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Original Research Article

Dentoalveolar compensation in various skeletal malocclusion groups in district solan population: A cephalometric study

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ABSTRACT

Objective: To assess the position and inclination of upper and lower incisors and bases in different groups of skeletal malocclusions.

Materials and Methods: 45 pretreatment lateral cephalometric radiographs were included. They were divided into his three groups of skeletal class I, class II, and class III. A variety of linear and angular measurements were used to assess both the position and inclination of the maxillary and mandibular bases, incisors, and the relationship between the incisors.

Results: There was a significantly stronger correlation between anterior-posterior skeletal mismatch and maxillary alveolar bone compensation in skeletal classes I, II, and III. Except for maxillary vertical skeletal discrepancy (MP-SN) and alveolar compensation, there was a weak correlation between maxillary and mandibular vertical skeletal discrepancy and alveolar compensation. The anterior-posterior position of the skeletal jaw had a greater effect on alveolar bone changes than the vertical inclination of the skeletal jaw in the Grad variant.

Conclusions: There may be a relationship between alveolar bone changes and skeletal anteroposterior and vertical position, inclination and intermaxillary relationship.

1. Introduction

Malocclusion is defined as an abnormal tooth or arch mismatch beyond what is considered normal.[1] Malocclusion is the third most common oral disease after caries and periodontitis,[2] and it is the third most common disease in the world. It is the most common dental health problems.[3] Many techniques are available. Evaluate, describe and classify obstacles. Given its growth in 1986, the Dental Aesthetics Index (DAI) has proven to be easy and fast to use.[4] This is a cross-cultural index that mathematically combines clinical and aesthetic components into a single score.[5] This index can be used in different communities and population groups without requiring any kind of modification.[6] The most common discrepancies in daily orthodontic loading are anteroposterior and vertical discrepancies. Anterior and posterior malocclusions are found in Class I, Class II, and Class III skeletal malocclusions. Skeletal class I is the normal sagittal relationship between the maxillary and mandibular bases, but these bases may have normal or abnormal relationships to the base of the skull.[7] Class II or Class III. In the vertical orientation, malocclusion occurs in normal, hypo-, and hyper-divergent patterns of the skeleton. Normal skeletal divergence is the normal vertical relationship between the bases of the maxilla and mandible, but these bases may be in normal or abnormal vertical relation to the base of the skull. The basic

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relationship between the maxilla and mandible diverges or converges with skeletal hyper- and hypo-divergent patterns, respectively.[8] These skeletal deviations from normal are associated with changes in alveolar segmentation, known as alveolar compensation. may be subject to change. Alveolar orthodontics is a system that can achieve and maintain normal relationships with various skeletal patterns.[9] Adjust the position and/or tilt of the upper and lower incisors antero-posteriorly to compensate for anteroposterior skeletal misalignment. All of these trade-offs are aimed at camouflaging skeletal disharmony to maintain the overall harmony and proportions of the dental facial components.[10] Factors responsible for alveolar adaptation include a normal eruptive system, surrounding soft tissue pressure, and the influence of teeth antagonizing adjacent teeth during occlusion. There are several linear and angular measurements used to assess the degree of skeletal maladjustment and alveolar balance.[11] Cephalometric analysis should preferably be based on both types of measurements, as angular measurements are clearly less reliable for super-divergent surfaces.[12] Although there are several studies in the orthodontic literature for the same purpose, a comprehensive assessment of anteroposterior and vertical position and inclination has not yet been performed.[13,14]

2. Objectives

To assess the position and inclination of maxillary and mandibular incisors and bases in different groups of skeletal malocclusions in the regional Solan population. Treatment with or without tooth extraction at the orthodontic department of Bhojia Dental College and Hospital. Subjects enrolled included patients with skeletal class I malocclusion (ANB = 22°), skeletal class II malocclusion (ANB > 4°), skeletal class III (ANB < 4°). Exclusion criteria included cases with nasal deformities, cases with symptomatic or craniofacial abnormalities, previous corrective treatment, and cases of major craniofacial surgery. The samples were divided into three groups:

All cephalogram were traced manually by the same operator. Various landmarks and planes were identified and marked (Tables 2 and 3) (Figures 1 and 2).

Various skeletal and dentoalveolar parameters were measured to record the maxillary and mandibular bases, incisors, and inter-incisor relationships. (Tables 3 and 4) (Figures 3 and 4).

