

CIRCUMSTANTIAL ATYPICAL EXTRACTION – A CASE SERIES

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Abstract:

It is not always necessary to treat patients in the same way on a regular or routine basis. Like here in this case series, an atypical extraction pattern gives more favorable results with a decrease treatment duration compared to routine extractions, and for this, proper diagnosis and treatment planning are needed. With minimal orthodontic manipulation, orthodontists can achieve improved functional occlusion and aesthetic outcomes. When mandibular anterior excess is shown in Bolton's analysis or the periodontal condition of lower incisors is not good, then lower incisor extraction should be considered. It not only helps in keeping the original arch shape and width but also the inter-canine width. A buccally placed canine can also be extracted if the lateral incisors and canine have good contact.

Keywords: atypical extraction, conventional extraction, lower incisor

INTRODUCTION

The debate of extraction versus non-extraction treatment plans is not new in orthodontics. Although extraction therapy's allure had waned under Angle's reign, the pendulum has swung back and forth. Traditionally extraction of first or second premolar was the typical choice for gaining spaces. But recently this approach has been changed depending on the goal of the treatment, stability, treatment time, and esthetics needs of an individual, which leads to extraction of teeth other than premolars such as mandibular incisors and canines.

Lower incisor extraction was proposed as early as 1904. Later, Reidel and colleagues¹, as well as case reports by other authors, advocated for the removal of one or more incisors in highly crowded mandibular arches, as one of the few reasonable choices

Despite obvious benefits such as less facial profile alteration and fewer posterior tooth movements in comparison to premolar extractions, which may shorten treatment time,²⁻⁵ mandibular anterior teeth extractions are relatively uncommon. Some studies also claim complications related to lower incisors extraction such as the development of black triangles,^{6,7} increase in overjet if Bolton discrepancy is absent pretreatment,⁸ and midline discrepancy.^{1,9}

According to Kokich and Shapiro, numerous factors should be addressed when deciding whether to extract lower incisors. If lower incisor extraction is performed without thorough planning, the ensuing occlusal disparity is frequently unsatisfactory.⁴

The difference in arch length and tooth size aids in determining the amount of space necessary for crowding correction, leveling the curve of spee, and lower incisors inclination. According to Bahreman patients with an anterior tooth ratio of more than 83 mm and an arch length deficit in lower anterior segments of more than 4 to 5 mm are the cases of first choice for extraction of one lower incisor.¹⁰ The extraction choice should be carried out to achieve harmony between the upper and lower arches with no inadequate or surplus space remaining.

The purpose of this case series is to evaluate treatment changes and finishing quality in patients treated with conventional premolar extraction v/s atypical extraction.

Case 1

Diagnosis

A 20-year-old male patient came to the orthodontic department with the chief complaint of irregularly placed teeth in the upper and lower front teeth region. Extraoral clinical examination revealed a mesocephalic head shape, mesoprosopic facial form, and an orthognathic facial divergence. In addition to significant dental crowding in the anterior tooth region and highly placed maxillary canines, intra-oral examination revealed that the upper right lateral incisor (12) was in cross-bite and the left mandibular

lateral incisor (32) was lingually placed and blocked. His molar relationship was class I bilaterally (Fig. 1). Pre-treatment cephalometric analysis indicated a skeletal class I relationship (ANB= 3°), proclined upper and lower incisors (U1 to N-A= 5mm/26°, L1 to N-B= 6mm/28°), normal mandibular plane angle (SN-Go-Mn=32°), with an IMPA of 98° (Table 1). Crowding was found to be 10 mm in the upper arch and 11 mm in the lower arch, according to the arch perimeter and Carrey's analysis. The treatment plan was fixed orthodontic therapy following all first premolars' extraction.

