SOONER THE BETTER: EARLY INTERCEPTION USING 2X4 APPLIANCE IN MIXED DENTITION PERIOD-A CASE REPORT

ABSTRACT

Mixed dentition is the most crucial period because early treatment would correct the occlusion as well as ensure normal development of teeth and jaw. Parents want their children's permanent teeth to develop into exquisite dental aesthetics when they shed their primary teeth. Interceptive orthodontics is a branch of orthodontic science and art that is used to detect and correct potential abnormalities and malpositions in the growing dentofacial complex. The 2x4, a versatile appliance is used in the mixed dentition. A single short term of fixed appliance therapy in the early mixed dentition period aids in the quick repair of early malocclusions with this method. Early therapy can raise a young child's self-esteem, improve their general personality and visual appearance, and prevent the need for more time-consuming orthodontic treatment in the future.

Keywords: Mixed dentition, interceptive orthodontics, odontome, 2x4 appliance

1. INTRODUCTION

The transition period from primary to permanent dentitions between 6-12 years of age is often a worrisome period for parents and guardians. Following the shedding of the primary teeth, parents or guardians expect their children's permanent teeth to erupt into magnificent dental aesthetics. Even children are now aware of the importance of dental aesthetics. Guidance of primary and permanent dentition eruption and development is an important element of paediatric patient care that contributes to the development of a permanent dentition that is harmonious, functional, and has an aesthetically pleasing occlusion. Orthodontic repair of mixed-dentition teeth is often a difficult task for paediatric dentists.

Shaw et al.[1,7] found that dental features were the fourth most common target in children for being exposed to nicknaming, teasing and harassment especially in the 9–10-year-old. Treatment of younger children during the early mixed dentition phase has advantages in terms of stability and avoiding future difficulties, which aids in the development of self-esteem and aesthetic appearance, so boosting their entire personality.[1]

In 1980, Ackerman and Proffit introduced interceptive orthodontics as a means of correcting problems in the developing dentition and defined it as the elimination of the existing interferences with the key factors involved in the development of the dentition. Interceptive treatment is foundational to reduce the severity of a developing malocclusion often being indicated and executed in the mixed dentition and bringing with it unique challenges. Timing of such treatment has always been the subject of much debate over the years. Most common malocclusions seen during mixed dentition stage are the anterior and posterior crossbites, crowding, rotations, midline diastema, spacing etc. Children with malocclusion during this time are frequently delayed in receiving treatment until all

permanent teeth have erupted or are given removable appliances, which generally result in restricted tooth movement due to a lack of compliance, retention, and activation. Many facets of orthodontics have been considered, including clinical effectiveness, orthodontist choice, early treatment outcomes, and psychological variables associated to orthodontics. [6]

Malocclusion of teeth in dentitions are either a mal-relationship of dental arches or malalignment of teeth. Malposition of teeth refers to altered positioning of one or more teeth often caused by local factors. Supernumerary teeth are the teeth that exceed the normal dentition, regardless of their morphology and location with commonly associated complications being impaction, delayed eruption, crowding, and diastema. The prevalence in permanent dentition varies from 0.5%–5.3%, while in deciduous dentition is 0.2%–0.8%.[5] They vary from a simple odontome, a conical or tuberculate tooth, to a supplemental tooth resembling a normal tooth and have a strong predilection for being mostly seen in the premaxillary region.

The 2x4 appliance, which consists of bands on the first permanent molars and bonded brackets on the erupting maxillary permanent incisors, is a flexible device used in the mixed dentition. To offer complete control of the arch form, a continuous arch-wire is used. A single short term of fixed appliance therapy in the early mixed dentition period aids in the quick repair of early malocclusions with this method. Treatment undertaken at an early stage can boost the young child's self-esteem, improving their overall personality and aesthetic appearance and also avoid the need of undergoing cumbersome orthodontic treatment in the future.

This paper describes the management of a case of rotated permanent teeth along with a supernumerary tooth (odontome) in the premaxilla treated with the help of 2X4 orthodontic appliance.

