European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 08, Issue 2, 2021

Reliability Of Alternative Points For Identifying Subspinale In Class II Division 1 And Division 2 Malocclusion By Using Lateral Cephalograms

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Abstract:

Aim- To test the reliability of three different alternative points to point A in class II division 1 and division 2 malocclusion.

Material and method- The study was conducted on 120 Left lateral cephalogram on the basis of ability to locate point A with considerable degree of accuracy.The sample was divided into two groups:Group 1 consisted of 60 class 2 division 1 lateral cephalogram and group 2 consisted of 60 class 2 div 2 lateral cephalogram.Three alternative methods for point A estimation were evaluated for reliability in vertical and horizontal planes.

Results and Discussion- Point A2 was the most accurate in both the vertical and horizontal planes and both A2 and A3 can be used in the vertical plane as an alternative to Point A.

Conclusion- Point A2 is the best reliable substitute to point A and A3 being the least dependable in both the groups for assessment of sagittal jaw relationship.

Keywords: Lateral cephalogram; Point A,Point A alternatives,SNA (Sella Nasion subspinale), Incisior inclination.

Introduction:

Cephalograms have been an important component of orthodontics since their introduction in 1931.In orthodontics, lateral cephalograms are used for growth assessment, diagnosis, treatment plannig, treatment progress evaluation, and final outcome evaluation.[1,2] Lateral cephalograms are two dimensional (2D) projections of three dimensional (3D) structures. In traditional cephalograms, accurate recognition of anatomical landmarks is subject to error.[3]

The precise and consistent recognition of anatomical landmarks is a must for effective cephalometric assessment. The location of the maxilla is typically evaluated cephalometrically by point A, that is one of the most famous cephalometric landmarks used for spatial analysis of maxilla.[4]

Cases at which point A is difficult to recognize, such as due to variation in the structure of the skeleton, overshadows of soft tissue, or due to irregular anatomy, such as in patients with cleft lip and palate or in small children due to the tooth germs molding the anterior contour of the maxilla. In such instances, various authors have presented alternative approaches to identify point A with acceptable precision.[5-7]

Since the position of point A is influenced by the inclination of the incisor, the location of substitute points to point A can also be affected. The null hypothesis, therefore, is that the accuracy of these various available points is not influenced by the inclination of the incisors and the purpose of the present study is to assess their reliability.

Material and method:

The study was conducted on 120 Left lateral cephalogram subdivided into two groups at the Department of Orthodontics and Dentofacial Orthopedics, Maitri College of Dentistry & Research Centre with following inclusion and exclusion criteria.

Inclusion Criteria: -

The patients should meet the following criteria: -

1. Patients with fully erupted permanent maxillary anterior teeth and aged above 14 years.
2. No unerupted or supernumerary teeth overlying the maxillary incisor apices.
3. No missing permanent maxillary incisors.
4. No skeletal irregularity present.
5. Pretreatment lateral head films with excellence of image quality and ability to locate point A with a considerable degree of accuracy.

Exclusion Criteria: -

1. Previous orthodontic treatment.
2. History of trauma.
3. Lack of well defined anatomic features, outlines, hard edges, and shadows that would have made location of point A untraceable, were not selected.

Group A- Class II Division 1

Group B- Class II Division 2

The cephalograms were traced on lead acetate tracing paper using 3H lead mechanical pencil maintaining the same illumination condition of the view box.

Parameters measured:-

In both groups, three different methods for estimating point A are tested for reliability, as indicated in the literature-

- Point 3mm labial to a point between the upper third and lower two-thirds of the long axis of the root of the maxillary central incisor taken as point A1.(Figure A)
- Point formed by the joining of a line parallel to the palatal plane, 7 mm below, and the anterior contour of the maxilla as an substitute for point A, taken as point A2.(Figure B)
- Point at the joining of the projection of point prosthion on a line parallel to the palatal plane, 7 mm below the palatal plane which is taken as point A3.
  (Figure C)

Both horizontal and vertical planes were evaluated for the reliability of these three alternative point for point A by considering and comparing the SNA (Sella Nasion subspinale) angle with SNA1, SNA2 and SNA3.(Figure D)