2	SNB	80°	79	80
3	ANB	2°	1	0.5
4	Mandibular plane angle (SN-Go-Me)	32°	32	32
5	Y-axis (S-N to S-Gn (outer angle))	66°	70	70
6	U1 to N-A (mm)	4 mm	5mm	4mm
7	U1 to N-A (angle)	22°	26	25
8	L1 to N-B (mm)	4 mm	6mm	4mm
9	L1 to N-B (angle)	25°	28	24
10	U1 to L1 (interincisal angle)	131°	123	129
11	Upper incisor to S-N plane	102° ± 20°	107	106
12	IMPA (incisor mandibular plane angle)	90°	98	94

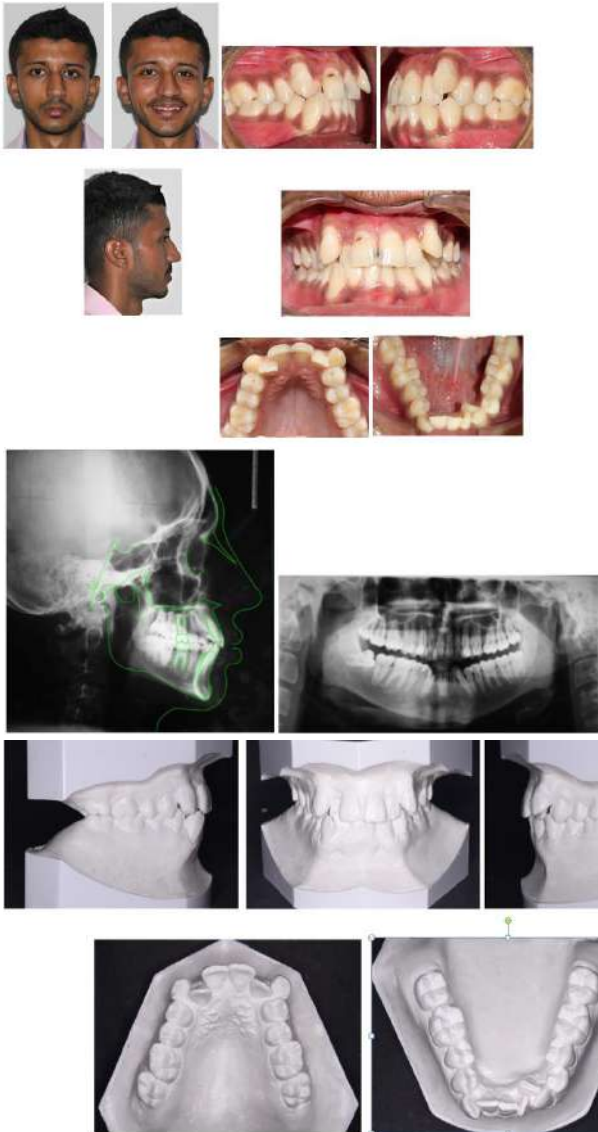


Fig. 1 Case 1. Pre-treatment records.

TABLE 1
CASE 1 CEPHALOMETRIC ANALYSIS

Sl. No.	Measurements	Range/Normal Value	Pre-Treatment	Post-Treatment
1	SNA	82°	80	80.5

Treatment Progress

The patient was referred for the restorations of maxillary central incisors and extraction of all first premolars. After two weeks of extraction, a Trans Palatal Arch (TPA) was banded across the maxillary first molars to reinforce the molar anchorage, followed by T-loop (0.017" X 0.025" TMA) placement bilaterally for separate maxillary canines' retraction (Fig. 2a).



Fig. 2 a. Case 1. T-loop placed bilaterally for separate maxillary canines' retraction

After 5 months of canine retraction, all teeth except the upper right lateral incisor (12) and lower left lateral incisor (32) were bonded with a pre-adjusted edge-wise appliance (0.022" x 0.028" slot MBT prescription, 3M Unitek). Levelling and alignment was initiated with 0.014" NiTi followed by 0.016" NiTi archwire. After two months, 0.018" SS archwires were placed in both upper and lower arches, with open coil springs in between 11 and 13 in upper and in between 31 and 33 to create space for the palatally placed right lateral incisor (12) and lingually placed mandibular left lateral incisor (32) respectively (Fig. 2b).



Fig. 2 b. Case 1. Open coil springs to create space for the palatally placed right lateral incisor (12) and lingually placed mandibular left lateral incisor (32)

Three months later posterior bite blocks were fixed with GIC (Glass Ionomer Cement) to raise the bite and piggyback NiTi wire was given so that the blocked teeth could align. Hereafter, SS archwires were sequentially increased to 0.017"x0.025" and 0.019"x0.025" to correct the tooth inclination. During treatment, the upper midline had shifted by 2 mm towards the right side, and the left side molar relationship had changed from class I to end-on molar relation. To correct the aforementioned discrepancies a sliding zig (0.018"x0.025" SS wire) was fabricated and used for the next 3 months followed by settling (Fig. 3). We finished the case with a bilateral class I molar and class I canine relationship, normal overjet, and overbite with an aesthetic soft tissue profile after 24 months of therapy (Fig. 4).



