Case Report

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Management of Ectopically erupted Maxillary Central Incisor and Driftodontics in Mandibular Arch.

Abstract:
Physiological drift is defined as the natural migration of a tooth into a space created by extraction, congenital absence, decay, or interproximal reduction without the application of any orthodontic force. Spontaneous decrowding of teeth by physiological drift has been called "driftodontics". This case report describes a case of 16-year-old-boy with severe crowding in the mandibular arch and ectopic erupted permanent maxillary incisor that was resolved by physiological drift after premolar extractions in the mandibular arch and fixed mechanotherapy in the management of the ectopic eruption of the permanent maxillary central incisor.
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Introduction:

The maxillary incisors and canines, often referred to as the 'social six',are the most prominent teeth in an individual's smile.[1] The normal eruption, position and morphology of these teeth are crucial to facial esthetics and phonetics. Ectopic eruption is a disturbance in which the tooth does not follow its usual course. Deviation in the eruption of incisors is a challenging situation often faced by the clinician. Ectopic eruption of the permanent maxillary incisor is attributed to a wide range of genetic factors and local factors such as supernumeraries, retained deciduous teeth, traumatic injury to the primary teeth and tooth size arch length discrepancy.[2] The prevalence of ectopic eruption is 5.6% and majority of these are permanent central incisors. O'Meara stated that insufficient inter-canine width and anteroposterior growth of the jaws contribute the most in the ectopic eruption.[3] Also, the multi factorial process of the growth and development makes it difficult to identify primary etiological factors responsible for it. Ectopically erupted teeth need orthodontic intervention, by means of either removable or fixed appliance, to be brought into correct position.[4] For proper alignment of ectopically erupted teeth in arch, space is needed, and this can be gained by methods such as interproximal reduction, lateral expansion, extraction, and molar distalization.[5] Amongthe aforementioned methods, orthodontists prefer extraction the most. Assuming that extraction is deemed necessary, it is important to determine when to extract and when to initiate the mechanotherapy. Traditionally, tooth extraction has been followed by appliance therapy. This procedure, which is still the most popular, was devised to avoid unfavourable tooth movement, particularly in the teeth next to extraction sites. However, starting treatment right after the extraction may not always be essential.

Bourdet (1757) first advocated balanced premolar extractions to achieve spontaneous alignment of the dental arches. This aspect of orthodontic treatment by physiological drifting of

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teeth is referred to as driftodontics.[6,7] Physiological drift is defined as the natural migration of a tooth into a space created by extraction, congenital absence of tooth, decay, or interproximal reduction without application of any orthodontic force.[6]

In this present case, we have illustrated the management of ectopically erupted maxillary central incisor, in conjunction with driftodontics in lower arch, after all four premolars extraction.

Diagnosis and Treatment Plan

A 16-year-old male patient presented with chief complaint of irregularly placed upper and lower front teeth (Fig.1 and Fig. 2). Extraoral examination revealed a mesocephalic head shape, mesoproscopic facial form with convex profile, posterior facial divergence and competent lips. Intraoral examination depicted Class I molar and end on canine relationship bilaterally with overjet of 2.5mm and 2 mm of overbite. Maxillary arch showed crowding with labially blocked out left central incisor (21). The mandibular arch had severe anterior crowding (8mm), with right lateral incisor placed lingually (42). The upper dental midline was deviated 2mm to the right.

Panoramic radiograph examination revealed the presence of developing tooth germs of all third molars except maxillary left third molar. The alveolar bone levels and root morphologies of the teeth were normal. Temporomandibular joint space appeared optimal with normal size, shape and position of the condyle heads. (Fig. 3). The cephalometric evaluation showed a skeletal class II jaw-base relationship (ANB,5°) with hyperdivergent growth pattern (SN-Go-Me,36°),proclined mandibular incisor (IMPA, 105°) with decreased interincisal angel (103°) (Fig 3, Table 1).On studycast analysis, Bolton's ratio indicated anterior (0.54mm) and overall(2.37mm) maxillary tooth material excess