Point A, A1, A2, and A3 projections of N perpendicular line and vertical linear NA comparisons were made with NA1, NA2 and NA3 to determine their vertical plane reliability.(Figure E)

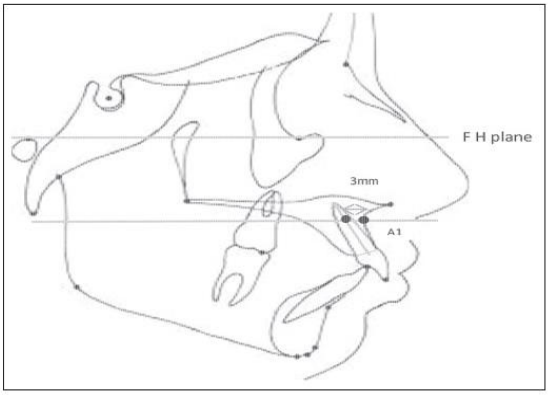

Figure A: Lateral cephalogram tracing showing method of determining point A1. FH Plane: Frankfort horizontal plane

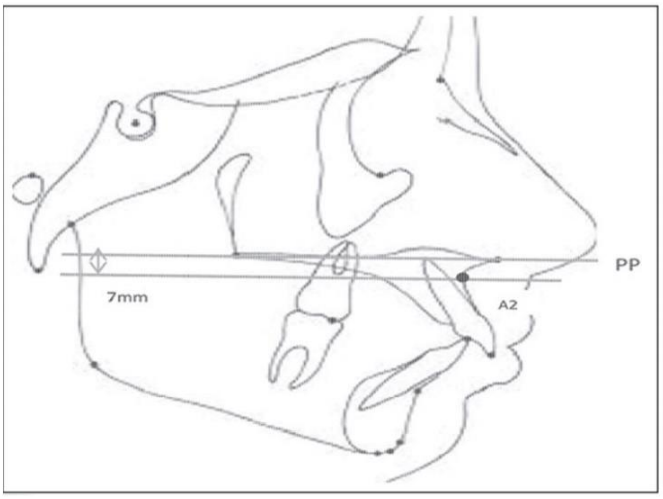

Figure B : Lateral cephalogram tracing showing method of determining point A2. PP: palatal plane

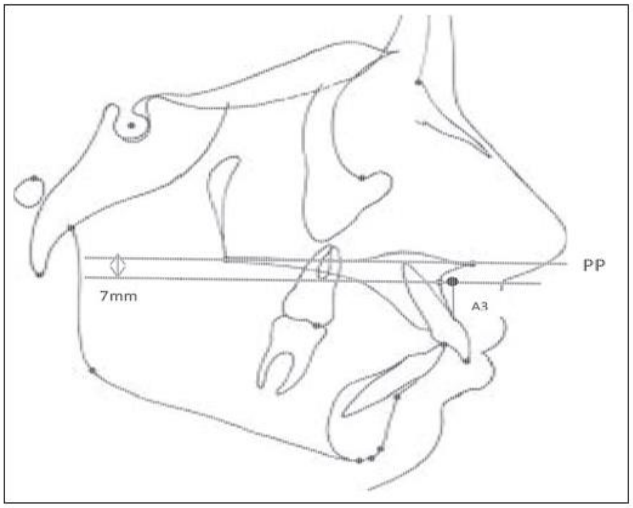

Figure C: Lateral cephalogram tracing showing method of determining point A3. PP: palatal plane

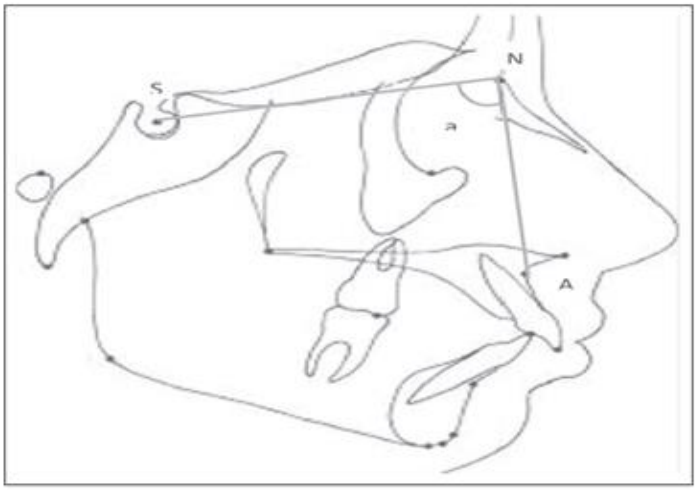

Figure D: Lateral cephalogram tracing showing SNA angle used for assessing reliability in horizontal plane. S: Sella; N: Nasion; A: Point A; a: SNA angle