2.1. *Statistical analysis*

The results obtained were statistically analyzed using SPSS software. Descriptive statistics and mean standard deviations were analyzed and ANOVA was applied.

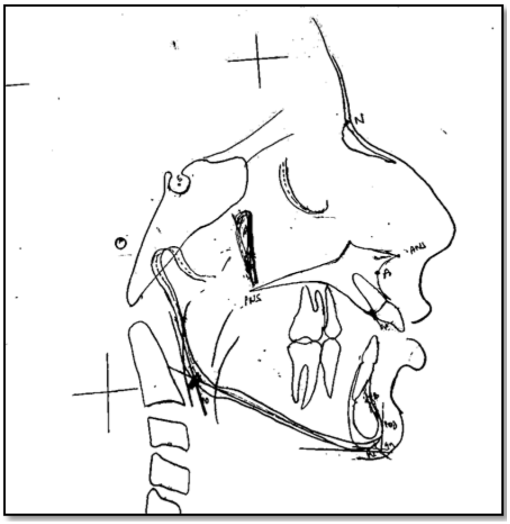

Fig. 1: Landmarks used in the study

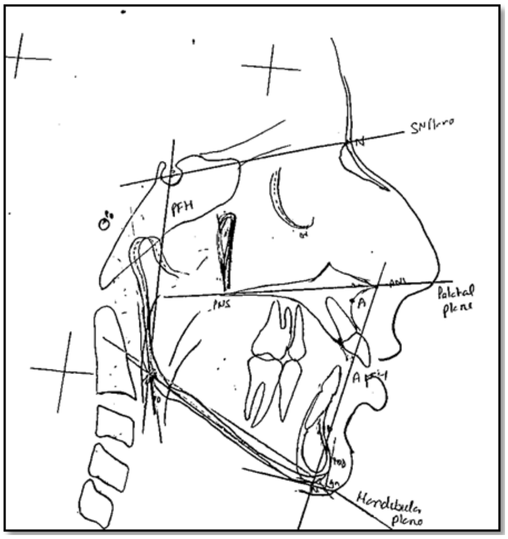

Fig. 2: Planes used in the study

3. Results

Forty-five pretreatment radiographs included in the study. They were divided into his three groups: Group I (skeletal class I, N = 15), Group II (skeletal class II, N = 15), and Group II (skeletal class III, N = 15) . Various linear and angular parameters were evaluated, compared and correlated for all three groups. Analysis of the mean values of various parameters comparing the three groups showed that the SNA angle was not significant (p=0.45), with increasing values in class II and lowest values in class III. - NV was found to be statistically significant [0.00]. Skeletal class I had an increased value, lowest in skeletal class III, significant PP/SN [0.00], increased value in skeletal class II, lowest in skeletal class III, SNB

Table 1: Grouping of sample

Group I	Group II	Group III
Skeletal Class I (N=15)	Skeletal Class II (N=15)	Skeletal Class III (N=15)

Table 2: Landmarks used in the study

Landmarks	Definitions
Nasion (Na)	The anterior nasal suture is located at the highest point of curvature of the nasal bridge.
Subspinale (“A" point)	The most posterior point of the ANS-PR curve The “A” point is usually located approximately 2 mm anterior to the root tip of the upper central incisor.
Supramentale ("B" point)	The most posterior point of the bone curve of the mandible, below the subdental bone and above the pogonion Point “B” is usually near the tip of the root of the mandibular incisor tooth located inPogonion.
Pogonion (Pog)	The foremost point of the pogonion contour of the jaw is usually located by a tangent perpendicular to the line of the mandible, or by a tangent falling from the nasion to the jaw
Gnathion	The most anterior inferior point is on the lateral shadow of the chin.
Menton (Me)	The lowest point on the symphyseal outline of the chin.
Sella(S)	The center of the hypophyseal fossa (Sella turcica). It is selected by eye since that procedure is reliable as a constructed center
Anterior nasal spine (ANS)	The most anterior point on the maxilla is at the level of the palate.
Posterior nasal spine (PNS)	The most posterior point on the bony hard palate in the sagittal plane

Table 3: Planesused in the study

Planes	Definition
Sella-nasion	A line joining sella and nasion.
Palatal line	A line joining PNS and ANS.
Mandibular plane	A line connecting gonion and gnathion
Anterior facial height	A line joining nasion to menton
Posterior facial height	A line joining sella to gonion

