criteria and pre-treatment records. The study was retrospective in nature thus the samples were selected only after the completion of treatment**.**

3. Material and Methods

The sample consisted of pre and post cephalogram of 25 subjects (13 females and 12 males) aged 18-25 years.

3.1. Inclusion criteria for the subjects are

1. Adult subjects (minimum age at the start of treatment was 18 years).
2. Extraction of all first premolar was planned.
3. Profile has improved during and after treatment.

3.2. Exclusion criteria

1. No other method was used for retraction such as headgears.
2. Patient who have undergone orthodontic treatment previously.
3. Orthognathic surgery.
4. Lateral cephalogram were taken from record files of the patient's lateral cephalogram was taken from the same machine (planmeca proline XC) in department of Oral medi cine and Radiology (using panoramic x-ray machine planmeca proline XC) exposed at 68.0kV 5mA for a exposure time of 23.0 seconds(Figure 1). The subjects were placed at a distance of 60 inches. Soft copy of lateral cephalogram was taken by copying it into a CD rom. Nemoceph (dental studio v6.0) software was used for tracing and analysing the lateral cephalogram. The size of headfilm used was 8 X 10 inches.

Lateral cephalograms were taken using standard protocols. Lateral cephalogram was taken in natural head position with lips relaxed and teeth in centric occlusion. Soft copies of lateral cephalograms were transferred to a computer loaded with planmeca software from where the digital lateral cephalogram was saved in bitmap file and taken into a CD ROM.

The soft copies of all the lateral cephalograms was transferred to nemotec software program (dental studio NX version 6.0).(Figure 2)

Calibration of image: image calibration was done by identifying the cross hairs 10mm apart on lateral cephalogram using the calibration tool of the (nemotec) software. Identification of landmarks was done after using image enhancement feature of the software like brightness, contrast adjustment and magnification were used to identify individual cephalometric landmarks as precisely as possible. The landmarks were marked using the inbuilt touchpad of the laptop. This was done for both pre and post treatment cephalogram. Following landmarks were used in the study:-

The reference points taken on the lateral cephalogram for this study included: (Figure 3)

1. Nasion (N): The most anterior point on the frontonasal suture in midsagittal plane
2. Sella (Se): Midpoint of the cavity of sella turcica
3. Porion (Po): The most superiorly positioned point of the external auditory meatus.
4. Orbitale (Or): Lowest point on the inferior rim of the orbit
5. Gonion (Go): A constructed point on the intersection of lower and posterior mandibular border.
6. Menton (Me): Lowest point on the mandible.
7. Gnathion (Gn): A midpoint located between the anterior (pogonion) and inferior (men ton) points of the bony chin.

Following four planes were used in the analysis. (Figure 4)

Mandibular plane (tweed) : a tangent was drawn to the lower border of the mandible Mandibular plane (steiner): A line drawn from gonion to gnathion.

Frankfort horizontal plane: a plane connecting lower border of the orbit and superior point on the auditory meatus.

S-N plane: a plane formed by connecting the centre of sella turcica and point nasion.

Parameters used to assess the changes included anterior face height (N-Me) and posterior face height (Se-Go) (fig5). Angular measurements taken in the study includes FMA, SN- GoGN (fig4). The anterior and posterior face height was taken to deduce the facial growth pattern using Jaraback ratio.

3.3. Data analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS for Windows (Statistical Presentation System Software, SPSS Inc.) version 17.0. Continuous data was repre- sented as mean and standard deviation. Paired t test was used.

3.4. Graphical representation of data

MS Excel and MS word was used to obtain various types of graphs such as bar diagram and Pie diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

4. Observation and Results

The changes in various parametres have been summarised in Table 1.

Mean difference of SN-GoGn (0.15±0.07), FMA(0.23±0.52), Anterior facial height (0.18±0.01) and

posterior height(0.45±0.01) and Jarabak ratio (0.47±0.01) did not show statistically significant difference pre and post treatment (Table 1). Assessment of pre and post treatment results do not show any alteration in mandibular if proper mechanics is followed during retraction in premolar extraction cases.