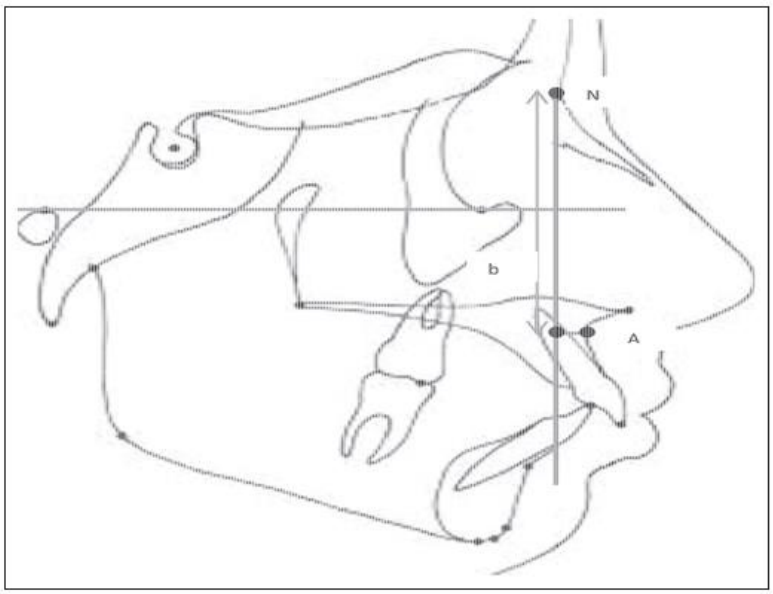

Figure E: Lateral cephalogram tracing showing linear measurement NA used for assessing reliability in vertical plane. N: Nasion; A: Point A; b: linear vertical distance NA

Pearson's correlation coefficient (SPSS 13.0) was used to assess the association of the alternative points A1, A2, and A3 to point A for both the groups. Level of significance was set at $P < 0.05$.

Results:

Evaluation in the horizontal plane-

In both groups A and B, the maximum mean value (85.05±5.02-A) (81.10±4.51-B) was observed for SNA3 followed by SNA2 (82.45±4.46),SNA1 (80.20±5.26)and SNA (82.15±4.26)for group A, in group B SNA1 (77.75±4.56), SNA (79.45±4.56) and SNA2 (79.40±4.80). (Table & Figure 1) It was observed a significant difference (p-0.020) between horizontal parameters of group A but for group B there was no significant difference (p-0.18).

There was a significant difference of SNA3 to SNA in group A observed so it is the least reliable point. Point A2 is more reliable as the mean difference between SNA-SNA2 is least. A Non-significant difference of SNA with SNA1, SNA2 and SNA3 was observed in group B. (Table 2)

The point A2 can be considered more reliable as the mean difference between SNA–SNA2 was found to be least as well as its correlation coefficient was found highest in both the groups (Table 3).

Evaluation in the vertical plane-

In both group A and B the maximum mean value (3.90±3.86-A) (1.10±3.46-B) was observed for NA3 followed by NA2 (0.60±3.09), NA (0.35±3.50) and NA1 (-2.25±3.47) but for group BNA (0.42±3.50), NA2 (-1.35±3.92) and NA1 (-3.25±4.00). (Table & Figure 1)

It was observed a significant difference of NA with NA1 and highly significantly differ with NA3 so A1 and A3 were least reliable point and A2 is most reliable point in group A. Highly Significant difference of NA with NA1 so it is considered as least reliable point and point A2 and A3 are considered as a more reliable point in group B. (Table 2). The point A2 measured more reliable as the mean alteration between NA–NA2 was found to be minimum as well as its correlation coefficient was found maximum in group A (Table 3).

