

Smile esthetics: Smile Arc Protection vs Traditional approach

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Citation of this Article: Junaid Khan, Atam Dev Jain, Mukesh Kumar, Manish Goyal, Sumit Kumar,“ Smile esthetics: Smile Arc Protection vs Traditional approach ”, IJDSIR- February - 2021, Vol. – 4, Issue - 1, P. No. 397 – 406.

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Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

Esthetics has always been associated with profile enhancement in orthodontic treatment. However patients come to the orthodontists primarily for improvement of their smiles but the literature contains more studies on skeletal structure than on soft-tissue structure, and the smile still receives less attention. Smile Arc Protection (SAP) bracket positioning technique supports today’s esthetic viewpoint of compensation for more width in the maxillary posterior teeth, with marginal negative space in the buccal corridors known as “12-tooth smile”. This concept includes ideal axial inclination of the maxillary anterior teeth, with supremacy of incisors and a curved

smile arc of the maxillary incisal edges that follows the lower lip curvature in a posed smile. In this case report we treated two cases by different techniques, case I was treated with SAP bracket positioning technique whereas case II by MBT technique. In case I, patient’s smile arc was significantly improved, while in case II the smile arc got flattened/ straight. Orthodontists must keep the patients expectations at top priority and make all the efforts to improve their smile esthetics rather than focussing only on attaining ideal occlusion or cephalometric values.

Introduction

Esthetics has always been associated with profile enhancement in orthodontic treatment. However patients come to the orthodontists primarily for improvement of their smiles but the literature contains more studies on skeletal structure than on soft-tissue structure, and the smile still receives less attention.¹

Smile has been classified into various types by different authors, according to Tjan et al, smile has been classified as low, average and high smile line, based on the amount of dental and gingival exposure during a natural full smile.² According to them, low smile line is one in which exposure of the maxillary incisors is less than 75% and no gingiva is seen, in average smile 75-100% of the maxillary anterior teeth are visible along with interproximal gingiva and high smile line is one in which 100% of anterior teeth can be seen along with contiguous band of gingiva.²

Ackerman et al. classified smile into two types: The social smile/posed smile is reproducible and voluntary. The enjoyment smile/unposed smile/Duchenne smile is an involuntary smile and is provoked by laughter or extreme pleasure and results from maximum contraction of the elevator and depressor muscles producing complete extension of the lips, gingival show, and maximum anterior tooth display.^{3,4}

According to Roy Sabri, there are 8 major components for esthetic smile, which include lip line, smile arc, upper lip curvature, lateral negative space (buccal corridor), smile symmetry, occlusal frontal plane, dental components and gingival components.¹

Half a century back, prosthodontists showed the importance of harmonious curve of maxillary anterior incisal edges that produce a youthful and attractive esthetic appearance.⁵ Although orthodontists have

conventionally referred to a “curved smile line”, Sarver uses the term “smile arc”.⁶

Smile Arc Protection (SAP) bracket positioning technique supports today’s esthetic viewpoint of compensation for more width in the maxillary posterior teeth, with marginal negative space in the buccal corridors known as “12-tooth smile”. This concept includes ideal axial inclination of the maxillary anterior teeth, with supremacy of incisors and a curved smile arc of the maxillary incisal edges that follows the lower lip curvature in a posed smile.⁵

This article presents two case reports in which the first case was treated by using SAP bracket positioning technique and the second one by conventional MBT prescription.

Keywords: Curved Smile line, smile arc, Smile arc protection, buccal corridor, 12 tooth smile, inclination of occlusal plane,

Case 1

A female patient 22 years old came to our department with chief complaint of irregularly placed upper and lower front teeth.