Fig. 3. Case 1. To correct the midline discrepancies a sliding zig was used

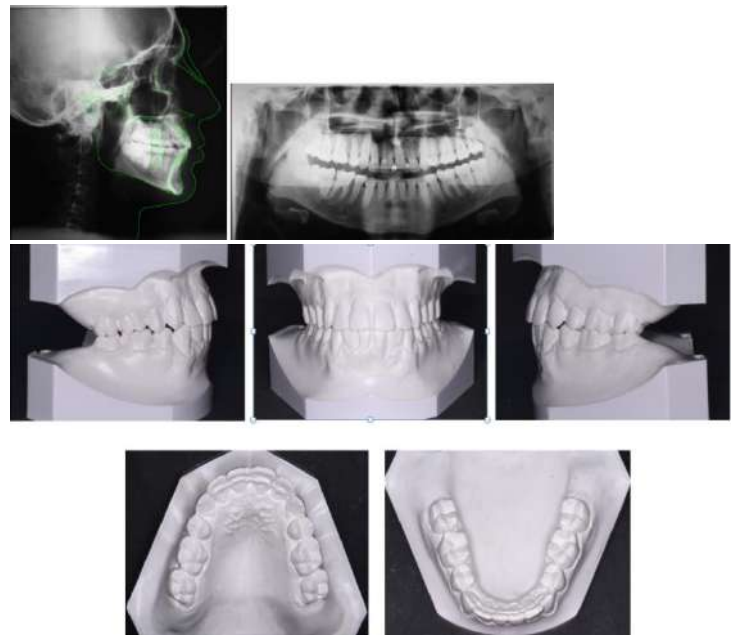


Fig. 4 Case 1. Post-treatment records.

Case 2

Diagnosis

An 18-year-old female reported to the orthodontic department with a chief complaint of irregularly placed teeth in her upper and lower front tooth region. Extraoral examinations revealed a mesocephalic head shape, mesoprosopic facial form, and a convex facial profile with incompetent lips. Whereas intraoral examinations depicted a class II molar relationship on the right side and an end-on molar relationship on the left side, highly placed maxillary canines (13,23), along with lower canine in crossbite bilaterally, and 1mm of lower midline shift towards the right side (Fig. 5). Lateral cephalometric analysis revealed a skeletal class I malocclusion (ANB, 4°), proclined upper and lower incisors (U1 to N-A= 5mm/24°, L1 to N-B= 6mm/33°), mandibular plane angle 31°, IMPA 98°, nasolabial angle 106° (Table 2).

