

Single Premolar Extraction for Correction of Midline Shift and “Vertical Open Loop” for Space Closure and Frictionless Orthodontic Treatment - A Case Report

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Abstract

This case report is of a 20 year old male patient who presented with irregularly placed overlapping upper front teeth with an unaesthetic facial profile and a non-consonant smile arc. This case was corrected non surgically merely by employing simple mechanics with the help of Fixed Orthodontic Mechanotherapy by

extracting a single maxillary 1st premolar of right side followed by retraction and closure of spaces with the help of “Vertical Open loops” bilaterally in the maxillary arch. The case ended in a Class II Molar relationship on right side and a Class I relationship on left side with Class I canine relationship bilaterally. The case report emphasizes on the efficient space closure with the help of loops, thus

minimizing friction which is a common problem during routine fixed orthodontic treatment and retraction with the help of Elastomeric chain that increases friction between the wire and bracket slot. Following fixed orthodontic treatment, marked improvement in patient's smile and facial profile were achieved and there was a remarkable increase in the patient's confidence and quality of life. The profile changes and treatment results were demonstrated with proper case selection and good patient cooperation with fixed appliance therapy. The patient was extremely satisfied with the results at the end of treatment

Keywords

Vertical Open Loop, Space closure, Orthodontic treatment, Single premolar extraction, Fixed Orthodontic mechanotherapy, Frictionless Orthodontic treatment, Correction of midline shift.

Introduction

Nowadays, patients with the slightest misalignment of teeth demand Orthodontic treatment to get it corrected and improve their smile and facial profile. Facial Esthetics has been in increasing demand in today's century. Fixed Appliance treatment can significantly alter and improve facial appearance in addition to correcting irregularity of the teeth. The number of patients seeking orthodontic treatment has increased significantly.^{1, 2} Treatment alternatives of correction of a Crowded dentition are either Orthodontic camouflage by extraction of premolars or a Combined orthodontic-orthognathic surgical therapy. It eventually depends mainly upon the severity of the malocclusion ^{3, 4} and the amount of needed tooth movements.^{3, 5} If the skeletal discrepancy ⁶ cannot be corrected by camouflage, any dental compensation may produce a reasonably good occlusion⁷ but at the expense of compromised esthetics. ⁸ Over the last few decades, there are increased number of patients who have become aware

of orthodontic treatment and are demanding high quality treatment, in the shortest possible time with increased efficiency and reduced costs. Class II malocclusion patients frequently show a combination of skeletal and dentoalveolar components. Many cephalometric peculiarities have been reported in class II malocclusion patients with an increased overjet and overbite, such as a prognathic maxilla and mandible, proclined maxillary and mandibular incisors. This case presents the correction of a crowded and misaligned dentition in a male patient proclined maxillary and mandibular anterior teeth with an upper midline shift towards the left, merely simply by executing extraction of a single maxillary right 1st premolar followed by retraction with the help of Vertical Open Loops. The Extraction protocol shown in this case is indicative of how an unaesthetic facial profile and smile can be converted into a pleasing one by routine Fixed Orthodontic treatment with extraction of a single premolar followed by retraction and closure of spaces.

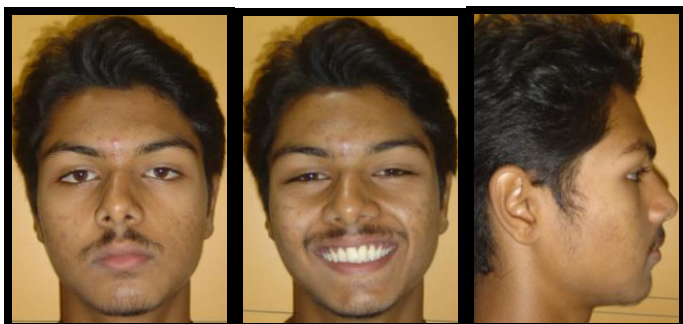
Case Report

Extra-Oral Examination

A 20 year old male patient presented with the chief complaint of irregularly placed upper front teeth and overlapping upper front teeth. On Extra oral examination, the patient had a convex facial profile, grossly symmetrical face on both sides with a retruded chin, competent lips, moderately deep mentolabial sulcus and an acute Nasolabial Angle, a Leptoprosopic facial form, Dolicocephalic head form, Average width of nose and mouth, minimal buccal corridor space, a non-consonant smile arc and posterior divergence of face. The patient had no relevant prenatal, natal, postnatal history, history of habits or a family history. On Smiling, there was excessive show of maxillary anterior teeth. The patient

had a toothy smile. On smiling the patient showed the presence of crowded anterior dentition and an unaesthetic facial profile with the upper dental midline shifted to the patients left. He also presented with a cant in the occlusal plane. The patient had an unaesthetic smile arc and was very dissatisfied with his smile.

