

Original Research

Received 08 June 2026

Revised 25 July 2026

Accepted 09 August 2026

Natural Resources for Human Health 2026, Vol. 6 (14s): 791–800

KEYWORDS:

Anterior crossbite, Mixed dentition, Interceptive orthodontics, Early correction, Removable and fixed appliances, Hawley appliance, 2×4 appliance, Malocclusion management

Correction of Anterior Crossbite in Mixed Dentition- A Case Series

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ABSTRACT: Anterior crossbite is a common developing malocclusion in mixed dentition that may result in abnormal occlusal function, tooth wear, periodontal complications, and altered mandibular function if left untreated. Early interceptive correction can restore normal incisor relationships and reduce the complexity of subsequent orthodontic treatment. This case series presents five mixed-dentition patients with dental anterior crossbite managed using different interceptive approaches. Treatment modalities included a Hawley appliance with Z-spring and posterior bite plane, 2 × 4 appliance, anterior sectional twin-bracket appliance, modified 2 × 2 utility arch, and an Essix appliance. Treatment selection was individualized according to the number of teeth involved, eruption status, available arch space, and anticipated patient cooperation. All patients demonstrated adequate space for correction based on mixed-dentition analysis. Thus, We have found that, early diagnosis and individualized appliance selection can provide effective correction of anterior crossbite during mixed dentition. Both removable and limited fixed appliances demonstrated satisfactory clinical outcomes when appropriately selected and monitored.

INTRODUCTION

Crossbite is more than just a misaligned bite; it is an early signal of disrupted jaw harmony, guiding clinicians toward proactive, growth-friendly care. Whereas Graber defined crossbite as a condition in which one or more teeth may be abnormally malposed buccal or lingually or labially with reference to opposing teeth, which was further classified as anterior, posterior, single-tooth, or segmental crossbite, which can arise from a variety of underlying causes which ranges from dental discrepancies to skeletal disharmony or functional shifts, often occurring individually or in combination. Beyond genetic influences, contributing factors

may include prolonged oral habits such as thumb sucking, as well as breathing difficulties linked to enlarged adenoids or tonsils, which can alter normal jaw development.

Preventive and interceptive orthodontic treatments are carried out during the primary and mixed dentitions to resolve or alleviate diverse early occlusal abnormalities in children and to allow normal skeletal pattern development in the next years (Rohilla et al., 2017). Although this topic has long sparked discussion, several researchers suggest that initiating orthodontic intervention between 6 and 8 years of age may allow clinicians to take advantage of a broader window of near-peak craniofacial growth. While comprehensive fixed-appliance treatment is typically reserved for the permanent dentition, selective early orthodontic measures during the mixed-dentition phase, a crossbite warrants prompt intervention, as addressing it at the earliest indication supports proper growth trajectories and minimizes the risk of more complicated corrections later. The prevalence of anterior crossbite in mixed dentition is a common clinical observation. With a prevalence of 4–5%, it typically manifests in the early stages of mixed dentition (Prakash & Durgesh., 2011) because the tooth is in its active stage of eruption and the root is still forming; therefore, the best age range for correction is immediately after it is diagnosed. If left untreated, anterior crossbite can lead to a range of complications, including abnormal wear of the teeth, periodontal issues, temporomandibular joint (TMJ) disorders, and aesthetic concerns (Ceyhan and Akdik., 2017 ; Medabesh et al., 2023; Anindyanari, et al., 2025 ; Alves et al., 2018).

