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## RESEARCH ARTICLE

# CHANGES IN 'POINT-A' ON 'ANGLE SNA' IN ANGLE'S CLASS II DIV 1 MALOCCLUSION CASES TREATED WITH MAXILLARY FIRST PREMOLAR EXTRACTION– A CEPHALOMETRIC STUDY

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**ABSTRACT**

**Aim**: The aim of this study was to examine the Change in sagittal position of point- A and Effect of change in point-A on SNA Angle in Angle's class II division 1 malocclusion cases treated with maxillary first premolar extraction.

**Materials and Methods**: Pre and post treatment lateral cephalograms were collected from those who treated by PEA with MBT prescription with extraction of maxillary first premolars. Lateral cephalograms was analysed using various cephalometric parameters. The total change in the position of point A was measured by superimposing the pretreatment and post treatment lateral cephalograms on the sella-nasion (SN) line at the sella. Treatment changes in sagittal position of point A and SNA angle were calculated on pre-treatment and post-treatment lateral cephalograms which was analysed using Wilcoxon paired "t" test.

**Results:** Point A has moved saggitally by 2.80mm backward and there is a decrease in the SNA angle by $0.52^0$. Although VT-Point A shows significant change, its effect on Angle SNA is statistically nonsignificant.

**Conclusion:** This study concluded that retroclination of maxillary incisors accompanied by backward movement of incisor root apex caused posterior movement of point A. However, this posterior movement doesn't significantly affect the SNA Angle.

**Clinical significance**: The present study is taken to evaluate the change in sagittal position of point A and its influence on SNA angle in class II div 1 malocclusion patients treated with maxillary first premolar extraction which will help us to assess the effective outcome in treating classII div1 cases.



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## INTRODUCTION

It is well said by Dr. Angle: "Malocclusion is a misalignment or incorrect relation between the teeth of the two dental arches when they approach each other as the jaws close". Malocclusion is not a disease but a morphological variation which may or may not be associated with pathological conditions. It is one of the most prevalent oral pathologies, next to dental caries and periodontal disease and usually ranked third among worldwide public health dental disease priorities (Nainan, 2011). Class II malocclusion is present in about 14% of the population in the World wide (Sheldon, 1998) and 87.79% of population in south Indian population (Kaur, 20130) is often characterized by a deficient mandible, leading to a convex profile, unesthetic facial proportions, and occlusal disharmonies. Both environmental and genetic factors and their interactions have been associated with Class II malocclusions; however, the etiologic mechanisms resulting in the array of dentoskeletal combinations observed in Class II patients remain elusive (Lina, 2014). The dentoskeletal morphology of Class II malocclusion has been analyzed in a number of cephalometric investigations. Changes in the position of point A were divided into skeletal changes, which resulted from the movement of the maxilla relative to the anterior cranial base (growth), and local changes, which are caused by local bone remodelling associated with orthodontic proclination of the upper anterior teeth (Kalafa, 1968 and Downs, 1948). There are limited studies investigating the effects of anterior tooth movement on the position of point A in the literature. An earlier study by Van der Linden (Van Der Linden, 1971) showed that point A was related to the inclination of the incisor teeth since labial inclination was associated with a more anteriorly positioned point A. In a recent study by Al-Abdwani *et al* (Al-Abdwani, 2009), it was shown that each $10^0$ proclination of upper incisors resulted in a statistically significant change in point A of 0.6 mm in the horizontal plane. Cangialosi and Meistrell (Van Der Linden

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Pgm, 1971) demonstrated a stronger correlation between changes in maxillary incisor inclination and sagittal position of point A as they retracted point A 1.7 mm due to $12.22^0$ proclination of upper incisors. Bloom and Rudee (Bloom, 1961 and Houston, 1983), studied correlation between the posterior movement, remodelling of Point A and movement of the upper lip which was not found to be significant. The present study is taken to evaluate the change in sagittal position of point A and its influence on SNA angle in class II div 1 malocclusion patients treated with maxillary first premolar extraction which will help us to assess the effective outcome in treating classII div1 cases.

## MATERIALS AND METHODS

Pre and Post treatment lateral cephalograms of 25 subjects of age group 18 – 30 yrs who visited department of orthodontics and dentofacial orthopaedics at A.J Institute Of Dental Science (AJIDS) and Manipal College Of Dental Science (MCODS), Mangalore were obtained. Subjects were selected according to the inclusion criteria such as subjects with Angle's class II div 1 malocclusion with class II molar relation, Patient with full complement of teeth, Overjet of atleast 5mm, age between 18 – 30yrs, Difference between initial and post-treatment U1-PP angle should be atleast $5^0$,cases treated with PEA Fixed appliance with extraction of maxillary first premolar, Pre and post radiographs with good hard and soft tissue outlines. Lateral cephalograms were analysed using various cephalometric parameters (Table 1, 2).