Pre Treatment Extra oral Photographs



Intra-Oral Examination

Intraoral examination on frontal view showed presence of crowded upper anterior teeth with incisal overlapping of central incisors. The upper dental midline was not coincident with the lower dental midline with a shift in the upper midline towards the left by 3 mm. On lateral view the patient showed the presence of Class II Division I incisor relationship with a severely increased overjet, an End on Canine relationship on right side, a Class I canine relationship on the left side, an End on molar relationship on the right side and a Class I molar relationship on the left side. Patient had an overjet of 3 mm and an overbite of 4 mm. The upper and lower arch shows the presence of a “U” shaped arch form.

Pre Treatment Intraoral Photographs



Photographic Analysis

EXTRA-ORAL EXAMINATION

- ▶ Grossly symmetrical
- ▶ Leptoproscopic
- ▶ Dolicocephalic
- ▶ Average width of the nose and mouth
- ▶ Competant lips

- ▶ Smile arc- Consonant
- ▶ Upper midline- non coincident with the facial midline and shifted to the left
- ▶ Upper midline not coincident with the lower midline

Profile : Convex
Lips : Incompetent
Nasolabial angle : 92 degrees

FRONTAL VIEW : SMILING

Pre Treatment Cephalometric Readings

STEINER'S ANALYSIS			
Measurement	Mean	Pre Rx	Inference
SNA	82°	83°	Average
SNB	80°	80°	Average
ANB	2°	3°	Class II Skeletal pattern
Go-Gn to Sn	32°	26°	Horizontal Growth Pattern
U1 to NA angle	22°	35°	Proclined max incisors
U1 to NA mm	4mm	6mm	Forwardly placed max incisors
L1 to NB angle	25°	29°	Proclined mandibular incisors
L1 to NB mm	4mm	5mm	Forwardly placed max incisors
Interincisal angle	130°	119°	Proclined upper and lower anteriors
Occlusal plane - SN	14°	13°	Horizontal Growth Pattern
'S' Line	U Lip	0mm	Forwardly placed upper and lower lips
	L Lip	0mm	

TWEEDS ANALYSIS			
Measurement	Mean	Pre Rx	Inference
FMA	25°	23°	Horizontal Growth Pattern
FMIA	65°	58°	
IMPA	90°	99°	Proclined lower incisors

Wits appraisal:-
AO ahead of BO by 3 mm indicating a Class II Skeletal Discrepancy

RICKETTS ANALYSIS			
Measurement	Mean (for 9 yrs)	Pre Rx	Inference
Facial axis(Ba-Na to Pt-Gn)	90± 3.5°	85°	Horizontal Growth Pattern
Facial angle(N-pg to FH)	87± 3°	80°	Backwardly positioned chin
Mandibular plane angle	26± 4.5°	23°	Horizontal Growth Pattern
Convexity at Pt. A	2± 2mm	3 mm	Average maxilla
L1 to A - Pg	1± 2 mm	4 mm	Proclined mandibular incisors
U6 to Ptv	Age + 3 yrs	23 mm	
L1 inclination(1 to A-Pog)	22± 4°	23°	Average
Lower lip to E plane(Pog-Pn)	-2 ±2 mm	5 mm	Forwardly placed lower lip

MC NAMARA ANALYSIS			
Measurement	Mean	Pre Rx	Inference
N perp - A	0 -1mm	1 mm	Average
N perp to Pog	0-4 mm	-4mm	Backwardly positioned chin
Facial axis angle(Ptm-Gn)-(Ba-Na)	0± 3.5°	3.5°	Average
Mand. Plane angle(FH-GoMe)	22 ± 4°	23°	Average
Eff. Maxillary Length(Co- A)		77 mm	Reduced
Eff. Mandibular Length(Co-Gn)		108mm	Reduced
Maxillomandibular differential		31mm	Increased
Lowerant. Facial ht(ANS-Me)		66mm	Reduced
U1 to Pt. A	4-6 mm	7 mm	Proclined max incisors
L1 to A-Pog	1-3mm	3mm	Average
Nasolabial angle	102 ± 8°	92°	Decreased Nasolabial angle
Pharyngeal analysis U	15-20	16 mm	Adequate upper and lower airway passage
L	11-14	13mm	