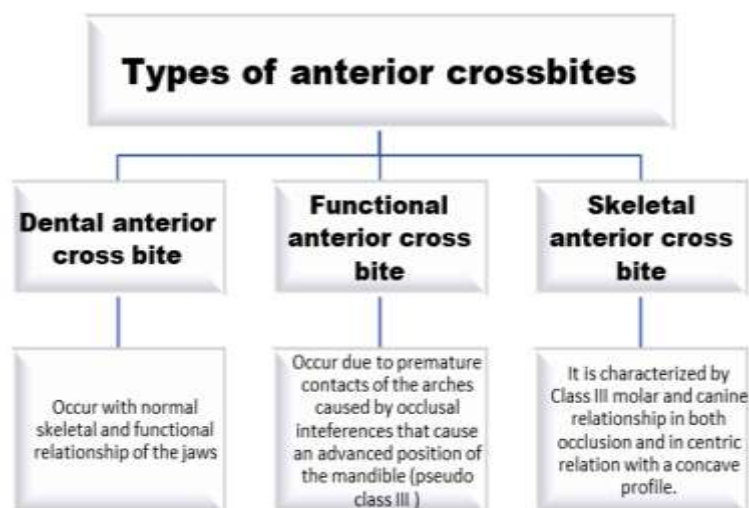


Fig no.1 Classification of Anterior crossbite (Dr. Radiyah ., 2023)

This case series provides a comparative overview of different removable and fixed approaches for anterior crossbite correction, assessing factors such as appliance type, design, activation, treatment duration, patient comfort, gingival response, compliance, and overall cost. The appliances reviewed included the **2 × 4 system**, which offers controlled three-dimensional anterior tooth movement; the modified **2 × 2 utility arch**, known for delivering light continuous forces ideal for early correction; the **twin bracket appliance**, which allows selective movement of individual incisors; the **Essix appliance**, which provides clear and comfortable minor tooth guidance; and the **Z-spring with a posterior bite plane**, which advances maxillary incisors while ensuring posterior disocclusion to aid correction . All patients included in this case series reported to the Department of Pediatric and Preventive Dentistry, Rajasthan Dental College and Hospital, during the mixed dentition period. Consent was obtained from parents/guardians. Alginate impressions were taken of both arches in all patients before starting, and two sets of casts were performed: a working model for practical use and a study model for examination and analysis. Moyer's mixed dentition analysis was performed for each patient, confirming the presence of adequate arch space for anterior crossbite correction without the need for space regaining or extraction. This case series presents the efficacy and clinical factors to consider when using these treatment methods. This case series was written following the CARE guidelines (2013) for reporting case reports.

Case presentation

Case 1- Hawleys appliance with Z spring and posterior bite plane

An eight-year-old patient presented with a chief complaint of a retained deciduous tooth in the upper anterior region. Extraoral examination revealed a bilaterally symmetrical convex facial profile. Intraoral examination revealed a retained deciduous tooth (62), resulting in palatal positioning of the permanent maxillary left lateral incisor (22) which resulted in development of anterior crossbite.

Diagnosis - Retained deciduous tooth in relation to 62 with Angle's Class I malocclusion and anterior crossbite in relation to 22.

Treatment plan – Extraction of the retained deciduous tooth (62) was performed under local anesthesia. A removable orthodontic appliance, a Hawley appliance with a Z-spring and posterior bite plane, was fabricated. Adams clasps and a Z-spring made of 21-gauge circular stainless-steel wire served as retentive components, and stabilization was achieved using a self-curing acrylic resin. The posterior bite plane prevented occlusal contact and raised the bite, whereas the Z-spring was positioned parallel to the palatal surface of 22.

The patient was instructed on insertion and removal of the appliance and advised to wear it consistently, including during sleep, and remove it while eating. The Z-spring was activated weekly for four weeks, followed by two additional weeks of wear for retention, resulting in successful correction of the anterior crossbite.