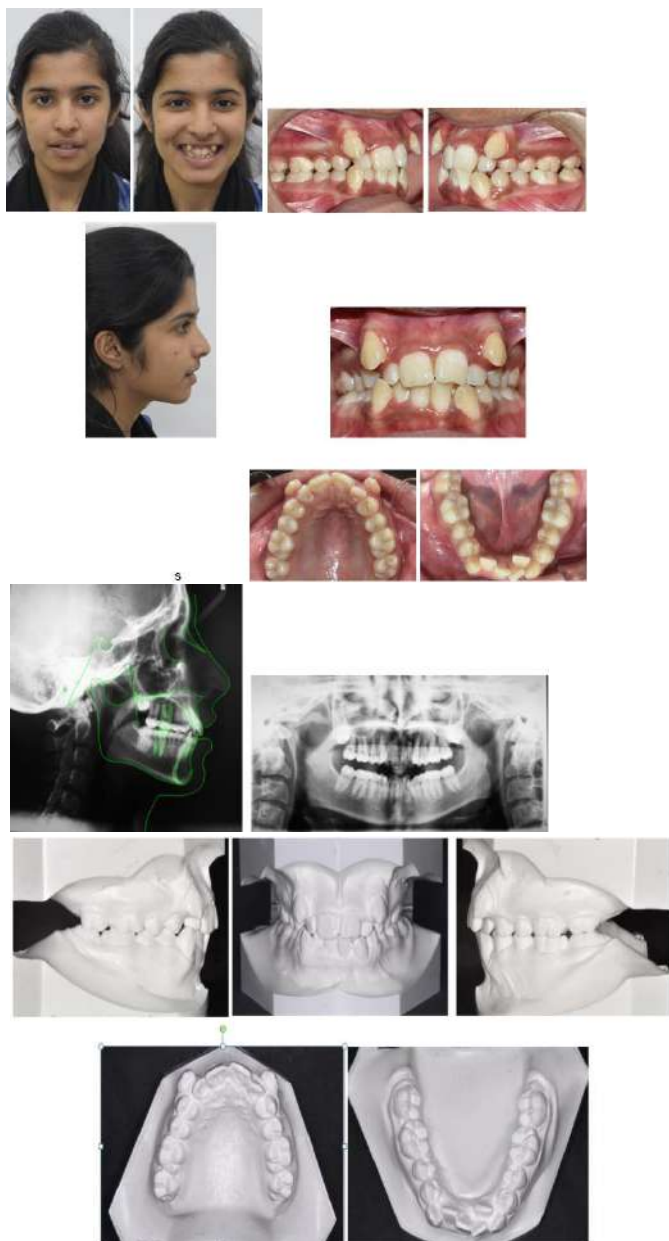


Fig. 5 Case 2. Pre-treatment records

TABLE 2
CASE 2 CEPHALOMETRIC ANALYSIS

Sl. No.	Measurements	Range/Normal Value	Pre-Treatment	Post-Treatment
1	SNA	82°	83°	83°
2	SNB	80°	79°	80°
3	ANB	2°	4°	3°
4	Mandibular plane angle (SN-Go-Me)	32°	33°	31°
5	Y-axis (S-N to S-Gn) (outer angle)	66°	70°	68°

	angle)			
6	U1 to N-A (mm)	4 mm	5mm	4mm
7	U1 to N-A (angle)	22°	24°	22°
8	L1 to N-B (mm)	4 mm	6mm	5mm
9	L1 to N-B (angle)	25°	33°	29°
10	U1 to L1 (interincisal angle)	131°	119°	127°
11	Upper incisor to S-N plane	102° ± 20°	106	104
12	IMPA (incisor mandibular plane angle)	90°	98°	94°

According to the conventional approach, the treatment plan was to extract four first premolars followed by fixed orthodontic therapy. Since the patient was a student and had to leave the city for higher studies, she requested for faster treatment protocol. At her request, the treatment plan was modified and it was decided to remove the upper canines (13 and 23) and lower left lateral incisor (32). As maxillary lateral incisors and 1st premolars have good contact bilaterally and lower left incisor is lingually blocked.

Treatment Progress

10 days after extraction of both maxillary canines, a trans palatal arch (TPA) was ligated to the upper first molars, followed by bonding with pre-adjusted edgewise appliance (0.022" x 0.028" slot with MBT Prescription, 3M Unitech). GIC (Glass Ionomer Cement) was used in the upper first molar and second premolar region bilaterally to open the bite. After three months of using 0.014" and 0.016" NiTi archwires to level and align the maxillary arch, the lower left lateral incisor (32) was extracted and a pre-adjusted edgewise appliance was bonded to the lower arch. The first archwire for levelling and alignment of the mandibular arch was 0.012" NiTi, which was gradually increased to 0.014" and 0.016"x0.022" NiTi during the next three months. When we reached to the rectangular SS archwire stage in the maxillary arch, a negative crown torque of 18 degrees was incorporated into 0.017" x 0.025" and 0.019" x 0.025" SS wire bilaterally to the first premolars' region (14 and 24) to imitate the canine root prominence. During the course of treatment, the lower midline was shifted towards the left, which was further corrected by using Class II and Class III elastics on the left and right sides. (Fig. 6). Final settling was done on

0.014" NiTi archwire.



Fig. 6. Case 2. To correct the lower midline Class II and Class III elastics was used on the left and right sides

The total treatment time was 12 months. Since the extraction pattern followed the extraction of teeth that were out of the arch, this decreases the time duration of treatment. Fixed lingual retainers from the maxillary right lateral to maxillary left lateral incisor and mandibular right canine to mandibular left canine were given in the upper and lower arch respectively (Fig. 7).