RAKOSI JARABAK ANALYSIS			
Measurement	Mean	Pre Rx	Inference
Saddle angle	123± 5°	132°	Retropositioned condyles
Articular angle	143± 6°	144°	Average
Gonial angle	128± 7°	120°	Horizontal Growth Pattern
Upper gonial angle	52-56°	56°	Average
Lower gonial angle	70-75°	64°	Horizontal Growth Pattern
Sum of posterior angles	396± 6°	396°	Average
Mandibular plane angle	32°	23°	Horizontal Growth Pattern
Angle of inclination	85°	83°	Downward and backwardly inclined maxilla
Basal plane angle	25°	24°	Horizontal Growth Pattern
Palatal plane to occlusal plane	11°	10°	Horizontal Growth Pattern
Occlusal plane to MP	14°	14°	Average
Post to Ant. Face ht. ratio	62-65%	68.72 %	Horizontal Growth Pattern
Y - axis(FH-SeGn)	66°	63°	Horizontal Growth Pattern
U1 - SN	102± 2°	123°	Increased
U1-Palatal plane	70± 5	53°	Proclined max incisors
L1 - MP	90± 3°	99°	Proclined lower incisors

HOLDAYSAYS SOFT TISSUE ANALYSIS			
Measurement	Mean	Pre Rx	Inference
Facial angle	90± 3°	80°	Backwardly positioned chin
Upper lip curvature	2-5 mm	5mm	Average
Skeletal convexity at Pt. A	2 ± 2 mm	3 mm	Average
H line angle	7 - 15°	15°	Average
Nose tip to H line	12 mm	7 mm	Average
Upper sulcus depth	5 mm	5 mm	Average
Upper lip thickness	15 mm	19 mm	Increased lip thickness
Upper lip strain	2 mm	4mm	Increased upper lip strain
Lower lip to H line	-1 to +2mm	5 mm	Proclined lower lips
Lower sulcus depth	5 mm	5 mm	Average
Soft tissue chin thickness	10-12 mm	11mm	Average

DOWNS ANALYSIS			
Measurement	Mean	Pre Rx	Inference
Facial angle	87.8° (82°-95°)	80°	Backwardly positioned chin
Angle of convexity	0° (-8.5°-10°)	-4°	Average maxilla
Mandibular plane angle	21.9° (17°-28°)	23°	Average
Y-axis	59° (53°-66°)	63°	Horizontal Growth Pattern
A-B plane angle	-4.6° (-9°-0°)	0°	Average
Cant of occlusal plane	9.3° (1.5°-14°)	8°	Horizontal Growth Pattern
Interincisal angle	135.4 +/- 5.8	119°	Proclined upper and lower anteriors
Incisor mandibular plane angle	1.4° (-8.2°-7°)	7°	Proclined lower anteriors
Incisor occlusal plane angle	14.5° (3.5°-20°)	18°	Proclined upper anteriors
U1 - A-Pog	2.7mm(-1-5mm)	7 mm	Proclined upper anteriors

Pre Treatment Cephalometric Summary

Parameters	Pre- Treatment
SNA	83°
SNB	80°
ANB	3°
WITS	3mm(AO ahead of BO)
MAX. LENGTH	77mm
MAN. LENGTH	108mm
IMPA	99°
NASOLABIAL ANGLE	92°
U1 TO NA DEGREES	35°
U1 TO NA mm	6mm
L1 TO NB DEGREES	29°
L1 TO NB mm	5mm
U1/L1 ANGLE	119°
SADDLE ANGLE	132°
ARTICULAR ANGLE	144°
GONIAL ANGLE	120°
FMA	23°
Y AXIS	63°

Diagnosis

This 20 years old male patient is diagnosed with a Class II skeletal pattern, Angle's Class II malocclusion with a horizontal growth pattern, proclined upper and lower anterior teeth, crowding in upper and lower anterior region, increased over jet and overbite, increased lip strain, protrusive upper and lower lips with a reduced Nasolabial angle and a Non consonant smile arc with an occlusal cant.