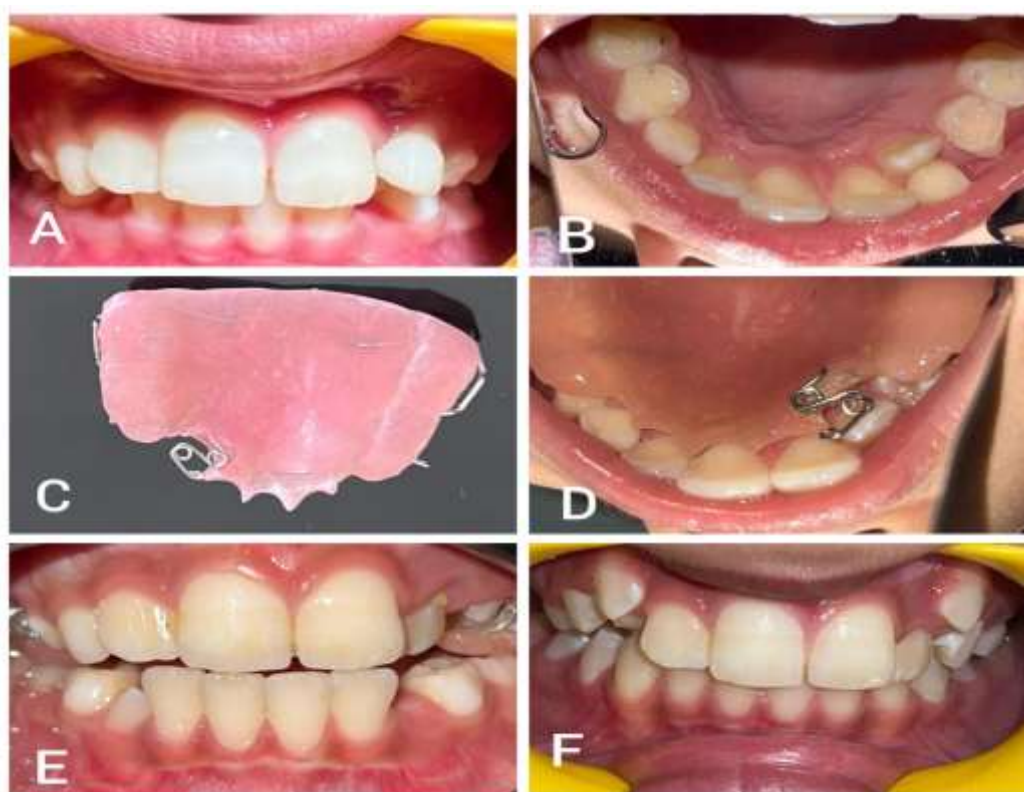


Figure 2 : (A) Pre-treatment anterior crossbite; (B) palatally displaced 22; (C) Hawley's appliance with spring; (D) Appliance in position; (E) Progressive crossbite correction; (F) Post-treatment correction with positive overjet.

Case-2- 2*4 appliance

A 9-year-old female patient presented with a chief complaint of pain in the lower right posterior tooth region for the past 10 days. Extraoral examination revealed a bilaterally symmetrical face with a concave facial profile. Intraoral examination revealed a segmental anterior crossbite with the maxillary incisors positioned palatally. Dental caries were present in relation to 46 and

36. Radiographic examination revealed caries approaching the pulp in relation to 46 and radiolucency involving enamel and dentin in relation to 36.

Diagnosis - Apical periodontitis in relation to 46 and reversible pulpitis in relation to 36, along with a segmental anterior crossbite involving the maxillary incisors.

Treatment plan - Root canal therapy was performed in 46, followed by composite restoration in 36. After parental consultation, orthodontic treatment was initiated using four preadjusted MBT brackets with a 0.022-inch slot bonded to the labial surfaces of 12, 11, 21, and 22, along with molar tubes on 16 and 26. A layer of composite resin was placed on the occlusal surface of the patient's permanent first molar to elevate the bite. Initially, as brackets were bonded only to the permanent incisors, a long span of flexible 0.014-inch round nickel–titanium archwire extended from the molar tubes to the incisors and dangling arch wire created problems, particularly during eating and tooth brushing, as it frequently dislodged from the molar tubes.; therefore, brackets were later bonded to the primary canines to improve anchorage.