ANOVA test results showed a significant difference between horizontal parameters of group A and a non-significant difference between group B on another hand a highly significant difference was observed between vertical parameters of both group A and B. (Table 4)

In the present study, in both vertical and horizontal planes, point A2 was found the most reliable.

Table 1: Mean and standerd deviation for both groups

	Group A		Group B	
	Horizontal Parameter			
Point	Mean	Std Dev	Mean	Std Dev
SNA	82.15	4.26	79.45	4.56
SNA 1	80.20	5.26	77.75	5.08
SNA 2	82.45	4.46	79.40	4.80
SNA 3	85.05	5.02	81.10	4.51
	Vertical Parameter			
NA	0.35	3.50	0.42	4.02
NA1	-2.25	3.47	-3.25	4.00
NA2	0.60	3.09	-1.35	3.92
NA3	3.90	3.86	1.10	3.46

Figure1: Mean and standerd deviation for both groups

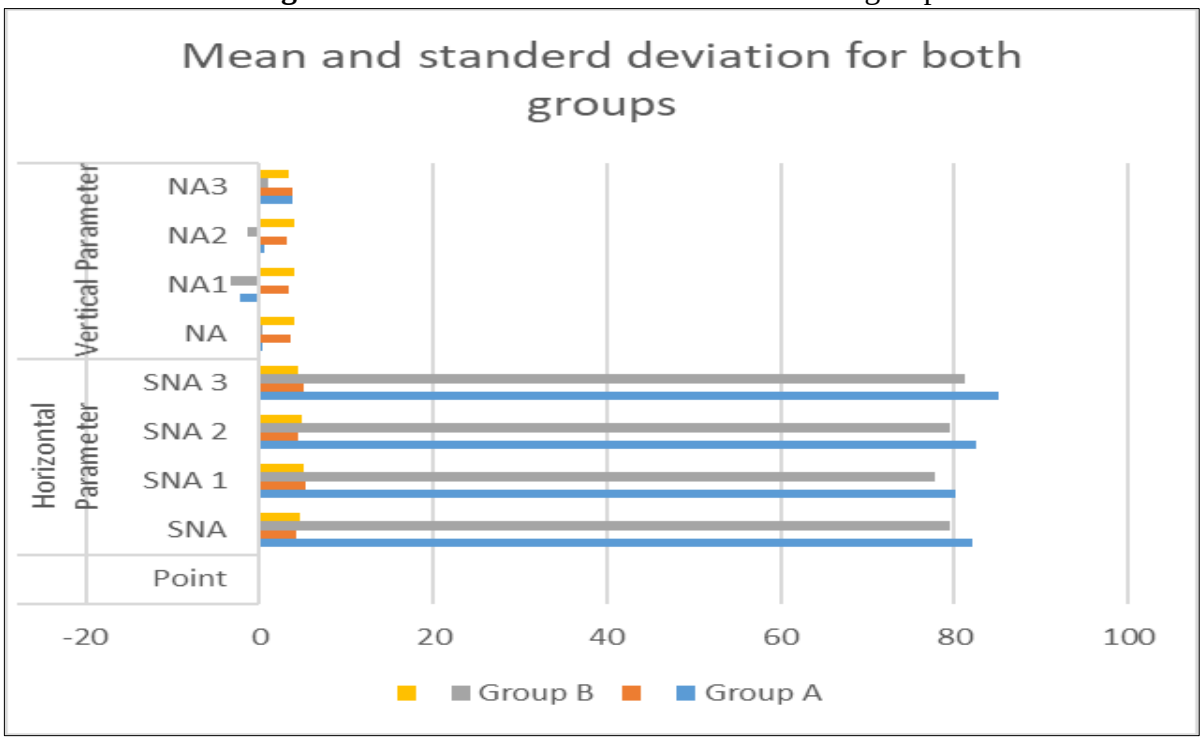

Table 2: Posthoc test results

Horizontal Parameter							
	Point	Group A			Group B		
		Mean Difference	Std Error	P- Value	Mean	Std Dev	P- Value
SNA	SNA 1	1.95	1.50	0.20	1.70	1.50	0.26
	SNA 2	-0.30	1.50	0.84	0.05	1.50	0.97
	SNA 3	-2.90	1.50	0.04	-1.65	1.50	0.27
Vertical Parameter							
NA	NA1	2.60	1.10	0.02	3.67	1.22	0.004
	NA2	-0.25	1.10	0.82	1.77	1.22	0.15
	NA3	-3.55	1.10	0.002	-0.68	1.22	0.57