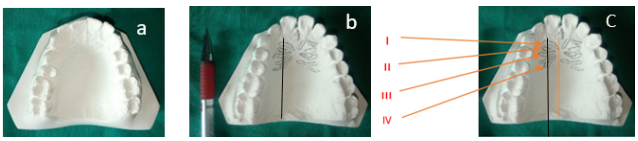

Fig. 1: (a-c): Deliniation and numbering of palatal rugae

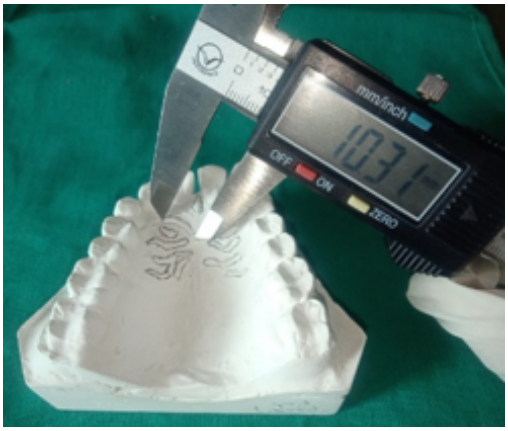

Fig. 2: Measurement is done with Vernier callipier

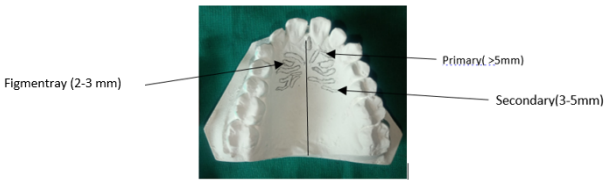

Fig. 3: Lengh of rugae pattern according to Lysell classification.

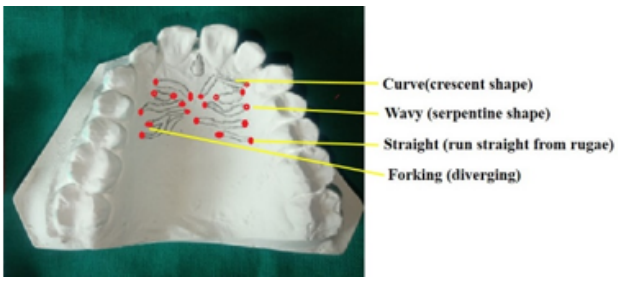

Fig. 4: Shape of rugae pattern.

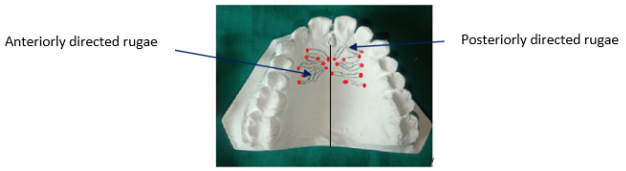

Fig. 5: Orientation of rugae pattern

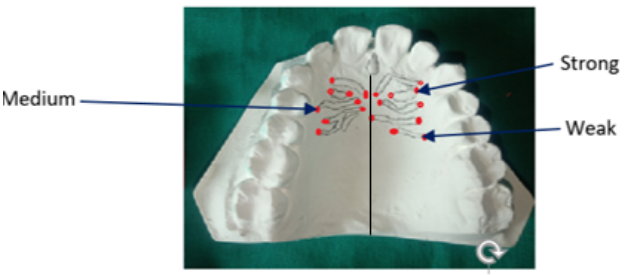

Fig. 6: Strength of rugae pattern

5. Discussion

This study was aimed to assess the relationship between changes in mandibular plane angle before and after treatment in cases with premolar extraction. Brodie[2] stated that the facial pat- terns once established did not change much. Bishara[3] in his study concluded that differences among facial types were more pronounced at adulthood. Studies have shown that the growth changes of the facial tissues, although not completed, occurred predominantly before the age of 18 years, hence samples included subjects above 18 years. The results of present study stated that vertical dimension did not alter significantly from pre to post treatment in subjects who had undergone premolar extraction. Staggers,[4] Beit,[5] Sharma,[6] Al-Nimri,[7] Kim[8] and Ko- cadarel[9] showed no significant increase in vertical dimension between premolar exrtraction and no extraction cases. According to these authors extraction did not result in collapse of vertical dimension when compared with non-extraction cases. For present study there was no alteration in mandibular plane angle in extraction cases. Similar to present study, Alhajeri- K,[10] reported a non-significant decrease in SN GoGn when compared to post treatment rec- ords. He also reported contradictory result for anterior facial height which showed significant increase in this study whereas it was non-significant in the present study. Aras A. et al.,[11] re- ported no significant alteration in mandibular plane related in subjects with skeletal open bite who had undergone all 1^{st} premolar extraction. Dwivedi et al.,[12] reported significant increase in mandibular plane angle in post treatment tracing in subjects with hyperdivergent growth pattern.