Initially, the central incisor was engaged in the wire. The patient was recalled for weekly follow-up, the lateral incisor was also engaged. Within four weeks, the incisors were properly aligned with a noticeable forward overjet. The brackets were then removed, the bite block eliminated, the enamel polished. The patient was reviewed after three months.

Case -3: Anterior sectional twin bracket appliance

A 7-year-old male presented with a chief complaint of food lodgement in the upper left back tooth region for 15 days. Extraoral examination revealed a bilaterally symmetrical face with a concave facial profile. Intraoral examination revealed that the patient was in the mixed dentition stage and the maxillary left central incisor was placed palatally and in crossbite with mandibular incisors. Clinical examination revealed blackish discoloration in relation to 64. On radiographic examination, dental caries was seen in relation to 64, and radiolucency involving the enamel and dentin.



Figure 3: (A) Pre-treatment view showing severe anterior crossbite,(B) Maxillary occlusal view demonstrating palatal displacement of incisors,(C) Sectional fixed appliance with NiTi archwire during correction,(D)Frontal intraoral view during active orthodontic correction.(E) Post-treatment view showing positive overjet and normal alignment.

Diagnosis-Dental caries wrt 64 and single tooth anterior crossbite wrt 21.

Treatment plan- Caries was excavated with a slow-speed round bur and spoon excavator, and GIC restoration was performed wrt 64. Alginate impressions were taken to make study casts for model analysis. Moyer's mixed dentition analysis revealed sufficient space within the dental arch to facilitate tooth repositioning. Based on the patient's dental age, incisor correction was planned using an anterior sectional twin bracket appliance. The bite was elevated by placing a layer of composite on the occlusal surface of permanent molars. Ultrasonic scaling was performed wrt the upper and lower arches.

Two preadjusted MBT brackets with a 0.022-inch slot bonded to the labial aspects of 12, 21, and 0.14" NiTi wire were inserted, and elastic modules were placed to secure the wire in place. The patient was instructed regarding oral hygiene. The patient was recalled every 15 days until the crossbite was corrected. Partial correction was observed at the first follow-up visit, and the wire was switched to 0.18" NiTi. Tooth 21 returned to its normal position at the second follow-up visit at one month. Subsequently, the bite plane was removed, and the brackets were debonded. The labial surfaces of teeth 11 and 21 were polished, and topical fluoride was applied. The patient was kept on follow-up, and there was no evidence of relapse.



Figure 4: (A) Pre-treatment frontal view showing anterior crossbite (B) Maxillary occlusal view showing palatally displaced incisor (C) Fixed orthodontic appliance with active archwire (D) Maxillary occlusal view during active treatment (E) Post-treatment maxillary occlusal view (F) Post-treatment frontal view showing corrected incisor relationship.

Case – 4: Modified 2*2 appliance (Utility arch)

An 8-year-old female patient was reported to the Department of Pediatric and Preventive Dentistry, Rajasthan Dental College and Hospital, with a chief complaint of mobile teeth in the upper left back tooth region. Extraoral examination revealed a bilaterally symmetrical face with a concave facial profile. Intraoral examination revealed grade II mobility of teeth 63, 64, 21, and 22, which were palatally placed, resulting in a severe crossbite. Tooth 32 was tipped lingually, locking tooth 21.

Diagnosis- Grade II mobility irt 63 and 64 and anterior crossbite irt 21 and 22.