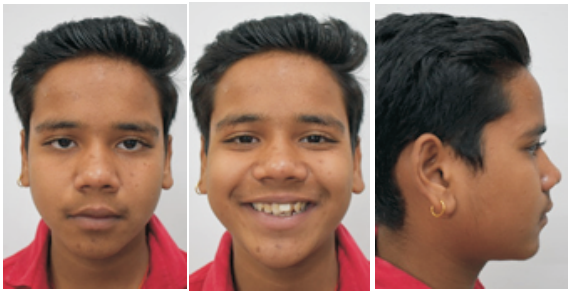

Fig. 1 Pre-treatment Extra-oral and Intra-oral Photographs

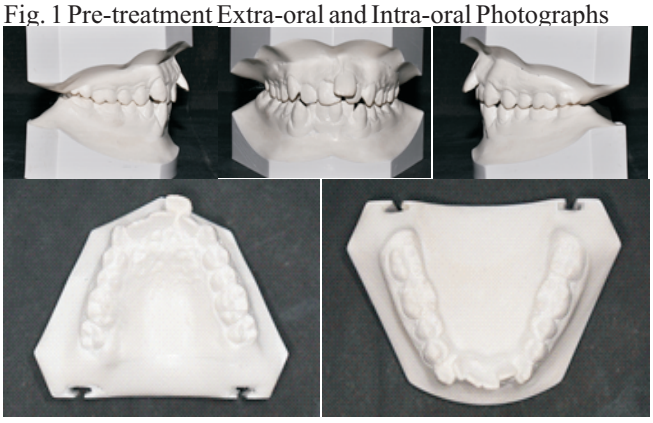

Fig.2 Pre-treatment models.

Fig 3. Pre-treatment Lateral Cephalometric and Panoramic Radiographs.

Table I. Lateral Cephalometric Measurement

Sl. No	MEASUREMENTS	RANGE	ACTUAL	
			PRE-TREATMENT	POST-TREATMENT
1	SNA	82°	82 °	82 °
2	SNB	80°	77 °	77°
3	ANB	2°	5 °	5°
4	Mandibular plane angle (SN -Go-Me)	32^0	36 °	35.5 °
5	Nasolabial angle	110 °	124 °	110 °
6	IMPA angle	90 °	105 °	98 °
7	Y-axis {S-N to S-Gn (outer angle)}	66°	71 °	71°
8	Facial axis angle {B-Na to Ptm-Gn (Inner angle)}	90°	93°	92°
9	U I to N-A(mm)	4mm	10 mm	5 mm
10	U I to N-A(angle)	22°	38°	23°
11	L I to N-B (mm)	4mm	8 mm	4 mm
12	L I to N-B (angle)	25°	33 °	26 °
13	U I to LI (Interincisal -angle)	131°	103 °	125 °
14	Upper lip	0-2 mm	3.5 mm	2 mm
17	Lower lip	0-2 mm	3 mm	1 mm

Treatment Objective:

The treatment objectives were to

- Achieve leveling and alignment of both the arches,
- Maintain class I molar relation bilaterally
- Achieve class I canine relation bilaterally,
- Achieving occlusal stability
- Achieve ideal overjet and overbite.
- Achieve soft tissue balance and harmony

Treatent Plan:

The treatment plan was presented to the patient:

1. Extraction of all first pre-molars followed byfixed orthodontic therapy.

Treatment Progress:

Considering the patient's age, profile, and arch discrepancy, we decided to extract all first premolars, followed by physiological tooth movement in the lower arch. The patient was referred for the extraction of premolars, and recalled after two weeks. A transpalatal arch (TPA,0.9mm Blue Elgiloy) was then placed in the upper arch for anchorage and bonding was done in the upper arch with pre-adjusted edgewise appliance (0.022"x 0.028" slotMBT prescription, 3M Unitek) with the exception of the ectopically eruptedmaxillaryleft central incisor.