She had convex facial profile with no facial asymmetry, posterior facial divergence, average mandibular plane, acute nasolabial angle, mesocephalic, mesoprosopic, incompetent lips and straight smile. Intraoral examination revealed class I molar and canine relationship bilaterally, reduced overjet and increased overbite (7 mm) due to excessive retroclination of 11,21. Moderate crowding was seen in both upper and lower arch, rotations irt 31,33,43. (Fig 1)

Panoramic radiograph revealed normal temporomandibular joint and normal crest of interdental alveolar bone. Third molars were present in lower arch. On the basis of cephalometric values, the patient had skeletal Class II bases with average growth pattern and decreased interincisal angle. (Fig 1) (Table 1)

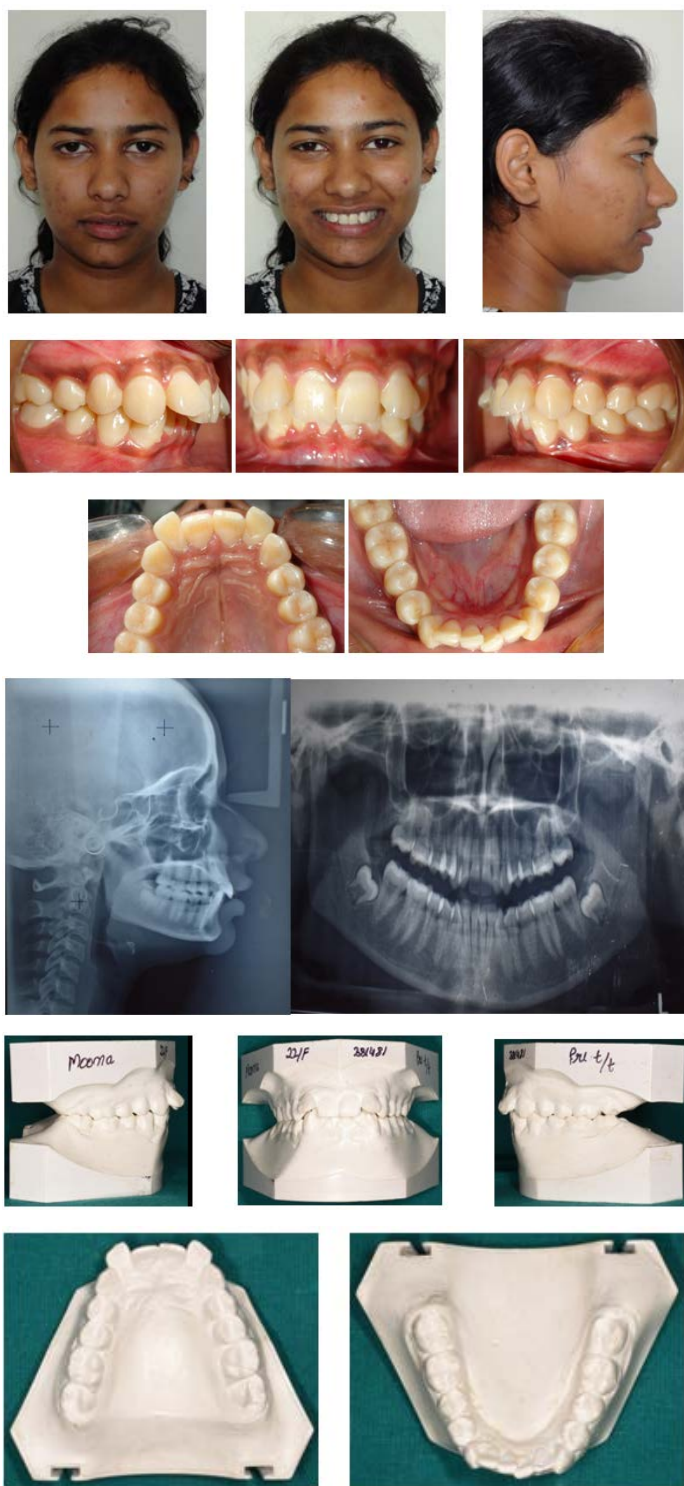


Fig 1: Pre treatment records (Case I)

Treatment objectives

- Leveling and alignment of the upper and lower teeth
- Maintain class I canine and molar relationship bilaterally
- Achieve ideal overjet and overbite
- To achieve an esthetic profile

Treatment alternatives

Two treatment options were decided:

First treatment option was non-extraction therapy.