2. CASE DISCUSSION

A 10-year-old male patient reported to the Department of Pediatric and Preventive Dentistry, K D Dental College & Hospital, Mathura with a chief complain of extra teeth in upper front tooth region since 1 year. There wasn't any significant family or medical history. Extra oral examination revealed convex profile of the patient. Intra oral examination revealed a supernumerary tooth between the maxillary central incisors. In addition, the permanent maxillary left lateral incisor was mesiolabially rotated and permanent maxillary right central incisor had an Ellis Class I fracture **(Fig. 1.)**. Clinical examination revealed carious maxillary and mandibular primary second molar. Because both teeth were on the verge of exfoliation, they were not pulled. An intraoral periapical radiograph of the maxillary central incisor region and a maxillary occlusal radiograph was carried out to detect the presence of odontome(compound) and any other radiographical deformity. Patient was in the mixed dentition stage with a U-shaped maxillary arch with Class I molar relationship on both sides. Moyer's mixed dentition space analysis was carried out and showed that there was enough space for eruption and alignment of all permanent teeth. Based on the intraoral and radiographic examination (both IOPAR and maxillary occlusal radiograph showing the presence of odontome) it was decided to correct the midline diastema and rotation of the maxillary left lateral incisor with interceptive orthodontics using 2X4 appliance therapy **(Fig.2)**.

Fig.1. PRE-TREATMENT PHOTOGRAPHS

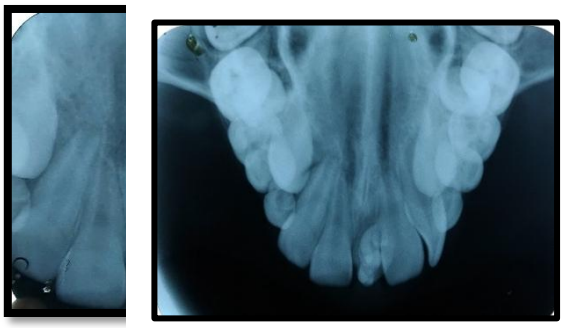

Fig.2. PRE-TREATMENT MAXILLARY OCCLUSAL AND IOPA RADIOGRAPHS

The odontome was retrieved under local anaesthetic with no difficulties, and the patient was seen again after one week. After 1 week, permanent first molars received orthodontic molar bands (stainless steel prefabricated bands) with buccal tubes, and all permanent incisors received edgewise brackets with 0.022" slot (MBT orthodontic bracket system) (2x4 appliance). A 0.012 NiTi arch-wire was placed in the brackets for initial movement and held for 8 weeks, after which a sequential change of wire from 0.014 NiTi arch-wire to 0.016 NiTi arch-wire and finally to 0.018 NiTi arch-wire was done at 6-week intervals. O rings were used to keep the arch-wire in place and changed along with arch wire. **(Fig.3)**.