**Table 1. Definition Of Cephalometric Landmarks In The Lateral Profile View**

| Cephalometric landmarks | Definition |
|---|---|
| Sella(S) | Centre of the pituitary fossa of the sphenoid bone |
| point(T) | Most superior point of the anterior wall of sella turcica at the junction with tuberculum sellae. |
| Nasion(N) | The most anterior point of the frontonasal suture in the median plane. |
| ANS | Tip of the median anterior bony process of the maxilla |
| PNS | Tip of posterior nasal spine |
| Point A | Deepest point on the curve of maxilla between the anterior nasal spine and supradentale |
| U1Ap(maxillary incisor apex) | Root apex of the most prominent maxillary central incisor |
| U1Ed(maxillary incisor edge) | Incisal edge of the most prominent maxillary central incisor |
| SBL(stable basicranial line) | Horizontal line passing through sella, 7 degrees inferior from the SN line, was drawn to form a stable basicranial line) |
| Vert T | Vertical reference line |
| Palatal plane (PP) | Anterior nasal spine to posterior nasal spine. |
| N perpendicular A | Line passing through Nasion perpendicular to Frankfurt's plane |

All radiographs used in the present study were taken with the same x-ray machine KODAK 8000C machine (69kvp, 12mA,2 sec). Cephalograms were traced by the same operator by hand (Fig 1,2). The total change in the position of point A was measured by superimposing the pretreatment and post treatment lateral cephalograms on the sella-nasion (SN) line at the sella (Fig 2). Treatment changes in sagittal position of point A and SNA angle were calculated on pre-treatment and post-treatment lateral cephalograms (Table 3) which was analysed using Wilcoxon paired "t" test (Table 4)

**Table 2. Cephalometric Parameters For Linear And Angular Measurements**

| Cephalometric parameters | | | |
|---|---|---|---|
| Skeletal | | | Dental |
| Angle | Linear | Angle | Linear |
| SNA | N perpendicular to point-A | U1-PP | Vert T-U1Ap |
| | | | Vert T-U1Ed |
| | | | Vert T-Point A |

Data analysis will perform by SPSS for Windows, version 14.0. Means and standard deviation between the pre-treatment and post-treatment measurements will be studied using Wilcoxon paired t-test. The level of significance is set at P <.05 (Table 4).

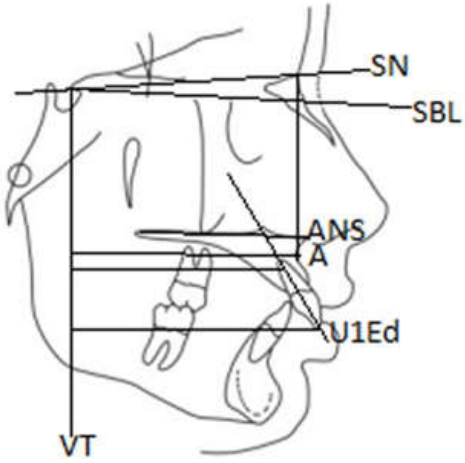



**Fig. 1. Shows; Diagrammatic representation of linear and angular measurements**

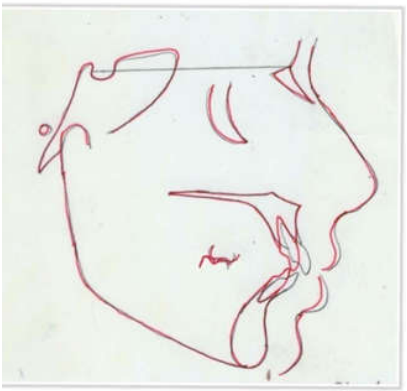
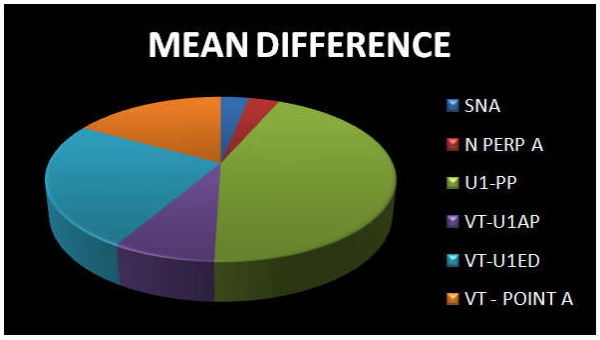