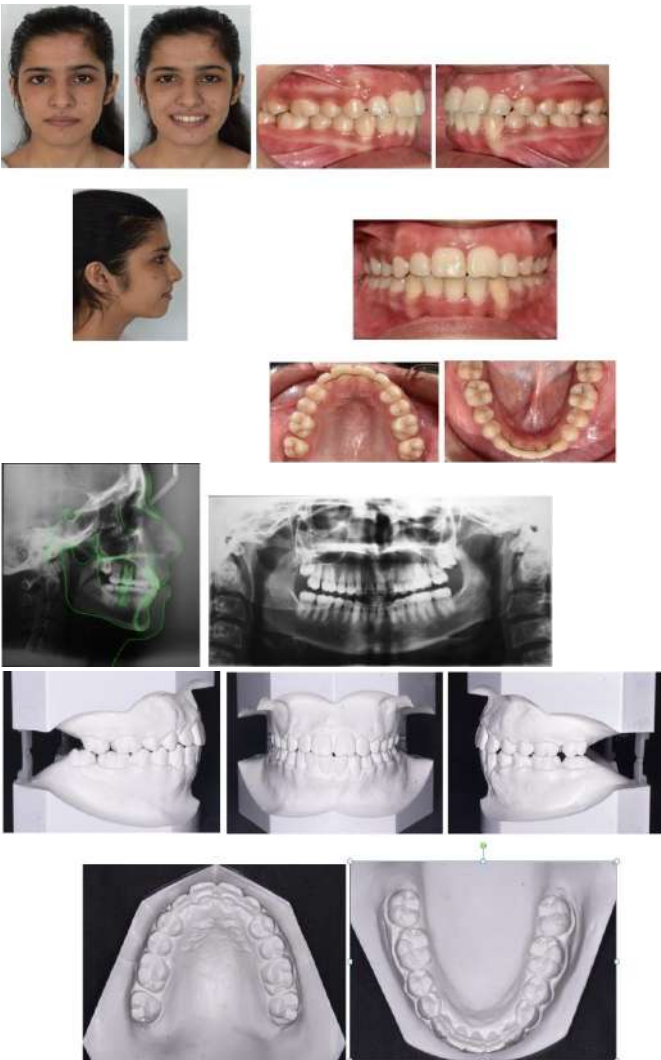


Fig. 7 Case 2. Post-treatment records

Case 3

Diagnosis

A 27-year-old female came to the orthodontic department for treatment due to her unattractive smile. Her extraoral clinical evaluations indicated a convex facial profile with incompetent lips, while intraoral examination revealed a bilaterally class 1 molar relationship, increased overbite, and substantial anterior crowding in both arches. The maxillary arch had bilateral palatally positioned upper lateral incisors (12,22) and distobuccally rotated central incisors (11,21), whereas the mandibular arch had lingually placed right central and left lateral incisors (41,32), with a periodontally compromised left central incisor (31) and lingually blocked left lateral incisors (32), crossbite (12,33) and (22,43) and scissor bite with respect to 14 (Fig. 8) Lateral cephalometric analysis revealed a mild skeletal class II jaw bases ($ANB=5^{\circ}$) with normodivergent growth pattern ($SN-Go-Me, 32^{\circ}$), with retroclined upper ($U1 \text{ to } N-A= 5\text{mm}/19^{\circ}$) and proclined lower incisors ($L1 \text{ to } N-B= 4\text{mm}/27^{\circ}$) (Table 3).