Second option was maxillary and mandibular first premolars extraction.

We opted second option rather going for first one because if we go with non extraction treatment, anteriors will flare which subsequently worsens the facial profile.

Treatment progress

Patient had undergone a fixed orthodontic mechanotherapy with a preadjusted appliance (0.022-in \times 0.028-in slot) followed by extraction of maxillary and mandibular first premolars. In this case, we use Smile Arc Protection (SAP) bracket positioning technique for bracket placement.⁵ An initial arch wire 0.014-in NiTi was used for the leveling and aligning in upper arch excluding 11,21. After 1 month 0.018-in SS was placed with 0.012-in NiTi (piggy back) to engage 11,21. After initial leveling and aligning of upper arch, lower arch was also bonded with 0.012-in NiTi archwire. The patient was progressively shifted to heavier arch wires and reached to 0.019 \times 0.025-in SS archwire within 8 and 6 months in upper and lower arch respectively.

Temporary Anchorage Device's (TADs) (SK surgical 1.5x8 mm) were placed in upper arch bilaterally for enmasse retraction of anteriors with the help of NiTi close coil spring and power arm of 8 mm height and also used for torque control. (Fig 2) In both the arches, extraction space was utilised to correct crowding, rotations and to retract the anteriors,



Fig 2: Retraction of anteriors using TADs (Case I)

After 8 months of retraction, TADs were removed and 0.014-in NiTi archwire placed in both the arches for settling. Total treatment duration was 18 months after that patient was debonded and full time wear Essix retainers were given along with lingual retainers.

Treatment result

Patient's profile improved ominously with significant reduction in the soft tissue facial convexity. Class I molar and canine relationship was maintained bilaterally with proper intercuspation. Ideal overjet and overbite were established. Lower midline was shifted towards left side by 1 mm. Lip competency was achieved and there was pronounced improvement in the patient's smile because of SAP bracket positioning technique, it became convex and follows the lower lip curvature. (Fig 3)

Lateral cephalometric values showed mild decrease in lower anterior facial height (LAFH), interincisal angle increased, marked reduction in facial convexity. (Table 1) Panoramic radiograph showed good root parallelism except for the root of upper right canine, which was tipped towards the first premolar. (Fig 3)