**Fig. 2. Shows; pre and post superimposition**




**Graph 1. Showing Comparison of Means of Each Variable**

**Table 3. Distribution of pre and post mean and standard deviation among variables**

| Parameters | | N | Mean | Standard Deviation |
|---|---|---|---|---|
| Sna | Pre | 25 | 82.9600 | 4.65904 |
| | Post | 25 | 82.4400 | 4.52843 |
| N perp a | Pre | 25 | -.9600 | 4.80867 |
| | Post | 25 | -1.5200 | 4.64686 |
| U1 – pp | Pre | 25 | 122.2400 | 6.04345 |
| | Post | 25 | 114.9600 | 6.61110 |
| Vt – u1ap | Pre | 25 | 63.2000 | 6.36396 |
| | Post | 25 | 61.8800 | 6.00222 |
| Vt-u1ed | Pre | 25 | 76.2000 | 6.80686 |
| | Post | 25 | 72.1200 | 6.07124 |
| Vt-point a | Pre | 25 | 70.9200 | 5.81607 |
| | Post | 25 | 68.1200 | 5.34104 |

**Table 4. Wilcoxon signed rank test of each variable and level of significance**

| | | N | Mean Rank | Sum of Ranks | Z | Sig. (p value) |
|---|---|---|---|---|---|---|
| U1-PP PRE-POST | Negative Ranks | 22 [a] | 12.95 | 285.00 | -3.861 [b] | 0.000 < 0.05 (H.SIG) |
| | Positive Ranks | 2 [b] | 7.5 | 15.00 | | |
| | Ties | 1 [c] | | | | |
| | Total | 25 | | | | |

| | | N | Mean Rank | Sum of Ranks | Z | Sig. (p value) |
|---|---|---|---|---|---|---|
| VT-U1AP PRE-POST | Negative Ranks | 14 [a] | 9.68 | 135.50 | -2.191 [b] | 0.028 < 0.05 (SIG) |
| | Positive Ranks | 4 [b] | 8.88 | 35.50 | | |
| | Ties | 7[c] | | | | |
| | Total | 25 | | | | |

| | | N | Mean Rank | Sum of Ranks | Z | Sig. (p value) |
|---|---|---|---|---|---|---|
| N PERP A PRE -POST | Negative Ranks | 11[a] | 9.00 | 99.00 | -1.667 [b] | 0.096 > 0.05 (NON SIG) |
| | Positive Ranks | 5 [b] | 7.40 | 37.00 | | |
| | Ties | 9 [c] | | | | |
| | Total | 25 | | | | |

| | | N | Mean Rank | Sum of Ranks | Z | Sig. (p value) |
|---|---|---|---|---|---|---|
| VT-POINT A PRE-POST | Negative Ranks | 17 [a] | 9,82 | 167.00 | -3.562 [b] | 0.001< 0.05 (H. SIG) |
| | Positive Ranks | 1 [b] | 4.00 | 4.00 | | |
| | Ties | 7 [c] | | | | |
| | Total | 25 | | | | |

| | | N | Mean Rank | Sum of Ranks | Z | Sig. (p value) |
|---|---|---|---|---|---|---|
| | | N | Mean Rank | Sum of Ranks | Z | Sig. (p value) |
| VT-U1ED PRE-POST | Negative Ranks | 22 [a] | 12.41 | 273.00 | -4.116 [b] | 0.000< 0.05 (H.SIG) |
| | Positive Ranks | 1 [b] | 3.00 | 3.00 | | |
| | Ties | 2 [c] | | | | |
| | Total | 25 | | | | |

(a.Post < Pre, b. Post > Pre, c. Post = Pre)

| | | N | Mean Rank | Sum of Ranks | Z | Sig.(p value) |
|---|---|---|---|---|---|---|
| SNA PRE-POST | Negative Ranks | 7 [a] | 6.57 | 46.00 | - 1.916[b] | 0.055 > 0.05 (NON SIG) |
| | Positive Ranks | 3[b] | 3.00 | 9.00 | | |
| | Ties | 15 [c] | | | | |
| | Total | 25 | | | | |

## RESULTS

Point A has moved sagittally by 2.80mm backward and there is a decrease in the SNA angle by $0.52^0$ . Upper incisors has retroclined by $7.28^0$ with respect to palatal plane. Upper incisor edge has moved backward by 4.08mm. Retraction of upper incisors resulted in backward movement of incisor root apex by 1.32mm due to torque expression in anteriors (Table 3). Table 4 shows Wilcoxon signed rank test of each variable and level of significance. The level of significance is set at $P < .05$. It can be shown that U1 – PP, VT – U1AP, VT- U1ED and VT –POINT A have significant changes between pre and post treatment measurements. Graph 1 shows mean difference of each parameters.