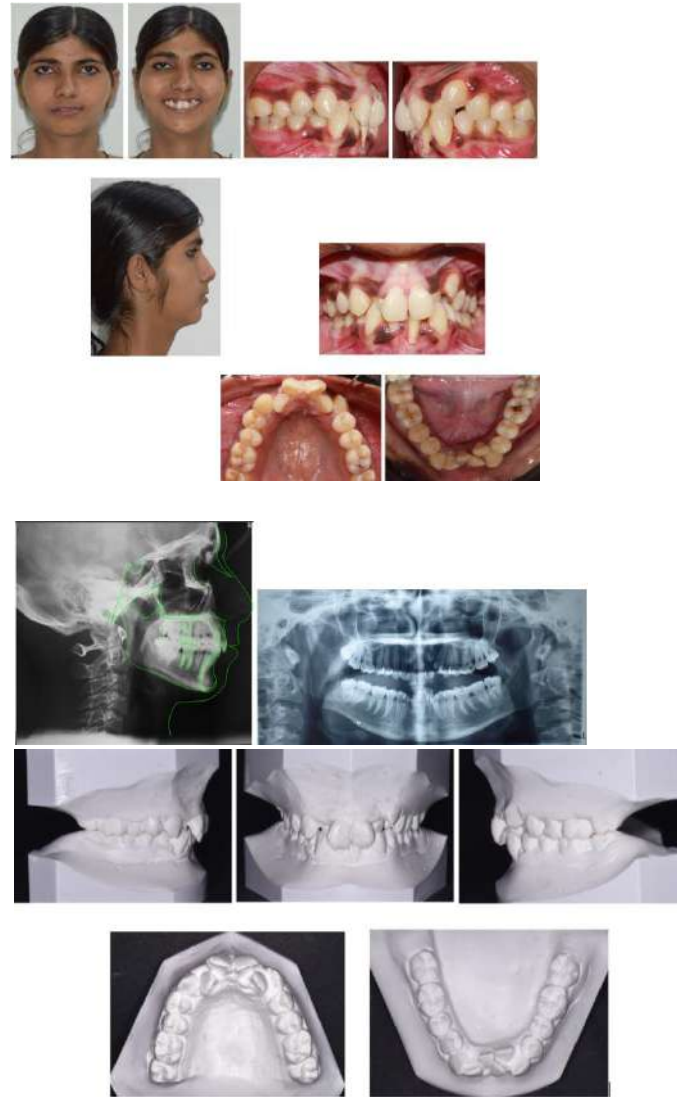


Fig. 8 Case 3. Pre-treatment records

TABLE 3
CASE 3 CEPHALOMETRIC ANALYSIS

Sl. No.	Measurements	Range/Normal Value	Pre-Treatment	Post-Treatment
1	SNA	82°	84	84
2	SNB	80°	79	79
3	ANB	2°	5	5
4	Mandibular plane angle (SN-Go-Me)	32°	32	31
5	Y-axis (S-N to S-Gn (outer angle))	66°	65	64
6	U1 to N-A (mm)	4 mm	5	3
7	U1 to N-A (angle)	22°	19	23
8	L1 to N-B (mm)	4 mm	4	5
9	L1 to N-B (angle)	25°	27	29
10	U1 to L1 (interincisal angle)	131°	138	132
11	Upper incisor to S-N plane	102° ± 20°	97	101
12	IMPA (incisor mandibular plane angle)	90°	94	97

A traditional approach to addressing this form of crowding required the removal of all premolars in both the maxillary and mandibular arches. The alternative treatment was to extract two first premolars (14,24) in the upper arch and two incisors (31,32) in the lower arch as 31 is periodontally compromised and 32 is lingually blocked and far from line of occlusion. The patient chose the second option for which the patient was referred for the upper premolars (14,24) extraction.

Treatment Progress

Two weeks after the upper premolars' extraction (14,24), pre-adjusted edgewise appliance (0.022"x0.028" slot MBT prescription, 3M Unitek) were bonded in the upper arch leaving the palatally displaced lateral incisors (12,22) and a Trans-Palatal-Arch (TPA) was banded across the upper first molars. After two months of leveling and alignment with 0.014" and 0.016" NiTi archwires, the wire was changed to 0.016"x0.022"

SS, and canines were laced-backed bilaterally. The archwire was replaced with 0.017"x0.025" SS, and the right and left lateral incisors were bonded and piggybacked with 0.012" NiTi wire once a suitable amount of space was obtained over the next three months. Furthermore, GIC cement was applied to the upper molar area to assist the buccal movement of these piggybacked lateral incisors (Fig. 9).