Though sample was mixed in present study but we achieved no significant difference in man- dibular rotation

Table 1: Sample size distribution of group I and group II

Sample	Group I (control)	Group II (study)
Maxillary study model (N=50)	n=25	n=25

Table 2: Depicts the statisticsfor the orientation, length strength and shape of left and right side of palatalrugae (I-IV) in group I

Orientation						Total	P Value
Rugae I	LFT	%(N)	0.0% (0)	92.0%(23)	8.0%(2)	100.0%(25)	
	RT	%(N)	4.0%(1)	96%(24)	0%(0)	100%(25)	0.221
Total		%(N)	2%(1)	94%(47)	4.0%(2)	100.0%(50)	
Rugae II	LFT	%(N)		52.0%(13)	48.0%(12)	100.0%(25)	
	RT	%(N)		44.0%(11)	56.0%(14)	100.0%(25)	0.389
Total		%(N)		48.0%(24)	52.0%(26)	100.0%(50)	
Rugae III	LFT	%(N)		56.0%(14)	44.0%(11)	100.0%(25)	
	RT	%(N)		48.0%(12)	52.0%(13)	100.0%(25)	0.389
Total		%(N)		52.0%(26)	48.0%(24)	100.0%(50)	
Rugae IV	LFT	%(N)	56.0%(14)	24.0%(6)	20.0%(5)	100.0%(25)	
	RT	%(N)	60.0%(15)	16.0%(4)	24.0%(6)	100.0%(25)	0.769
Total		%(N)	58.0%(29)	20.0%(10)	22.0%(11)	100.0%(50)	

Shape			Curve	Wavy	Straight	Forking	Island	Total	P Value
Rugae I	LFT	%(N)	52.0%(13)	24.0%(6)	0.0%(0)	20.0%(5)	4.0%(1)	100%(25)	
	RT	%(N)	52.0%(13)	16.0%(4)	12.0%(3)	20.0%(5)	0.0%(0)	100%(25)	0.355
Total		%(N)	52.0%(26)	20.0%(10)	6.0%(3)	20.0%(10)	2.0%(1)	100%(50)	
Rugae II	LFT	%(N)	56.0%(14)	40.0%(10)	4.0%(1)			100%(25)	
	RT	%(N)	60.0%(15)	36.0%(9)	4.0%(1)			100%(25)	0.957
Total		%(N)	58.0%(29)	38%(19)	4.0%(2)			4%(50)	
Rugae III	LFT	%(N)	40.0%(10)	60%(15)	0.0%(0)	0.0%(0)		100%(25)	
	RT	%(N)	32.0%(8)	60%(15)	4.0%(1)	4.0%(1)		100%(25)	0.528
Total		%(N)	36.0%(18)	60%(30)	2.0%(1)	2.0%(1)		100%(50)	
Rugae IV	LFT	%(N)	63.6%(7)	36.4%(4)				100%(11)	
	RT	%(N)	60.0%(6)	40.0%(4)				100%(4)	0.608
Total		%(N)	61.9%(13)	38.1%(8)				100%(21)	

Length			Primary	Secondary	Fragmented	Total	P Value
Rugae I	LFT	%(N)	92.0%(23)	8.0%(2)		100%(25)	
	RT	%(N)	84.0%(21)	16.0%(4)		100%(25)	0.334
Total		%(N)	88.0%(44)	12.0%(6)		100%(50)	
Rugae II	LFT	%(N)	96.0%(24)	4.0%(1)		100%(25)	
	RT	%(N)	88.0%(22)	12.0%(3)		100%(25)	0.305
Total		%(N)	92.0%(46)	8.0%(4)		100%(50)	
Rugae III	LFT	%(N)	84.0%(21)	12.0%(3)	4.0%(1)	100%(25)	
	RT	%(N)	80.0%(20)	20.0%(5)	0.0%(0)	100%(25)	0.465
Total		%(N)	82.0%(41)	16.0%(8)	2.0%(1)	100%(50)	
Rugae IV	LFT	%(N)	27.3%(3)	72.7%(8)		100%(11)	
	RT	%(N)	30.0%(3)	70.0%(7)		100%(10)	0.633
Total		%(N)	28.6%(6)	71.4%(15)		100%(21)	