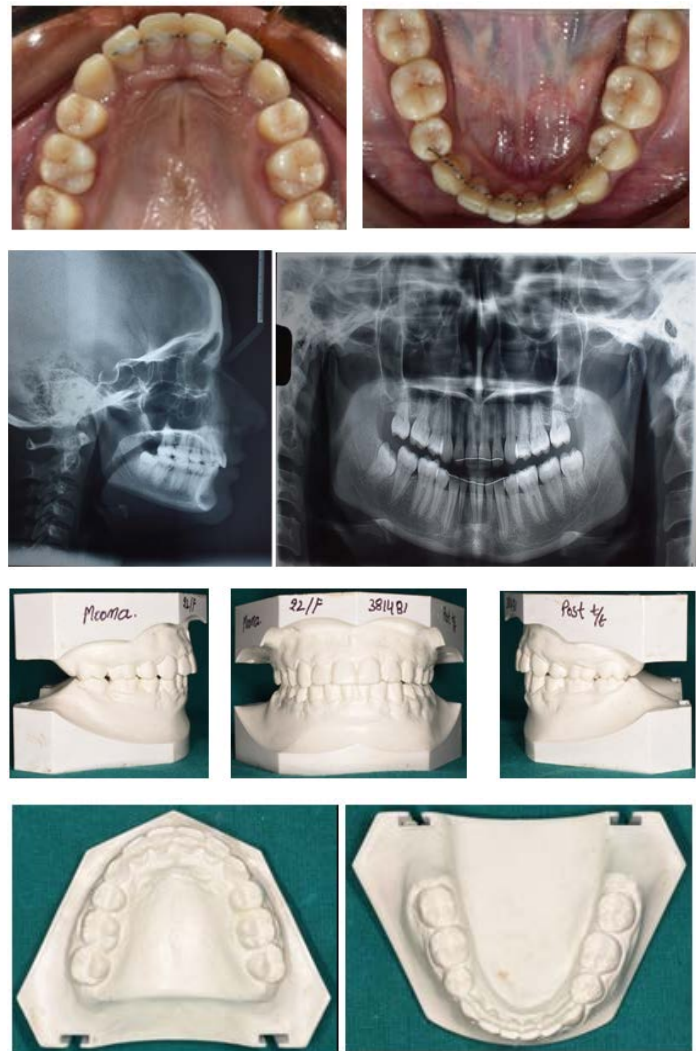


Fig 3: Post treatment records (Case I)

Parameters	Normal value	Pre treatment	Post treatment
SNA	82°	83°	81°
SNB	80°	76°	77°
ANB	2°	7°	4°

Wits (mm) (AO ahead of BO)	-4.5 to 1.5 mm	+1 mm	0 mm
Facial axis	90°	96°	95°
FMA	25°	22°	21°
Upper incisor to SN	102°	80°	78°
LAFH	-	53 mm	52
Pn perp. to OP	75°	66°	mm 67°
U1 to NA	22°	17°	15°
U1 to NA (mm)	4 mm	3 mm	2 mm
L1 to NB	25°	32°	30°
L1 to NB (mm)	4 mm	2 mm	2 mm
IMPA	90°	103°	100°
Interincisal angle	135°	125°	130°
Nasolabial angle	102°	86°	96°
Mentolabial sulcus (mm)	4 mm	5 mm	4 mm
Upper lip protrusion (mm)	1 mm	+2 mm	0 mm
Lower lip protrusion (mm)	1mm	+2 mm	0 mm

Table 1: Cephalometric values



Fig 4: Superimposition (Case I): Sella - Nasion at Nasion, Black (pre treatment), red (post treatment)

Case 2

A male patient 17 years old came to our department with chief complaint of irregularly placed upper and lower front teeth.

He had convex facial profile with no facial asymmetry, posterior facial divergence, steep mandibular plane, obtuse nasolabial angle, mesocephalic, mesoprosopic, incompetent lips. Intraoral examination revealed class II molar relationship on right side and class I on left side, end on canine relationship on right side and class I on left side, reduced overjet and increased overbite (8 mm) due to excessive retroclination of 21. Severe crowding was seen in both upper and lower arch, rotations irt 11,12,33,42,43. (Fig 5)

Panoramic radiograph revealed normal temporomandibular joint and normal crest of interdental alveolar bone. Third molars were present except 48. On

the basis of cephalometric values, the patient had skeletal Class I jaw bases with average growth pattern and retroclined lower anteriors. (Fig 5) (Table 2)