Table 3: Pearson correlation for both groups

Horizontal parameters		SNA	SNA1	SNA2	SNA3
	Group 1	1	0.974	0.979	0.974
	Group 2	1	0.977	0.99	0.9
Vertical Parameter		NA	NA1	NA2	NA3
	Group 1	1	0.83	0.98	0.96
	Group 2	1	-0.04	0.03	- 0.005

Table 4: ANOVA for both the groups

		Sum of Squares	df	Mean Square	F	Sig.
		Group 1				
Horizontal Parameter	Between Groups	238.23	3	79.41	3.48	0.020*
	Within Groups	1732.15	76	22.79		
	Total	1970.38	79			
		Group 2				
	Between Groups	112.25	3	37.41	1.65	0.18
	Within Groups	1715.3	76	22.57		
	Total	1827.55	79			
Vertical Parameters		Group 1				
	Between Groups	381.3	3	127.10	10.39	0.001*
	Within Groups	928.9	76	12.22		
	Total	1310.2	79			
		Group 2				
	Between Groups	227.9	3	75.99	5.10	0.003*
	Within Groups	1132.45	76	14.90		
	Total	1360.44	79			

Discussion:

The evaluation of sagittal jaw relationships is an important element of cephalometrics in orthodontics. The introduction of point A, point B, and A–B plane angle to cephalometrics by Downs (1948) was a revolutionary step in the definition of the sagittal jaw relationship in orthodontics.[8] The anteroposterior (AP) relationship of the jaws has therefore been determined by many measurements, many of which utilize point A as a point of reference for the assessment of the AP location of the maxilla.Point A, however, is difficult to locate when anterior maxilla anatomy is blurred in lateral cephalometric

radiographs due to different causes, such as variation in the structure of the skeleton, overshadows of soft tissue, or due to unusual anatomy such as in patients with cleft lip and palate or in children due to tooth germs molding the anterior maxilla contour.

According to the result of the present research, the reliability of point A1 was least in both groups in the vertical plane. The explanation may be that the root length of the central incisor was treated by Bongaarts et al.[7]as a guide for evaluating the location of point A in the vertical plane. While point A in horizontal position is dependent on the root's inclination, but its vertical position is not linked to it in any way. Instead, point A in vertical location is influenced by the presence of ANS, which forms the palatal plane's anterior boundary. Both A2 and A3 can be used in the vertical plane as an alternative to Point A.

Point A2 was the most accurate in both the vertical and horizontal planes, according to the present study. The fact that Tindlund et al.[6]used the palatal plane as a guide to evaluate the location of point A in the vertical plane may be an explanation for its high reliability in the vertical plane, as it is understood that the position of point A is influenced by the anterior inclination of the palatal plane.In addition, also in the horizontal plane, the use of the anterior maxilla contour as a guide for horizontal position enabled point A2 most accurate. Therefore, Point A2 can also be used as a suitable alternative in both horizontal and vertical directions to point A.In those cases where in lateral cephalograms the anterior contour of the maxilla is not clearly visible, point A1 can be used as an alternative to point A instead of A2 to draw a line NA1 that is very similar to the actual NA line and therefore to evaluate the sagi ttal jaw plane, as A1 is a reliable alternative point in the horizontal plane.

Conclusion:

Based on the results of this investigation the following conclusions were drawn:

- Point A2 is the best reliable substitute to point A and A3 being the least dependable in both the groups for assessment of sagittal jaw relationship.
- In lateral cephalograms, point A1 can be used as a reliable substitute in cases where the anterior contour of the maxilla is blurred.
- Point A2 horizontal reliability is influenced by the orientation of the incisors, with retroclined incisors being more reliable relative to proclined upper incisors.

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