Strength			Strong	Medium	Weak	Total	P Value
Rugae I	LFT	%(N)	88.0%(22)	12.0%(3)		100%(25)	
	RT	%(N)	84.0%(21)	16.0%(4)		100%(25)	0.500
Total		%(N)	86.0%(43)	14.0%(7)		100%(50)	
Rugae II	LFT	%(N)	88.0%(22)	12.0%(3)		100%(25)	
	RT	%(N)	84.0%(21)	16.0%(4)		100%(25)	0.500
Total		%(N)	86.0%(43)	14.0%(7)		100%(50)	
Rugae III	LFT	%(N)	80.0%(20)	12.0%(3)	8.0%(2)	100%(25)	
	RT	%(N)	76.0%(19)	20.0%(5)	4.0%(1)	100%(25)	0.651
Total		%(N)	78.0%(39)	16.0%(8)	6.0%(3)	100%(50)	
Rugae IV	LFT	%(N)	36.4%(4)	0.0%(0)	63.%(7)	100%(11)	
	RT	%(N)	30.0%(3)	40.0%(4)	30%(3)	100%(10)	0.058
Total		%(N)	33.3%(7)	19.0%(4)	47%(10)	100%(21)	

Table 3: Depicts the statistics for the orientation, length strength and shape of deviated and non-deviated side of palatal rugae (I-IV) In Group II)

Orientation			Zero	Negative	Positive	Total	P Value
Rugae I	Deviated	%(N)	8.0%(2)	84%(21)	8.0%(2)	100%(25)	
	Non deviated	%(N)	0.0%(0)	80.0%(20)	20.0%(5)	100%(25)	0.191
Total		%(N)	4.0%(2)	82.0%(41)	14.0%(7)	100%(50)	
Rugae II	Deviated	%(N)		56.0%(14)	44%(11)	100%(25)	
	Non deviated	%(N)		56.0%(14)	44%(11)	100%(25)	0.612
Total		%(N)		56.0%(28)	44%(22)	100%(50)	
Rugae III	Deviated	%(N)		68.0%(17)	32.0%(8)	100%(25)	
	Non deviated	%(N)		48.0%(12)	52%(13)	100%(25)	0.126
Total		%(N)		58.0%(29)	42%(21)	100%(50)	
Rugae IV	Deviated	%(N)	0.0%(0)	85.7%(6)	14.3%(1)	%(N)	
	Non deviated	%(N)	11.1%(1)	66.7%(6)	22.2%(2)	%(N)	0.577
Total		%(N)	6.3%(1)	75.0%(12)	18.8%(3)	%(N)	

Shape			Curved	Wavy	Straight	Forking	Island	Total	P Value
Rugae I	Deviated	%(N)	48%(12)	16%(4)	8.0%(2)	24.0%(6)	4.0%(1)	100%(25)	
	Non deviated	%(N)	40%(10)	8.0%(2)	16.0%(4)	32.0%(8)	4.0%(1)	100%(25)	0.772
Total		%(N)	44%(22)	12%(6)	12.0%(6)	28.0%(14)	4.0%(2)	100%(50)	
Rugae II	Deviated	%(N)	52%(13)	36%(9)	4.0%(1)	8.0%(2)		100%(25)	
	Non deviated	%(N)	44%(11)	28%(7)	16.0%(4)	12.0%(3)		100%(25)	0.491
Total		%(N)	48%(24)	32%(16	10.0%(5)	10.0%(5)		100%(50)	
Rugae III	Deviated	%(N)	13(52.0%)	12(48.0%)	0(0.0%)			25(100%)	
	Non deviated	%(N)	12(48.0%)	10(40.0%)	3(12.0%)			25(100%)	0.200
Total		%(N)	25(50.0%)	22(44.0%)	3(6.0%)			50(100%)	
Rugae IV	Deviated	%(N)	5(71.4%)	2(28.6%)				7(100%)	
	Non deviated	%(N)	8(80.0%)	2(20.0%)				10(100%)	0.559
Total		%(N)	13(76.5%)	4(23.5%)				17(100%)	