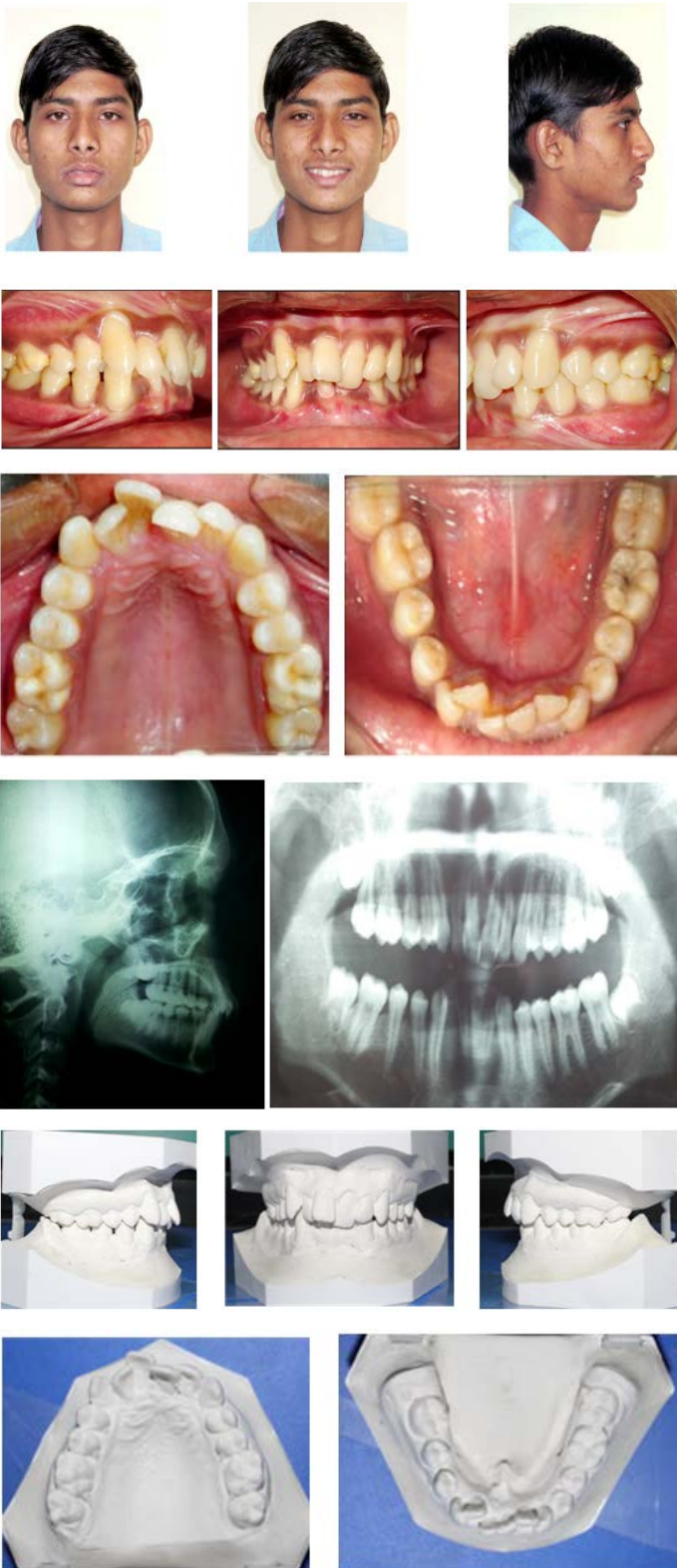


Fig 5: Pre treatment records (Case II)

Treatment objectives

- Leveling and alignment of the upper and lower teeth
- Maintain class II molar relationship on right side and class I on left side
- Achieve class I canine relationship on right side and maintain class I on left side
- Achieve ideal overjet and overbite
- To achieve an esthetic profile

Treatment alternatives

Two treatment options were decided:

First treatment option was maxillary and mandibular first premolars extraction and end up in class I.

Second option was maxillary right and left first premolar and mandibular right first premolar extraction and end up in subdivision.

We opted second option after explaining the treatment alternatives to the patient.

Treatment progress

Patient had undergone a fixed orthodontic mechanotherapy with a preadjusted appliance with MBT prescription (0.022-in \times 0.028-in slot) followed by extraction of maxillary right and left first premolars and mandibular right first premolar. An initial arch wire 0.012-in NiTi was used for the initial leveling and aligning in upper arch. After initial leveling and aligning of upper arch, lower arch was also bonded with 0.012-in NiTi archwire. The patient was progressively shifted to heavier arch wires and reached to 0.019 \times 0.025-in SS archwire within 8 and 6 months in upper and lower arch respectively.