Table 4: Skeletal Measurements

Maxillary base planes	Definitions
SNA	The angle between 3 point landmarks S, N, and A points, determining the anteroposterior position of the maxilla relative to the cranial base.
A-NV	The linear distance measured between point A and Nasion vertical line, measuring the anteroposterior position of the maxilla relative to the Nasion vertical line.
PP/SN	The angle between Sella-Nasion (SN) and ANS- PNS (PP), determines the vertical position of the maxillary base relative to the cranial base.
Mandibular base planes	
SNB	The angle between 3 point landmarks S, N and B points, determining the anteroposterior position of the mandible relative to the cranial base.
B-NV	The linear distance measured between point B and Nasion vertical line, determining the anteroposterior position of the mandible relative to the Nasion vertical line.
MP/SN	The angle between Sella-Nasion (SN) and Go-Me (MP), determines the vertical position of the mandibular base relative to the cranial base.
Skeletal maxillo- mandibular relation planes	
ANB	The angle between 3 point landmarks A, N, and B points, determining the anteroposterior jaw relation
AB Diff–NV	The linear differences between A-NV and B- NV, determining the anteroposterior jaw relation
MMP	The angle between the palatal plane and mandibular plane determines the vertical jaw relation.
Jarabak ratio	It is the ratio of posterior to anterior facial height, determining the vertical facial proportion.

Table 5: Dentoalveolar Measurements

Maxillary incisors planes	Definitions
U1-NA	The linear distance between the Nasion-point A-line and the most protruded point in the maxillary incisors
U1/SN	The angle between the long axis of the most protruded maxillary incisor and the Sella-Nasion (SN) line.
U1/PP	The angle between the long axis of the most protruded maxillary incisor and the ANS-PNS (PP) line
Mandibular incisors planes	
L1-NB	The linear distance between the Nasion-point B line and the most protruded point in the mandibular incisors.
L1/MP	The angle between the long axis of the most protruded mandibular incisor and the Go-Me (MP) line.
Inter-incisal angle (U1/L1)	The angle between the long axes of the most protruded maxillary and mandibular incisor.

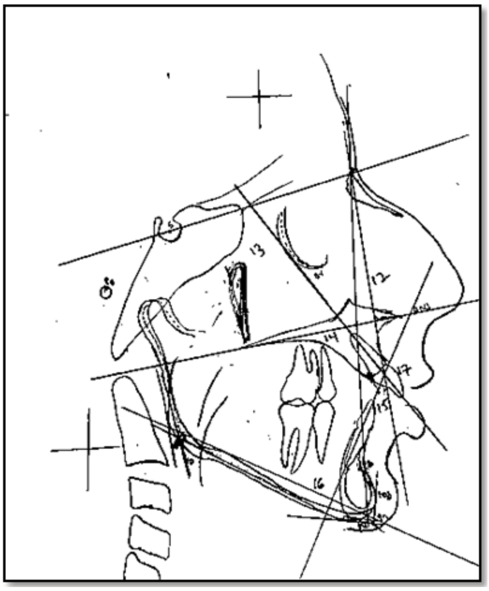

Fig. 3: Skeletal Measurements

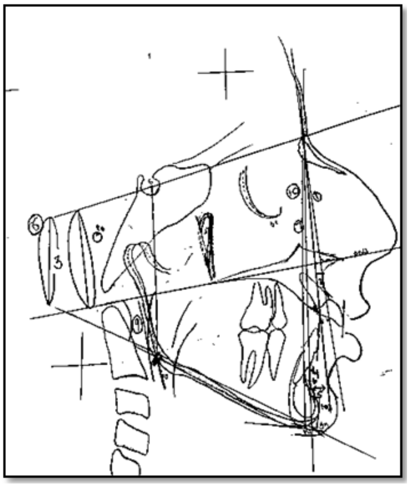

Fig. 4: Dentoalveolar measurements.