Treatment plan-Alginate impressions were taken for the study cast and one with bands on 16 and 26 for the Nance palatal arch space maintainer. Moyer's mixed dentition analysis revealed sufficient space for repositioning. Teeth 63 and 64 were extracted under LA, and postoperative instructions were given. Utility arch was fabricated using 0.16" AJ Wilcock wire irt brackets slots on 21, 22 on the cast. After 7 days, the patient was recalled, and molar bands with buccal tubes and brackets of preadjusted MBT with a 0.22" slot were placed on 16, 26, 21, and 22, respectively. Buccal arch wire sleeves were inserted so that they did not impinge the buccal vestibule mucosa. The bite was raised using composite on the occlusal surface of permanent molars. The wire was cinched back so that it did not come out of the molar tube. Care instructions were given to the patient, and follow-up was scheduled after 7 days; the helix was activated to obtain the desired tipping movement. On the next recall, that is, on the 15th day, the desired result was achieved. The brackets and molar tubes were removed, the labial surface of 21 and 22 were polished, and topical fluoride was applied. The patient was instructed to come for follow-up every 3 months.



Figure 5: (A) Pre-treatment frontal view showing anterior crossbite (B) Pre-treatment maxillary occlusal view showing palatal displacement of the maxillary incisor (C) Frontal view showing partial correction of the anterior crossbite (D) Maxillary occlusal view showing tooth alignment (E) Frontal view with fixed orthodontic appliance and active archwire (F) Maxillary occlusal view during active orthodontic treatment (G) Post-treatment frontal view showing correction of anterior crossbite (H) Post-treatment maxillary occlusal view showing satisfactory alignment.

Case 5- Essix appliance

An 8 year-old male patient was reported to the Department of Pediatric and Preventive Dentistry, RDCH with a chief complaint of unesthetic appearance and delayed eruption in the right front tooth region. Extraoral examination revealed a bilaterally symmetrical face with a concave facial profile. Intraoral examination revealed a single tooth anterior crossbite irt 21, which led to locking growth of the maxillary arch and labial proclination of 31.

Diagnosis -Anterior crossbite irt 21

Treatment plan - Impressions were taken using alginate of the upper and lower casts, and two sets of casts were made, one for study and one for scanning. Moyer's mixed dentition analysis revealed sufficient space for repositioning. The casts were scanned using a 3Shape intraoral scanner, and the scan was designed using Exocad software by the designer. 3 models were made by moving 32- 0.50 mm labially. These model designs were then 3-D printed. On these 3-D printed models, the bite was raised using a composite block. A full arch Essix appliance was then made on the mandibular cast. Patient was instructed to wear it all the time except during meal. Patient was given all the 3 Essix appliance and was instructed to change it in every 10 days to the next one. The patient was advised to wear the last tray for 15 more days for retention. Ultrasonic scaling was performed, followed by fluoride application. The patient was kept on follow-up, and there was no evidence of relapse.