Temporary Anchorage Device's (TADs) (SK surgical mini implant 1.5x8 mm) were placed in upper arch bilaterally for enmasse retraction of anteriors with the help of NiTi close coil spring and power arm of 8 mm height. (Fig 6)



Fig 6: Retraction of anteriors using TADs (Case II)

For intrusion of lower incisor 2 TADs (1.5 X 6 mm size) were placed bilaterally in between lateral incisor and canine. (Fig 7) In both the arches, extraction space was utilised to correct crowding, rotations and to retract the anteriors. After 8 months of retraction, TADs were removed and 0.014-in NiTi archwire placed in both the arches for settling by using 3/16 in elastics. Total treatment duration was 20 months after that patient was debonded and full time wear Essix retainers were given along with lingual retainers.



Treatment results

Patient was greatly satisfied with the treatment outcomes and well aligned dental arches. Patient's facial profile was improved and lip competency was achieved but his smile arc became straight. Class I canine relationship achieved and class II molar relationship was maintained on right side whereas class I molar and canine relationship was maintained on the left side with ideal intercuspation. Midline was coinciding with ideal overjet and overbite. (Fig 8)

Panoramic radiograph showed parallelism of roots except for the roots of maxillary left central and lateral incisors. Mild resorption of root was seen in maxillary left second premolar. Lateral cephalogram showed tipping of occlusal plane cranially, mild increase in lower anterior facial height, decreased interincisal angle. (Fig 8) (Table 2)



Fig 8: Post treatment records (Case II)

Parameters	Normal value	Pre treatment	Post treatment
SNA	82°	83°	81°
SNB	80°	80°	78°
ANB	2°	3°	2°
Wits (mm) (BO ahead of AO)	-4.5 to 1.5 mm	-1 mm	0 mm
Facial axis	90°	94°	94°
FMA	25°	20°	24°
Upper incisor to SN	102°	75°	69°
LAFH	-	57 mm	60 mm
Pn perp. to OP	75°	71°	77°
U1 to NA	22°	22°	33°
U1 to NA (mm)	4 mm	3 mm	1 mm
L1 to NB	25°	14°	20°
L1 to NB (mm)	4 mm	1 mm	2 mm
IMPA	90°	89°	95°
Interincisal angle	135°	140°	120°
Nasolabial angle	102°	110°	125°
Mentolabial sulcus (mm)	4 mm	6 mm	5 mm
Upper lip protrusion (mm)	1 mm	0 mm	-1 mm
Lower lip protrusion (mm)	1mm	+1 mm	0 mm

Table 2: Cephalometric values

Discussion

Changing in upper brackets positions to enhance the smile arc is known as SAP bracket positioning. Even though the bracket positions are customized according to every patient’s esthetic needs, in this technique, upper incisor brackets are generally placed more gingivally than the canine brackets. The lower posterior brackets are placed a bit gingivally to avoid occlusion, while the lower anterior brackets are placed slight incisally to augment overbite.⁵

If required recontouring of canine and lateral incisors must be done, the incisal edges of the canine bracket wings are placed gingival to the mesiodistal contact line. Then the distance from the canine bracket slot to the incisal edge of the canine is measured. The position of the central incisor

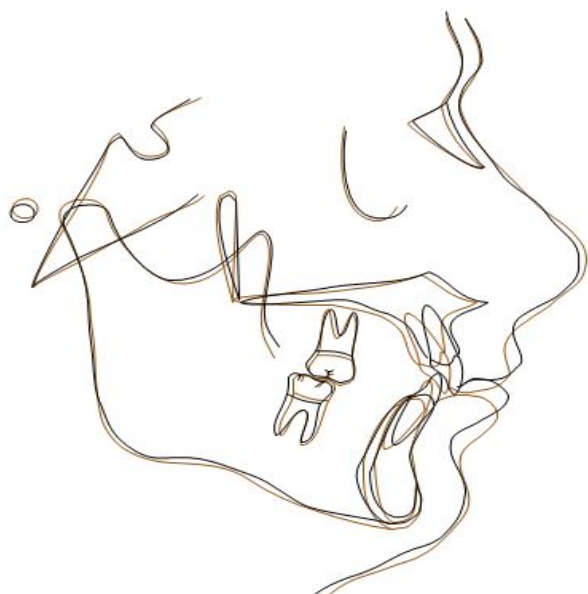


Fig 9: Superimposition (Case II): Sella - Nasion at Nasion, Black (pre treatment), red (post treatment)