was also found to be significant [0.01] with increasing values in skeletal class III and minimal in skeletal class II, B-NV was found to be significant [0.00] with increasing values in skeletal class II and skeletal class III minimal, ANB determined to be significant [0.00] Skeletal class II highest, Skeletal class III lowest, AB Diff NV also significant [0.00], Skeletal class II highest, Skeletal class III lowest, MMP not significant [0.33]] Skeleton Largest in class II, smallest in skeletal class III, MP/SN not significant [0.24], largest in skeletal class II, smallest in skeletal class I, Jarabak ratio not significant [0.19], in skeletal class I Maximum U1-NA not significant [0.64], maximum skeletal class III, minimum skeletal class II, U1/SN not significant [0.64], maximum skeletal class I, minimum skeletal class II, U1/SN PP not significant [0.47], largest in skeletal class II, smallest in skeletal class I, L1-NB not significant [0.57], largest in skeletal class II, smallest in skeletal class III, L1/MP not significant Not significant ant [0.18], largest in skeletal class III, smallest in skeletal class I, inter-incisor angle (U1/L1) not significant [0.91], largest in skeletal class I, skeletal class III As shown in Table 6.

hows the correlation between anterior-posterior and vertical skeletal relationships and alveolar parameters. In skeletal class I, there was a strong correlation between MMP and U1-NA (0.02), SNB and U1-SN (0.06), and ANB and U1-PP (0.05). In contrast, weak correlations were found between SNA, PP-SN, MP-SN and all alveolar parameters. In skeletal class II, there were weak correlations between SNA, SNB, MMP, PP-SN, and MP-SN and all alveolar parameters, but strong correlations between ANB and U1/L1 (0.00). There was a correlation. ANBs with skeleton class III, SNA and L1-MP (001), U1/L1 (0.02), and U1-PP (0.01) showed a weak correlation was seen in all alveoli. measurement. Correlations between skeletal-based and alveolar parameters differed by skeletal class.

Table 6: Descriptive statistics and comparison of anterior-posterior skeletal and dentoalveolar parameters in sagittal malocclusions

Parameters	Class I	Class II	Class III	F Value	P Value
SNA	81.57 (±4.10)	82.18 (±4.32)	80.33(±3.92)	.804	0.45
A-NV	2.64 (±2.49)	1.68 (±2.11)	-3.83 (±2.60)	31.29	0.00*
PP/SN	6.35(±2.67)	9.12(±4.55)	1.20(±2.39)	21.51	0.00*
SNB	79.13 (±4.03)	77.81(±5.26)	82.53(±4.17)	4.367	0.01*
B-NV	5.92 (±3.83)	7.50 (±3.22)	-1.34(±6.35)	16.170	0.00*
MP/SN	29.71 (±4.74)	32.50 (±6.40)	29.26 (±5.65)	1.476	0.24
ANB	2.42(± 1.08)	4.75 (±2.93)	1.20 (±2.07)	28.408	0.00*
AB Diff–NV	5.00 (± 2.66)	7.81 (±4.56)	1.60 (±2.29)	13.142	0.00*
MMP	24.35(±5.82)	26.37(±2.68)	24.26 (±4.39)	1.127	0.33
Jarabak ratio	71.46 (±17.63)	64.83 (±4.43)	65.60 (±4.95)	1.717	0.19
U1-NA	5.60 (±2.46)	5.00 (±2.89)	6.00 (±3.50)	.439	0.64
U1/SN	111.35(±10.56)	105.37(±25.44)	111.13(±19.56)	.451	0.64
U1/PP	84.50 (±29.81)	98.18 (±26.85)	91.40 (±34.70)	.750	0.47
L1-NB	5.37 (±2.64)	5.43 (±1.99)	4.60 (±2.61)	.561	0.57
L1/MP	86.71(±34.14)	100.43(± 5.94)	93.93 (±8.22)	1.760	0.18
U1/L1	119.07(±14.52)	117.25(±11.28)	117.13(±14.42)	.095	0.91