Levelling and aligning were initiated with0.014"nickel titanium(NiTi) arch wire. Simultaneously, the lower teeth were left to move physiologically by driftodontics inthe premolar extraction space. After 2 months, open coil spring was inserted on a 0.018" stainless steel (SS) wire, between the upper right maxillary central incisor and left lateral incisor for gaining the space(Fig 4). After2 months, the maxillary left central incisor was bonded. Since the deflection was more, levelling and alignment was again continued with 0.012" nickel titanium archwire, progressing up to 0.016" NiTi archwire for the complete alignment.

During theten months of upper arch alignment, anterior crowding in the lower arch was resolved to some extent by physiological drift (Fig5).Ten months later, banding and bonding was done in the lowerarch, except the lingually placed right lateral incisor. Levelling and alignment were then initiated with 0.012" nickel titaniumarchwire. Two months later, an open coil spring was inserted on 0.018" stainless steel archwire in the lower arch between right central and canine for gaining the space and the normal alignment of the right lateral incisor. After two months, the right lateral incisor was also bonded, and initial levelling and alignment was continued with 0.014" nickel titanium, and completed using 0.016" and 0.016" x 0.022" nickel titanium archwire. After 18 months of treatment, retraction for the remaining extraction space closure was started using 0.017"x 0.025"stainless steel arch wire, and continuous elastic chain, from molar to molar, was given in the upper arch and Class I force was given in the third quadrant(Fig 6). Class II intermaxillary elastics (5/16", 3.5 oz) were effectively used for the correction of overjet and overbite. Settling of occlusion was done using 0.014" nickel titanium archwire.

After 23 months of overall treatment, debonding was done, and a fixed lingual retainer was bonded on the upper arch, lateral incisor to lateral incisor, (2-2) and in the lower arch, canine to canine.

Fig.4.Open Coil Spring Activation for Correction of Ectopically Erupted 21.

(a) (b)

Fig.5.Physiologically Drift of Lower Teeth (a)Before driftodonticsand (b) After driftodontics.

Fig.6. Mid-treatment progress

Treatment Result:

Post-treatment records revealed good esthetics and occlusion(Fig7). The intraoral findings showed good alignment in both the arches, with Class I molar and Class I canine relation bilaterally, and also, dental midline coincided with the facial midline. Post-treatment cephalometric radiographs (Table 1, Fig.9) showed improvement in the incisor inclination (U1 to N-A = 23°/5mm, L1 to N-B =26 °/4), (SN-Go-Me = 35 °, IMPA = 98°).

Post-treatment panoramic radiograph showed good root parallelism with no significant root resorption, and the patient was advised for the extraction of lower left third molar due to the absence of the antagonist tooth (Fig.9), and for gingival recontouring in upper right central incisors. Superimposition of the pre-treatment and post-treatment cephalometric tracings showed that the treatment objectives were achieved (Fig.10).

Fig.7.Post -treatment Extra-oral and Intra-oral photographs

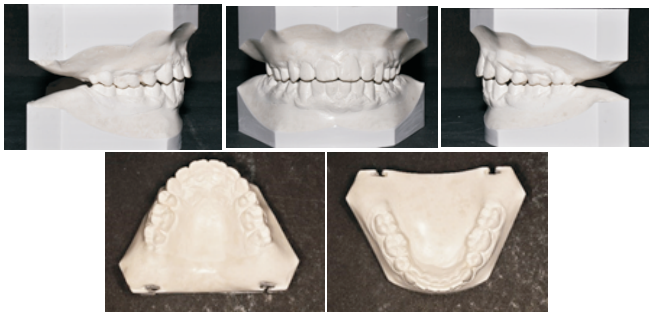

Fig.8. Post-treatment Study Model.

Fig.9. Post-treatment Cephalometric and Panoramic Radiographs.

Fig.10.Superimposition of Lateral Cephalometric Tracing Pre-Treatment(black) and post-Treatment (red).