bracket is about 1.5mm more gingivally from its incisal edge than the canine bracket is from its recontoured incisal edge. Finally, the lateral incisor bracket is placed 0.75-1mm more incisally than the central incisor bracket.^{7,8,9} (Fig 10)

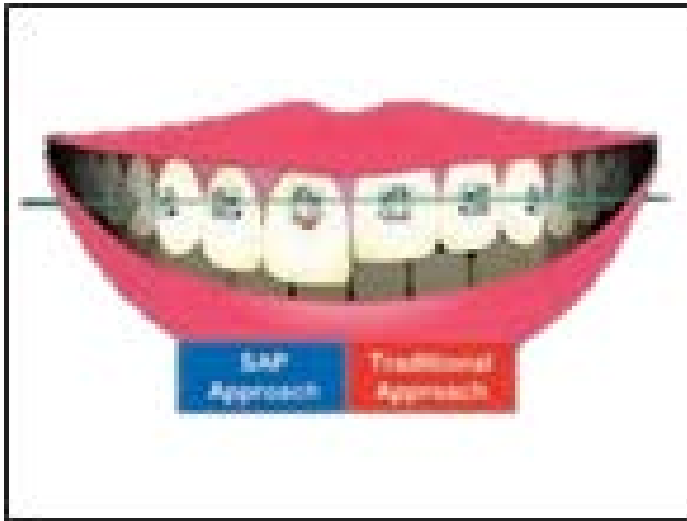


Fig 10: Comparison of bracket placement height in SAP vs Traditional approach

Enlow defined occlusal plane as 'a line passing through one half of the cusp heights to the first permanent molars and one half of the overbite of the incisors'. The upper smile arc is the relationship of the curvature of the maxillary incisal and canine edges to the curvature of the lower lip during the social smile, which is influenced by the OP angle.¹⁰

Batwa et al conducted a study to determine the effect of occlusal plane on smile attractiveness they concluded that changing the OP angle effect the smile attractiveness.¹¹

One more important aspect on which Inclination of occlusal plane (IOP) has a profound effect is smile esthetics. When the IOP is canted upward anteriorly or rotated anti-clockwise, it will result in a non-consonant smile arc and when it is canted downward anteriorly or rotated clockwise, it will lead to a more consonant smile arc. Although, excessive canting of occlusal plane anteriorly will again lead to an un-esthetic smile as the

lower lips will now cover the upper incisors. So, the concept of IOP should be kept in mind while doing treatment planning and should be changed according to treatment needs as studies indicate that fixed appliance therapy causes a change in IOP and eventually change the curvature of smile arc.^{12,13}

In case I OP was maintained, on the other hand in case II the plane was tipped cranially as shown in Table 1 and 2 respectively.

The smile arc of the patient was improved by using SAP bracket positioning technique in case I, while in case II the smile arc got flattened/ straight in which MBT prescription was used because bracket placement with these heights typically flatten the smile curve. (Fig 11)



Fig 11: Comparison of smile arc of the patients

Conclusion

Smile esthetics is the chief reason people visit an orthodontist. So, orthodontists must keep the patients expectations at top priority and make all the efforts to improve their smile esthetics rather than focussing only on attaining ideal occlusion or cephalometric values. In the present cases, we have seen how bracket placement effect the smile arc. Hence, this concept of bracket positioning should be kept in mind while diagnosing or planning the treatment of the patient and should be modified according to the treatment needs.

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