4. Discussion

Coordination of maxillary and mandibular development is not always perfect. Therefore, by case analysis and statistical methods, the mechanisms that regulate tooth eruption and position relative to the base of the jaw to achieve and maintain a normal relationship between the upper and lower dental arches is required. This mechanism is called the alveolar compensatory mechanism and can be defined as a system that attempts to maintain a normal intermaxillary relationship in a variety of jaw relationships (Bjork, 1947, 1966; Bjork and Palling, 1954; Solow, 1966; Bjork and Skieller, 1972).[15–19] Alveolar compensation results from soft tissue pressure. This can be altered by underlying skeletal inconsistencies. However, some patients with similar skeletal maladjustments exhibit different forms of compensation resulting in positive and negative overjets. (Kim Sung-jin, Kim Kyung-ho, Yoo Hyun-suk, Baek Hyun-sung, 2018).[20] Adult patients with skeletal maladjustment should be evaluated for growth if adequate alveolar decompensation is necessary for successful treatment outcome. It can be treated with braces, orthodontic camouflage, or orthognathic surgery. Therefore, prealveolar bone compensation is an important basis for successful orthodontic treatment by orthodontic compensation (camouflage) or decompensation (skeletal-based orthodontics). To evaluate the position and inclination of upper and lower incisors and bases in different groups of skeletal malformations in the population of the Solan district Forty-five pretreatment lateral cephalometric radiographs of young adult patients aged 17–30 years undergoing fixed orthodontic treatment at Bhojia Dental College and Hospital, Baddi were included. The samples were then divided into her three groups: Group I (Skeleton Class I), Group II (Skeleton Class II), and Group II (Skeleton Class II). Group III (skeletal class III) is based on her ANB perspective with 15 subjects in each group. Various linear and angular parameters were evaluated, compared and correlated for all three groups. In skeletal class I, there was a strong correlation between low starting position and tilted upper incisors and the degree of anterior-posterior shift of posteriorly tilted upper incisors. In contrast, weak correlations were found between maxillary base position, maxillary incisor tilt, and mandibular base tilt for all alveolar parameters. This indicates that the lower incisors are more prominent and tend to minimize basal discrepancy differences. There is a strong correlation between the maxillary-mandibular vertical relationship (MMP) and the position of the maxillary incisors, with both maxillary and mandibular incisors tending to tilt posteriorly as the vertical spacing of the jaws increases. A study by (Björk and Skieller 1972) suggests that this can be explained.[19] He reported that the inclination of the lower incisors with respect to the SN plane remained constant despite the rotation of the jaw. This is because the lips and tongue are slanted to maintain functionality incisal occlusion. Consistent with this, Ceylan et al. (2003),[21] found a positive correlation with maxillary incisors and no relationship with mandibular incisors for the NA lineage. This difference is primarily due to differences in sagittal measurements.

This is because our study was based on a skeletal correlator, whereas we considered overjet as a correlator. Jansson et al. (1994)[22] reported that maxillary and mandibular alveolar heights were similar in class I and class II tooth-skeletal malocclusions. In skeletal class II, weak correlations between maxillary baseline position, mandibular baseline position, maxillary-mandibular vertical relationship, mandibular plane palate inclination and mandibular plane inclination, and all alveolar parameters

Table 7: Pearson correlation coefficients between anteroposterior and vertical skeletal relation and dentoalveolar measurements.

Variable	Correlation	U1-NA	L1-NB	U1-PP	U1-SN	L1-MP	U1/L1
Skeletal class I							
SNA	Pearson's Correlation [PC]	.240	.046	-.234	.418	.074	-.386
	Sig-(2-Tailed)[Sig]	0.40	0.87	0.42	0.13	0.80	0.17
SNB	PC	.273	.034	-.095	.509	.047	-.305
	Sig	0.34	0.90	0.74	0.06*	0.87	0.28
ANB	PC	-.104	.046	-.530	-.308	.107	-.328
	Sig	0.72	0.87	0.05*	0.28	0.71	0.25
MMP	PC	.348	.226	.158	.404	-.004	-.197
	Sig	0.22	0.43	0.59	0.15	0.99	0.50
PP-SN	PC	-.169	-.177	.530	.336	.067	.205
	Sig	0.56	0.54	0.05	0.24	0.66	0.48
MP-SN	PC	.601*	.359	-.177	-.002	.249	-.146
	Sig	**0.02***	0.20	0.54	0.99	0.39	0.61
Skeletal Class II							
SNA	PC	-.227	.352	.124	.170	.094	-.030
	Sig	0.43	0.23	0.67	0.56	0.74	0.91
SNB	PC	-.030	.443	.170	.130	.074	-.271
	Sig	0.91	0.11	0.56	0.65	0.80	0.34
ANB	PC	-.634*	-.273	-.139	255	.091	.749**
	Sig	0.01*	0.34	0.65	0.37	0.75	0.00*
MMP	PC	.256	.373	.407	.417	-.061	-.494
	Sig	0.37	0.18	0.14	0.61	0.83	0.07
PPSN	PC	-.112	.366	.131	-.167	-.137	-.037
	Sig	0.70	0.19	0.65	0.56	0.64	0.90
MPSN	PC	.000	.266	.298	-.090	-.302	.057
	Sig	1.00	0.35	0.30	0.76	0.29	0.84
Skeletal Class III							
SNA	PC	-.174	-.469	.086	.277	-.628*	.591*
	Sig	0.55	0.09	0.77	0.33	0.01*	0.02*
SNB	PC	.040	-.066	-.202	.134	.269	-.193
	Sig	0.89	0.82	0.48	0.64	0.35	0.50
ANB	PC	.164	.102	.615*	.445	.247	-.030
	Sig	0.53	0.72	**0.01***	0.11	0.39	0.92
MMP	PC	.046	-.069	.006	-.296	.070	-.216
	Sig	0.87	0.81	0.98	0.30	0.81	0.45
PP-SN	PC	-.332	-.398	.029	.077	-.380	.470
	Sig	0.24	0.15	0.92	0.79	0.18	0.09
MP-SN	PC	.170	.193	.217	-.200	-.423	.161
	Sig	0.56	0.50	0.55	0.49	0.13	0.58