It shows that U1 – PP, VT – U1ED, VT – U1AP and VT-POINT A shows significant difference in all subjects. Although VT-Point A shows significant change, its effect on Angle SNA is statistically nonsignificant.

## DISCUSSION

The present study is taken to evaluate the change in sagittal position of point A and its influence on SNA angle in Angle's class II div 1 malocclusion patients treated with maxillary first premolar extraction which will help us to assess the effective outcome in treating class II div1 cases. This study could explain the correlation between changes in maxillary incisor inclination and sagittal position of point A.

Although Point A shows significant backward movement in sagittal direction, its effect on Angle SNA is statistically nonsignificant. The result of this investigation resembles various other studies. Earlier studies by Vander Linden (Michael, 1973), Al Abdwani (Joseph, 1977), Candgialosi and Meistrell (Van Der Linden Pgm, 1971), Erverdi (Bloom, 1961), Al-nimmri (Hassa, 2015), Ali Bicakcia *et al*, (Housten, 1992) and Hassan *et al*, (Scott Conley, 2006) reported that there is a significant correlation between the axial inclination of the upper incisors and the position of point A. Cangialosi and Meistrell (Van Der Linden Pgm, 1971) in his study evaluated the changes associated with palatal root torque of the upper incisor and point A in adolescent patients. They demonstrated a statistically significant correlation between changes in upper incisor root position and point A as they moved posteriorly by 1.7 mm and 3.5 mm, respectively. Erverdi (Bloom, 1961), reported that there is a significant correlation between the axial inclination of the upper incisors and the position of point A. Al-nimmri[14] found that the position of point A is affected by local bone remodelling associated with proclination of the upper incisor in Class II division 2 malocclusion, but this minor change does not significantly affect the SNA angle. An earlier study by Van der Linden (Michael, 1973), showed that point A was related to the inclination of the incisor teeth since labial inclination was associated with a more anteriorly positioned point A. Ali Bicakcia *et al* (1992), showed Point A moved 1.04 mm backward and 0.48mm forward in the study and control groups, respectively. However, this posterior movement of point A does not significantly lead to reduction in the SNA angle. In a recent study by Al-Abdwani *et al* (Joseph, 1977), it was shown that each $10^0$ proclination of upper incisors resulted in a statistically significant change in point A of 0.6 mm in the horizontal plane.

Hassan *et al* (Scott Conley, 2006). showed that each $10^0$ retroclination of maxillary incisor results in a borderline statistically significant displacement of point A of 0.6 mm in upward direction and conversely, each $10^0$ proclination of maxillary incisor results in borderline statistically significant displacement of point A of 0.6 mm in downward direction (p=0.06). There are limited studies in the literature showing the correlation between changes in maxillary incisor inclination and sagittal position of point A is statistically nonsignficant. Goldin (Bruce Goldin Labial Root Torque, 1989), Bloom & Rudee, (Housten, 1992 and Houston, 1983), Rains & Nanda (Rains, 1982), and Scott Conley & Jernigan (Scott Conley, 2006), reported that there is no correlation between the axial inclination of the upper incisors and the position of point A.

Correlation between this posterior movement, or remodeling of Point A and movement of the upper lip, was not found to be significant, as reported by Bloom and Rudee (Housten, 1992 and Houston, 1983). ScottConley and Jernigan (2006), also observed a statistically significant reduction of the variable A-Nperp in cases treated with extraction of two upper premolars. Rains and Nanda (Rains *et al*., 1982), did not find significant alterations on point A. Goldin (Bruce Goldin Labial Root Torque, 1989), in his study evaluated the effect of labial root torque on sagittal position of point A in 17 subjects and performed a control group in an attempt to account for growth, which was weakness of previous studies evaluating the effect of incisor tooth movement on position of point A. The measurements were made on cephalographs taken at the first time period (1.5 years) and at the end of total treatment. The results showed that labial root torque resulted in anterior movement of point A at the first time period; however, no difference was observed between the control and study groups for the anterior movement of point A at the end of total treatment time.

## Conclusion

The present study concluded that the position of point A was influenced by the inclination of maxillary incisors. However, this posterior movement doesn't significantly affect the SNA Angle. In the present study, nasion might have moved in a forward, however mainly in a downward direction during the treatment, so the posterior movement of point A could not lead to a significant decrease in SNA angle.

## Clinical Significance

The present study is taken to evaluate the change in sagittal position of point A and its influence on SNA angle in class II div 1 malocclusion patients treated with maxillary first premolar extraction which will help us to assess the effective outcome in treating classII div1 cases.

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