Fig. 9. Case 3. Piggybacked done in upper lateral incisors for buccal movement

Meanwhile, the mandibular incisors (31,32) were removed, and the lower arch was bonded a week later. 0.014" NiTi archwire was used to begin leveling and alignment. After a month, 0.016" NiTi archwire wire was placed in the lower arch and 0.017"x0.025" NiTi in the upper arch, respectively, which were later changed to 0.017"x0.025" SS and 0.019"x0.025" SS, respectively. During the levelling and alignment phase, the mandibular incisors extraction space is used in relieving the crowding in the lower arch while Class I elastics were used bilaterally over the next four months to close off the remaining space in the upper arch. Enameloplasty was then performed in mandibular canines (33, 43) to imitate the morphology of mandibular incisors. We ended the case in a bilateral class I molar relationship with a good soft tissue profile with normal overjet and overbite (Fig. 10). The total treatment time was 17 months. Fixed lingual retainers from the right lateral incisor to the left lateral incisor, and from canine to canine were given in both maxillary and mandibular arches respectively. Table 3 shows the cephalometric readings after therapy.

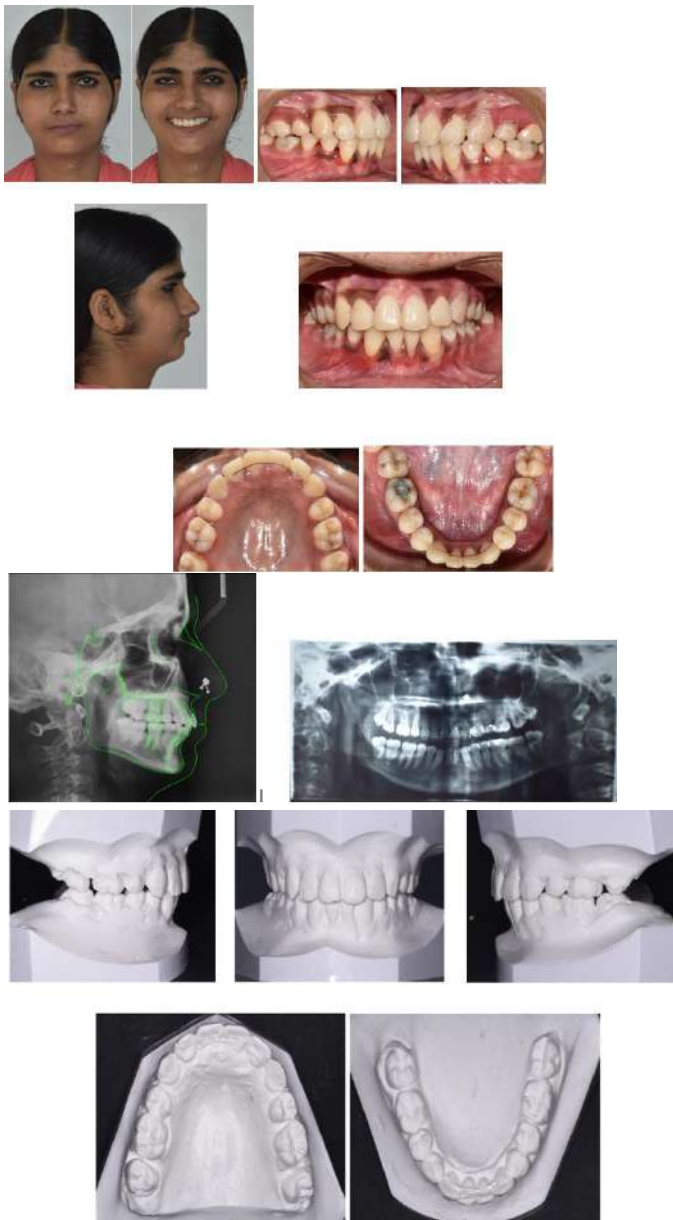


Fig. 10. Case 3. Post-treatment records.

DISCUSSION

Extraction of mandibular incisors and mandibular canines is not new in dentistry.¹¹ With minimal orthodontic manipulation, orthodontists can achieve improved functional occlusion and aesthetic outcomes by intentionally extracting lower incisors. It provides several advantages¹², including the ability to maintain a harmonious appearance by maintaining the lower incisor in an anterior-posterior position, as well as lowering treatment time.⁴ But some potential dangers due to improper case selections such as an increase in overjet and overbite increases and space

reopening are also mentioned in the literature¹³. In situations of moderate to severe crowding, extraction of one incisor may be enough to keep the arch shape and width without expanding the inter-canine width.