PROBLEM LIST			
	Anteroposterior	Vertical	Transverse
Dental	<ul style="list-style-type: none"> > Upper midline shift to left > Rotated teeth > Increased Overjet > Crowding in upper and lower anterior teeth > Proclined maxillary and mandibular incisors > End on Molar relation on right side and End on canine relation on right side 	<ul style="list-style-type: none"> > Increased Overbite > Occlusal Cant 	
Skeletal	<ul style="list-style-type: none"> > Class II Skeletal pattern 	<ul style="list-style-type: none"> > Horizontal growth pattern 	
Soft tissue	<ul style="list-style-type: none"> > Protrusive upper and lower lips > Increased thickness of upper and lower lips > Decreased nasolabial angle > Increased upper lip strain > Posteriorly positioned chin 		

TREATMENT OBJECTIVES
<ul style="list-style-type: none"> > To correct crowded and overlapping upper anterior teeth > To correct the upper midline shift > To correct Occlusal cant > To correct proclined maxillary and mandibular anterior teeth > To correct the Increased strain on lips > To correct rotated teeth > To correct increased overjet and overbite > To achieve Angle's Class II molar relation on right side > To achieve Canine Class I relation on right side > To achieve a pleasing smile and a pleasing profile

ORTHODONTIC TREATMENT PLAN
<p>Fixed <u>Mechanotherapy</u> (MBT 0.022 slot)</p> <ul style="list-style-type: none"> > Extraction of 14 > Banding of 16,26,36,46 > Bonding with MBT brackets with variation in bonding for correction of occlusal cant > Initial leveling and alignment with 0.016" NiTi wires, following sequence A of MBT > Vertical Open loop to be given bilaterally in the maxillary arch for retraction of the upper anterior segment > Use of 0.019/0.025" rectangular NiTi followed by 0.019/0.025" rectangular stainless steel wires for retraction and closure of spaces. > Differential forces on upper right and left side for correction of midline shift > Final finishing and detailing with 0.014 round stainless steel wires > Retention by means of lingual bonded retainers in the upper and lower arch

Model Analysis

<p>Bolton ratio:- Mandibular anterior excess:- 0.48 mm Mandibular overall excess:- 0.17 mm</p>	<p>Arch Perimeter Analysis : Need to extract 1st premolars</p>
<p>Ashley Howe's index:- Need for extraction</p>	<p>Careys Analysis : Need to extract 1st premolars</p>
<p>Pont's Index : Expansion not needed</p>	<p>Chadda's Index : Expansion not needed</p>

Treatment Progress

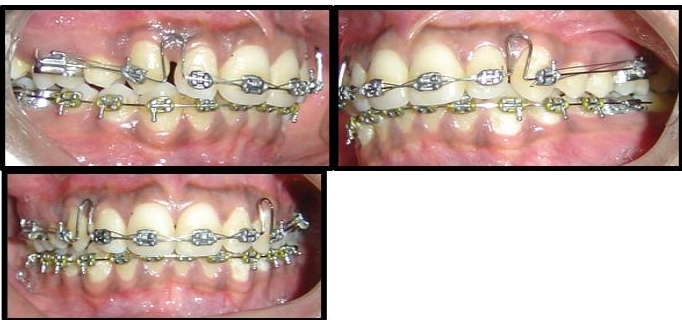
The maxillary 1st premolar of right side was first extracted. Complete banding was done with all molars, thereafter bonding in both maxillary and mandibular arch was done, using MBT-0.022X0.028" slot. Initially a 0.012" NiTi wire was used which was followed by 0.014 , 0.016", 0.018", 0.020" NiTi archwires following sequence A of MBT. After 6 months of alignment and leveling NiTi roundwires

were discontinued. Use of 0.019" x 0.025" rectangular NiTi with accentuated Anchor sweeps in the upper and lower stiff archwires were given to prevent the bite deepening during retraction in the upper arch followed by 0.019" x 0.025" rectangular stainless steel wires for retraction of closure of spaces. 2 bilateral Vertical Open loops were given in the maxillary arch to promote frictionless and efficient retraction. Loops not only promote frictionless retraction but also improves the efficiency of the treatment by completing the treatment as a faster pace. The Vertical Open loop of right side was more activated than the left side and this promoted moving the upper anterior segment more towards the right side and thus correcting the midlines and making them coincident. Finally light settling elastics were given with rectangular steel wires in lower arch and 0.012" light NiTi wire in upper arch for settling , finishing, detailing and proper intercuspation. The upper and lower dentition crowding was unraveled and irregularity of upper anterior region was aligned and the incisor relationship changed from Class II division 1 to Class I. Canine relationship also changed from End-on to Class I on the right side. Molars were ended in a full cusp Class II molar relationship on right side and a full cusp Class I on the left side at the end of the treatment as only a single upper 1st premolar was extracted. Hawley's removable retainers were given to the patient followed by fixed lingual bonded retainers in the upper and lower arch. After completion of orthodontic treatment, the smile of the patient changed from being unaesthetic and flat to a more pleasing and consonant smile. The occlusal cant was also corrected progressively towards the end of treatment The treatment changed the patients overall profile and helped her feel more confident. He was very happy and satisfied with the

treatment. A pleasing smile and a pleasing profile was achieved.