had, with alveolar compensation. It shows that the slope of the base of the maxilla has minimal effect. Most of these effects were due to tilting of the mandibular base. This is exactly the biomechanical concept behind the camouflage of deep bite by retrograde and anterior inclination of the incisors (Elfeky HY, Fayed MS, Alhammadi MS, Soliman SAZ, El Boghdadi DM, 2018),[23] which showed an anterior-posterior discrepancy with the interincisor angle, suggesting that the most important predictor of overbite was her ANB angle. This indicates that sagittal malocclusion plays an important role in the short face group. The lack of positive contact with the upper incisors due to the elevated overbite may have caused the lower anterior teeth to erupt upward, which may also have caused a decrease in occlusion. In skeletal class III, there was a strong correlation between maxillary base position and lower incisor inclination, and between incisor-ANB angle and upper incisor inclination, suggesting maxillary recession and mandibular protrusion. I was. The reduced inter-incisor angle, combined with a possible counterbalance mechanism, suggests that the lower incisors are tilted and the overjet is reduced. For this reason, Class III malocclusions with low anterior facial height are the most clinically difficult to treat with orthodontics or orthopedics (p. Spalj, S. Metstrovic, 2019)[23] On the other hand, there was a weak correlation between all alveolar parameters and the vertical and sagittal parameters. This indicates that both maxillary and mandibular incisors tend to slope more posteriorly with increasing vertical jaw spacing.The therapeutic goal of the jaw movement approach is to reverse some of the alveolar compensation, restore the underlying skeletal base to its normal position, and normalize its relationship to each other and to the cranial base (De Clerck HJ, Proffit WR, 2015).[24] Several studies have investigated alveolar compensation in different vertical patterns. The positional relationship between the upper and lower incisors has not been investigated in previous studies. For the negative correlation between maxillary and mandibular tilt and vertical patterns, Kuitert et al. (2006) found that in both short-face and long-face groups. Excessive vertical inferior surface development combined with increased molar eruption was associated with vertical prefrontal basal and alveolar height. Modi et al. (2013)[25] found a negative correlation with upper and lower incisor inclination when not accompanied by increased growth. Therefore, treatment planning must consider corrections for all three spatial levels.

5. Conclusions

Adult patients with skeletal discord can be treated with growth correction, orthodontic camouflage, or orthodontic surgery if adequate alveolar compensation or decompensation is required for successful treatment outcome gain. Anterior alveolar decompensation is therefore the most important basis for successful orthodontic treatment by orthodontic compensation (camouflage) or decompensation (skeletal-based orthodontics). In skeletal class I, there was a strong correlation between maxillary incisor inclination and mandibular initial position, maxillary incisor inclination and degree of anterior-posterior mismatch, and vertical relationship between maxilla and mandible. Place the upper incisors. In skeletal class II, there was a strong correlation between the degree of anterior-posterior maladaptation and the angle between the incisors.[3] In skeletal class III, there was a strong correlation between the maxillary base position and the inclination of the lower incisors. There was a correlation. The angle between the incisors and the degree of anterior-posterior mismatch with the slope of the upper incisors.

6. Source of Funding

None.

7. Conflict of Interest

None.

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