Previously,^{14,15} canine-protected occlusions had already been determined to be the optimal occlusion for natural teeth as well as dentures, and our treatment should be directed toward it. The primary concept of canine protected occlusion is that only the canine contacts when the mandible has laterotrusive movements. As a result, the remaining dentition is protected from unfavorable torsional occlusal forces on contact and centric relations.¹⁶ However, recent research has found that the stability and durability of canine-protected occlusion are debatable. No single type of functional occlusion has been found to predominate in nature. For example, D'Amico,¹⁴ Ismail and Guevara,¹⁷ and Scaife and Holt¹⁵ all found that Canine Protected Occlusion predominated, whereas Beyron¹⁸ and MacMillan¹⁹ found a predominance of group function occlusion. In addition, the natural occurrence of balanced occlusion (ie, with nonworking contacts) was found in populations studied by Weinberg,²⁰ Yuodelis, and Mann.²¹ Canine-protected occlusion may be only one of the numerous forms of optimum functional occlusion toward which orthodontic patients' treatments should be directed. However, depending on the features of patients, group function occlusion and occlusion with no interference appear to be appropriate functional occlusion schemes.¹⁶

Case 1 and case 2 shown in this article are more alike presented with a buccally placed maxillary canine and severe crowding in the mandibular arch. Rotation of the lower left central incisor and lingually placed lower left lateral incisors is also observed in both cases. But the treatment time for case 2 was much less in comparison to case 1 due to an atypical extraction pattern.

In case 1, a routine method of extracting all 4 premolars was followed. Here in this case in maxillary arch, the lateral incisors were palatally tipped and did not have good contact with the 1st premolars. Therefore, the separate canine retraction was done and then lateral incisors were aligned which increased the treatment duration. In the lower arch 1st premolar was extracted bilaterally and an open coil spring was placed between 31 and 33 to create space for the blocked-out lateral incisor, the complex mechanism, and severely rotated tooth led to the gingival recession of the adjacent tooth.

Whereas in case 2, the maxillary canines were removed, despite the usual method of removing the premolars. In this case, the patient had good contact bilaterally between the maxillary lateral incisors and the 1st premolar and the arch was also well aligned except for the buccally placed canine.

Previous researches concluded that no statistically significant difference between canine extraction and premolar extraction patients were found in terms of smile attractiveness,²² as well as for the prevalence of temporomandibular disorder^{23,24} when premolars replaced canines and justify for extraction of single or both canine in a clinical situation such as impaction and transposition. Negative crown torque to the upper first premolar roots must be added as they are less able to deal with occlusal stresses than canines, that's why eliminating any obstruction of their lingual cusps by administering an appropriate amount of buccal root torque has been recommended in the literature, resulting in a canine eminence that improves aesthetics. To obtain the ideal tip and torque, a canine bracket was used on premolar in case 2. The shade of canine can be one of the contributing factors that affect smile attractiveness in cases of upper canine extraction, but because here both canines were extracted, this didn't affect smile attractiveness. In the lower arch, extraction of the mandibular incisor was done. As the mandibular incisor was out of the arch, extracting it doesn't affect the inter-canine width. No increase in overjet or formation of black triangle was seen at the end of the treatment. There was no midline discrepancy post-treatment.

In case 3, although the left maxillary canine was buccally placed, in the treatment plan, instead of extracting the buccally placed canine, we followed the routine method of extracting upper premolars, as in this case, the maxillary lateral incisors and 1st premolar didn't have good contacts. While in the mandibular arch, 2 lingually placed incisors were extracted. Gingival recession was seen with respect to 31 as the patient had poor oral hygiene. The potential dangers mentioned by the previous studies such as black triangle formation, increase overjet, midline discrepancies due to lower incisor extraction can be avoided by careful treatment planning

CONCLUSIONS

1. By proper diagnosis and treatment planning, atypical extractions give more favorable and stable results and also helps in decreasing the treatment duration compared to the routine extractions.
2. If the lateral incisors and premolars have good contacts, a buccally placed canine can be extracted. This helps in reducing treatment period.
3. When Bolton's analysis shows mandibular anterior excess, than lower incisor extraction should be considered.
4. Factors indicating which lower incisors to be extracted includes periodontal health of the tooth, amount of anterior tooth

ratio, and distance of tooth from Angle's line of occlusion

DECLARATION OF PATIENT CONSENT

The author certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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