Discussion:

Tooth eruption is referred as the movement of a tooth from its developmental position to its functional position in the dental arch. Genetic, molecular, cellular, or tissue factors can modify a normal eruption. Ectopic eruption is that when a tooth emerges in an abnormal position. Ectopic eruption affects almost 5.6 percent of the general population, with the majority of instances involving the permanent central incisors. The local factors which may lead to ectopic eruption are: retained primary teeth, supernumerary teeth or odontomes, trauma to primary teeth, developmental disturbance like cleft palate and tooth size arch length discrepancy.[8] In instances when deviation is small, Huber et al.[9] recommend removing the appropriate etiological factor and allowing natural guiding of ectopically erupted teeth. After removing the etiological factor, Barberia et al.[10] observed spontaneous correction of an ectopically erupted tooth. To resolve such situation before it deteriorates, space gaining for the normal alignment of the ectopically erupted teeth in the arch is usually the first approach needed. Extraction of premolars is usually the choice in cases of severe crowding. Therefore, we planned to extract the upper premolars to gain the space for the alignment of the ectopically erupted upper central incisor, along with the help of open coil spring placed on 0.018SS archwire between upper right central incisor and left lateral incisor.

Charles Tweed[11] and Begg[12] explained the notion of permanent tooth extraction to address malocclusion 60 years ago. When a tooth is extracted or a tooth is missing, the other teeth in the arch will automatically migrate to restore balance. Extraction, caries, proximal reduction, or congenital absence might cause the remaining teeth to migrate spontaneously to find a new balance. This modification was termed "physiological drift" by Bourdet.[6,7] Driftodontics is described as when permanent teeth are removed without any appliance therapy and the remaining teeth physiologically drift into the spaces and, is more common in the lower arch. To better understand the process behind physiological drift, several experimental animal investigations were done. Moss et al.13 used clinical, radiological, and histological approaches, as well as examination of plaster replicas of the teeth, to determine the rate of horizontal tooth drift in six adult monkeys. They came to the conclusion that premolars moved distally whereas posterior molars drifted mesially. According to Robertson, Cavina, and Moss, mesial molar drift takes up 91 percent of the first premolar space, whereas Weber claims that one-third is taken up by mesial molar drift and two-thirds by distal canine drift.[7,14]

There are two schools of thought on whether the appliance should be placed immediately after extraction or not. Some orthodontics feel that placing orthodontic equipment right away will help to prevent posterior tooth anchoring loss. Delaying placement, on the other hand, allows for natural drifting of teeth into extraction slots, minimising the length of orthodontic therapy. It was observed that fixed orthodontic treatment begun with well aligned incisor yield more stable result than cases beginning with crowded or rotated teeth for better stability. Alexander[15] advised waiting six to eight months following extraction to bond the lower arch to allow the lower incisors to unravel and straighten. Also, it has been purposed that most effective driftodontics occurs after eight to ten months after extraction and need for fixed appliance therapy.[16] hence, to relieve mandibular anterior crowding in our case we opted to follow the second school of thought. For ten months, no attempt has been made to move the teeth into the extraction spaces in the lower jaw. Driftodontics, or the spontaneous drift of canines, premolars, and molars, closed almost all of the extraction spaces in the jaw. The braces were then bonded in position to correct the lower tooth's rotations and inclinations, as well as accomplish proper interdigitation with the upper teeth. We waited for eight to ten months following the first premolar extraction and allowed physiological drifting of the teeth into the extraction space which minimizes the duration of orthodontic procedure. However, other potential benefits of physiologicdrift include better occlusal relationships, increased dentoalveolar support, and a shorter period of full appliance therapy owing to spontaneous realignment of the dentition.[17,18] Driftodontics is also beneficial for the patients in having braces for a shorter period and also in the ease of oral hygiene. It also minimizes the side effects of orthodontic forces usually exerted on the teeth during treatment. Furthermore, with proper manipulation and timing, the combination of physiologic drift followed with fixed orthodontic treatment reduces the treatment time and chair time.

Conclusion:

Driftodontics, or the natural movement of teeth following extractions, is favourable to the patient in terms of dental hygiene and preventing orthodontic treatment adverse effects. In this case, there may be no treatment necessary except for the gainingof space and allowing the tooth to erupt alone in a matter of time.Each case must be treated independently in order to formulate the proper treatment plan and to achieve the best possible outcome for each patient. Moreover, the pattern of physiologic drift of mandibular canines after premolar extraction helps relieve crowding.

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