Mid Treatment Intraoral Photographs



Post Treatment Extra oral Photographs



Post Treatment Intraoral Photographs



Post Treatment Cephalometric Readings

Parameters	Post-Treatment
SNA	82°
SNB	80°
ANB	2°
WITS	1mm
MAX. LENGTH	78mm
MAN. LENGTH	107mm
IMPA	97°
NASOLABIAL ANGLE	99°
U1 TO NA DEGREES	28°
U1 TO NA mm	3mm
L1 TO NB DEGREES	24°
L1 TO NB mm	2mm
U1/L1 ANGLE	132°
SADDLE ANGLE	128°
ARTICULAR ANGLE	142°
GONIAL ANGLE	122°
FMA	24°
Y AXIS	64°

Discussion

The patient's chief complaint was irregularly placed upper front teeth .The selection of orthodontic fixed appliances is dependent upon several factors which can be categorized into patient factors, such as age and compliance, and clinical factors, such as preference/familiarity and laboratory facilities.The execution of only Fixed appliance therapy and extraction of only uppersingle premolarappropriately resulted in correction of the midline shift towards the patients left side an improvement in the patient's profile in this case. The midlines were corrected and the maxillary anterior segment was shifted to the patient’s right side. Alongside fixed orthodontic treatment, the maxillary1stpremolar of right side was removed and retraction was done with the help of Vertical Open loops bilaterally in the upper arch to

correct the already existing malocclusion. This patient had a very unique malocclusion. He had an End on molar relationship on right side and a Class I molar relationship on the left, however the upper midline was shifted to the patients left. The canines were in an End on relationship on the right side and Class I relationship on the left side. The patient presented with mild crowding in the upper anterior region with the central incisors overlapping each other incisally. An occlusal Cant was present initially with the occlusion canted downwards towards the patients right, which got corrected consequently during fixed appliance therapy. The U1 to NA values both in degrees and in mm decreased significantly and the upper and lower incisor proclination was corrected. The Nasolabial angle also improved drastically from being acute to slightly obtuse. Successful results were obtained after the fixed MBT appliance therapy within a stipulated period of time. The overall treatment time was 16 months. After this active treatment phase, the profile of this 20 year old male patient improved significantly as seen in the post treatment Extra oral photographs. Removable Hawleys retainers followed by fixed lingual bonded retainers were then delivered to the patient. The crowding in the upper arch was unraveled and the smile arc of the patient improved drastically to being more consonant and pleasant. After the orthodontic fixed appliance therapy the Profile of the patient drastically changed at the end of the treatment and the patient was very happy and satisfied with the results.

Comparison of Pre and Post Treatment Cephalometric Readings

Parameters	Pre- Treatment	Post-Treatment
SNA	83°	82°
SNB	80°	80°
ANB	3°	2°

WITS	3mm(AO ahead of BO)	1mm
MAX. LENGTH	77mm	78mm
MAN. LENGTH	108mm	107mm
IMPA	99°	97°
NASOLABIAL ANGLE	92°	99°
U1 TO NA DEGREES	35°	28°
U1 TO NA mm	6mm	3mm
L1 TO NB DEGREES	29°	24°
L1 TO NB mm	5mm	2mm
U1/L1 ANGLE	119°	132°
SADDLE ANGLE	132°	128°
ARTICULAR ANGLE	144°	142°
GONIAL ANGLE	120°	122°
FMA	23°	24°
Y AXIS	63°	64°

Conclusion

This case report shows how the correction of crowded dentition can be managed alongside fixed orthodontic treatment with just the extraction of an upper single premolar and frictionless retraction with the help of Loops, thus lowering the treatment time and enhancing the profile of the patient. The planned goals set in the pretreatment plan were successfully attained. Good intercuspation of the teeth was obtained and the unaesthetic appearing Class II division 1 incisor relationship was changed to Class I relationship. The molars were settled in a full cusp Class II relationship on right side, a full cusp Class I molar relationship on left

side and canines in a Class I relationship bilaterally. The maxillary and mandibular teeth were found to be esthetically satisfactory in the line of occlusion with a pleasing consonant smile arc and competent lips at the end of treatment. The overjet became near ideal and normal overbite was achieved. The correction of the malocclusion was achieved and crowding was unraveled with a significant improvement in the patient aesthetics and self-esteem. The patient was very satisfied with the result of the treatment.

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