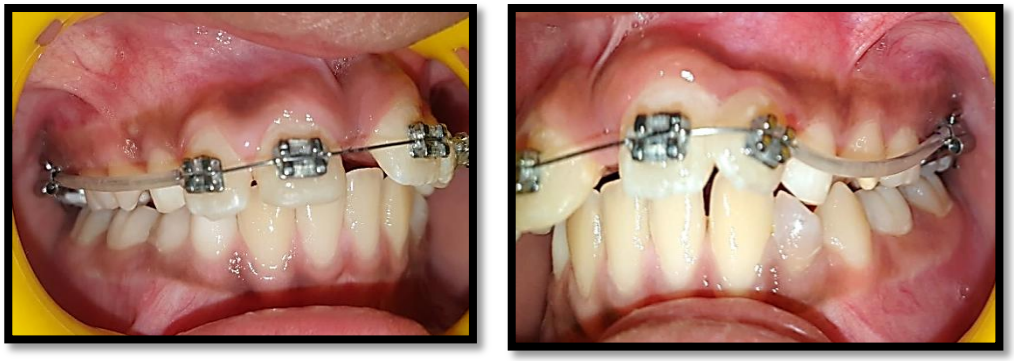

Fig.3. Initial wire placement of 0.012 NiTi wire

Fig. 4. Change of 0.016 NiTi wire with e-chains

Power e-chain was placed for minute space closures along with 0.016 NiTi arch wire **(Fig. 4)**. Finally, 0.019/0.025 SS wire was placed at consolidation phase for 1 month. The incisors were appropriately aligned at the end of 7 months, with the closure of the midline diastema and rectification of the rotated maxillary left lateral incisor. The brackets were removed once all of the teeth were in normal alignment, and a lingual bonded retainer was implanted on the four anterior teeth to avoid recurrence. The patient is kept on follow-up for 3 months and reviewed regularly **(Fig.5)**.

Fig. 5. After debonding

3. DISCUSSION

Malocclusion or malposition of teeth if left untreated may lead to complications in the developing dentition which may be detrimental either to the functions or aesthetics. Our job as paediatric dentists is to reduce the impact of malocclusion on the developing dentition and make the transition to orthodontists as seamless as possible. Orthodontists and pediatric dentists need to work together to streamline what is possible to achieve. American Academy of Orthodontics in 1969 defined interceptive orthodontics (IO) as, “That phase of the science and art of orthodontics employed to recognize and eliminate potential irregularities and malpositions in the developing dentofacial complex”. Because of the amount of growth and development that happens during adolescence, the bulk of interventive orthodontic treatment is performed in the mixed dentition. Cross bites, midline diastemas, malocclusion caused by oral habits, crowding, scissor-bites, space loss, etc. are among the malocclusions that would benefit from IO treatment.

Supernumerary teeth can range in appearance from a basic odontoma to a conical or tuberculate tooth, closely resembling a normal tooth, and are more commonly found in the permanent dentition, with a higher likelihood in the upper arch. Supernumerary teeth can be managed differently based on their type and position. Rotation of the teeth, such as in the case presented here, is a common anomaly we see in our daily practice. When a rotated tooth is combined with neighbouring dental malposition and insufficient arch space, Ulusoy AT et al found that tooth rotation is more difficult to repair. Although rotations can be addressed at various phases of root formation, correcting rotated teeth before root complete improves retention.[3]

In our situation, the compound odontome was interfering with correct premaxillary arch alignment. In our situation, timely removal of supernumerary teeth made it easier for the orthodontic appliance to work properly, resulting in the ideal arch alignment. A detailed clinical examination, identification of the cause, development of a differential diagnosis, creation of a sequential treatment plan, and keeping progress records are all required to manage any condition affecting the developing dentition. Removable appliances have been recommended as a way to treat anterior tooth discrepancies. The disadvantage of detachable appliances, according to Fiona Mckeown et al, is the absence of control over tooth position and single-point contact on teeth, which can lead to unwanted tilting motions. [2] According to Ninou and Stephens et al, the success of detachable appliances is largely dependent on patient compliance, both in terms of wearing and modifying the appliance.[2]

As a result, we chose the 2X4 appliance, which is multifunctional, easy to use, and well accepted by most patients, and allows tooth movements in all three planes of space. This equipment, as opposed to removable appliances, overcomes restrictions such as the patient's lack of participation, retention, and inappropriate activation. The 2X4 appliance has several advantages, including physical movement of teeth, palatally directed torque of

incisor teeth to reduce the likelihood of recurrence, and maximum cosmetic results through efficient and effective incisor de-rotation. This inexpensive and readily installed appliance has a significant practical advantage over previous methods of managing complex mixed dentition disorders, as well as evident psychological benefits. Semifixed appliances (i.e. 2X2, 2X3 appliances) and removable appliances are two further treatment alternatives (split labial bow).

Because permanent teeth are still in the eruptive phase during this stage of dentition, early treatment permits the occlusion to harmonise over time, preventing further difficulties if left untreated. The 2X4 appliance, which is a fixed sectional appliance, is used to cure small malocclusions. Orthodontic treatment at a later date, on the other hand, is usually lengthy and complicated due to significant space loss and neighbouring tooth migration. Gingival recession can cause opposing teeth to become movable or loose. Considering the long-term consequences on the dentition, children with mixed dentition may require orthodontic intervention to correct malocclusion disorders. Because of the greater risk of demineralization associated with a fixed appliance, the patient must also be capable of maintaining a high quality of oral health.