Length			Primary	Secondary	Fragmented	Total	P Value
Rugae I	Deviated	%(N)	23(92.0%)	2(8.0%)		25(100.0%)	
	Non deviated	%(N)	24(96.0%)	1(4.0%)		25(100.0%)	0.500
Total		%(N)	47(94.0%)	3(6.0%)		50(100.0%)	
Rugae II	Deviated	%(N)	24(96.0%)	1(4.0%)		25(100.0%)	
	Non deviated	%(N)	22(88.0%)	3(12.0%)		25(100.0%)	0.305
Total		%(N)	46(92.0%)	4(8.0%)		50(100.0%)	
Rugae III	Deviated	%(N)	21(84.0%)	3(12.0%)	1(4.0%)	25(100.0%)	
	Non deviated	%(N)	20(83.3%)	4(16.7%)	0(0.0%)	24(100.0%)	0.563
Total		%(N)	41(83.7%)	7(14.3%)	1(2.0%)	49(100.0%)	
Rugae IV	Deviated	%(N)	2(28.6%)	4(57.1%)	1(14.3%)	7(100.0%)	
	Non deviated	%(N)	3(33.3%)	4(44.4%)	2(22.2%)	9(100.0%)	0.866
Total		%(N)	5(31.3%)	8(50.0%)	3(18.8%)	16(100.0%)	

Strength			Strong	Medium	Fragmented	Total	P Value
Rugae I	Deviated	%(N)	23(92.0%)	2(8.0%)		25(100.0%)	
	Non deviated	%(N)	18(72.0%)	7(28.0%)		25(100.0%)	0.069
Total		%(N)	41(82.0%)	9(18.0%)		50(100.0%)	
Rugae II	Deviated	%(N)	19(76.0%)	6(24.0%)		25(100.0%)	
	Non deviated	%(N)	20(80.0%)	5(20.0%)		25(100.0%)	0.500
Total		%(N)	39(78.0%)	11(22.0%)		50(100.0%)	
Rugae III	Deviated	%(N)	17(68.0%)	6(24.0%)	2(8.0%)	25(100.0%)	
	Non deviated	%(N)	19(76.0%)	4(16.0%)	2(8.0%)	25(100.0%)	0.774
Total		%(N)	36(72.0%)	10(20.0%)	4(8.0%)	50(100.0%)	
Rugae IV	Deviated	%(N)	1(14.3%)	6(85.7%)		7(100.0%)	
	Non deviated	%(N)	2(22.2%)	7(77.8%)		9(100.0%)	0.600
Total		%(N)	3(18.8%)	13(81.3%)		16(100.0%)	

between pre and post treatment. Thus it can be suggested that appropriate mechanism as per growth pattern must be followed so as to keep vertical dimension stable and prevent distortion of facial aesthetics.

Further studies must be directed in larger sample size divided as per growth pattern to ob- serve changes between pre and post treatment.

6. Conclusion

1. No significant alteration in SN-GoGn angle and FMA was observed from pre to post.
2. Changes in facial height (anterior and posterior) was insignificant between pre and post treatment
3. No significant alteration was seen in Jarabak's ratio between pre and post treatment.
4. It can be suggested that appropriate mechanics as per growth rotation must be followed to keep vertical dimension stable.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Author biography

Akansha Chauhan, Post Graduate Student https://orcid.org/0000-0003-1998-6298

Rohit Khanna, Professor and HOD https://orcid.org/0000-0002-3930-9238

Tripti Tikku, Professor https://orcid.org/0000-0003-0054-8554

Sneh Lata Verma, Reader https://orcid.org/0000-0002-9924-9521

Rana Pratap Maurya, Reader https://orcid.org/0000-0003-4708-9842

Kamna Srivastava, Reader https://orcid.org/0000-0001-9390-1454

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