Despite the many advantages of 2x4 appliances, there are also some drawbacks that need to be considered such as

- Cannot correct skeletal malocclusion
- Unsuitable for primary teeth
- Limited anchorage which limits the kind of tooth movement that can be taken up by this method.
- Need of retention till the eruption of permanent teeth.

The charm of this IO procedure is that it helps improve function and esthetics reducing the potential for subsequent treatment and remaining relatively stable once the appliance is removed.

4. CONCLUSION

Parental involvement and the dentist are key components of achieving a successful orthodontic treatment outcome. Early detection and diagnosis of malocclusions can improve treatment outcomes by stabilizing the process. A growing child just catching on to their appearance, who may be becoming more aware of their appearance, will find that this simple, easy-to-use equipment has a considerable advantage over the usual method of addressing mixed dentition issues.

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COMPETING INTERESTS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript

CONSENT

The patient parents signed informed consents, and kept in the records of departmental hospital**.**

REFERENCES

1. Soni Shivani, Bafna Yash, Choksi Krunal, Patel Jaimin & Kotadiya Javnika. (2019). Early Orthodontics Interception in Mixed Dentition Using 2x4 Appliance: A Series of 3 Case Report. JMSCR Volume 07 Issue 01 January 2019.

2. Dr. Parikrama J. Solanki, Dr. Shantanu R. Choudhari, Dr. Chirag M. Vaghela and Dr. Sandip I. Saxena. 2017. "Use of Two by Four Appliance: A Treatment Modality for the Correction of Malaligned Maxillary Anterior Teeth during Mixed Dentition Period.", International Journal of Development Research, 7, (12)

3. Lopamoodra Das, Arpita Sarkar, D hrubojyoti Banerjee, Anwesha Adak, Subrata Saha and Subir Sarkar. 2020. "Catch them young: early interception of malocclusion in mixed dentition period using 2x4 appliance", International Journal of Current Research, 12, (02), 10247-10250.

4. Rohilla M, Bodh M, Kumar A, Namdev R. Early Interception Using 2x4 Appliance: A Case Series. International Journal of Advances in Case Reports, 4(7), 2017, 226-229.

5. Rai, A., Koirala, B., Dali, M., & Shrestha, S. (2020). Earlier the Better: Interceptive Orthodontics to Correct Various Forms of Malocclusion in a Nine-year-old Boy. Orthodontic Journal of Nepal, 10(1), 83–87.

6. Proffit WR, Fields Jr HW, Sarver DM. Contemporary orthodontics. Elsevier Health Sciences; 2006 Dec 8.

7. Fiona McKeown H, Sandlerd J. The two by four appliance: a versatile appliance. Dental Update. 2001 Dec 2;28(10):496-500.

8. Sockalingam SNMP, Khan KAM, Kuppusamy E. Interceptive Correction of Anterior Crossbite Using Short-Span Wire-Fixed Orthodontic Appliance: A Report of Three Cases. Case Rep Dent. 2018 Apr 29; 2018:4323945.

9. S. Nagarajan M. P. Sockalingam, Ahmad Shuhud Irfani Zakaria, Khairil Aznan Mohamed Khan, Fayyadhah Mohd Azmi, Nurhidayah Muhd Noor, "Simple Orthodontic Correction of Rotated Malpositioned Teeth Using Sectional Wire and Orthodontic

Appliances in Mixed-Dentition: A Report of Two Cases", Case Reports in Dentistry, vol. 2020, Article ID 6972196, 5 pages, 2020.

ABBREVIATIONS

IOPAR: Intra Oral Peri Apical Radiograph
NiTi: Nickel Titanium
SS: Stainless Steel
AAO: American Academy of Orthodontics
IO: Interceptive Orthodontics