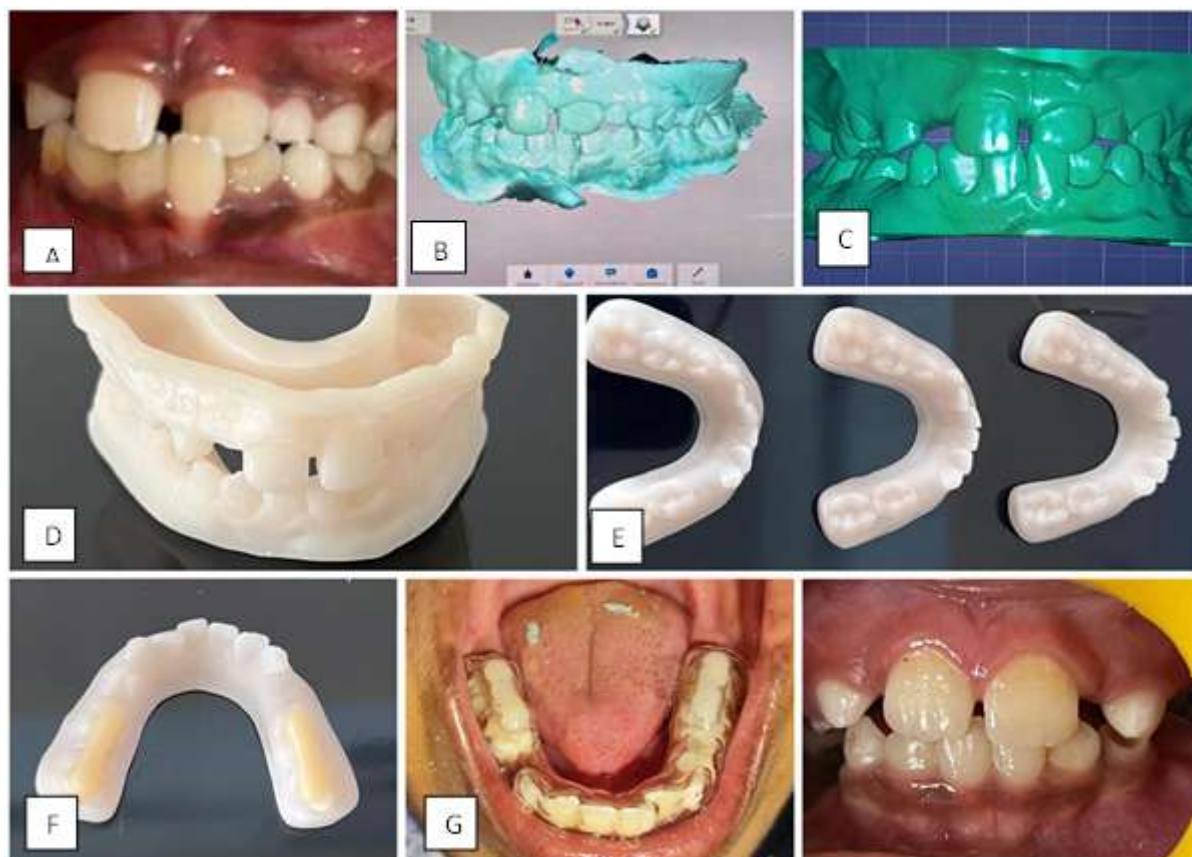


Figure 5: (A) Pre-treatment view showing anterior crossbite wrt 21 (B) Cast scanned by intraoral scanner (C) Exocad designing (D) 3-D printing of cast after designing (E) Modified 3-D printed casts for mandible F: Bite block formed with flowable composite (G) Essix appliance post-fabrication on cast in patient mouth (H) Post-treatment showing correction of anterior crossbite.

DISCUSSION

Early interception of anterior crossbite in mixed dentition is essential to prevent periodontal trauma, abnormal wear, and functional mandibular displacement, with treatment selection guided by eruption stage, teeth involved, compliance, and severity for predictable outcomes (Vishnu., 2024 ; Bayrak and Tunc., 2008). The 2×4 appliance is a commonly used fixed interceptive method offering precise control of incisor inclination and rotation, while modified utility arch mechanics further enhance control, reduce appliance bulk, and improve comfort in younger patients (Kamila et al., 2020 ; Ugolini et al., 2021). The 2×2 appliance also provides three-dimensional control with faster and more predictable correction than removable approaches (Dowsing and Sandler., 2004 ; Prakash and Durgesh., 2011). Removable appliances are effective in cooperative patients using bite planes and springs, though treatment duration is longer (Bindayel., 2012; Heikinheimo and Salmi 1987). Essix appliances are indicated for mild cases requiring limited tipping and alignment (JJ., 1993; Rinchuse., 1997). Tongue-blade therapy is useful for early single-tooth correction but is limited by compliance and force control, while reversed stainless-steel crowns offer a simple cost-effective option (Boyd., 2008). Composite inclined planes, including Catlan's appliance, achieve rapid correction but are contraindicated in skeletal Class III cases. Planas Direct Tracks facilitate functional mandibular repositioning but are less effective in true skeletal discrepancies (Planas and de Salvador., 1994).

Appliance	Hawleys appliance with finger spring and posterior bite plane	2*4 appliance	Anterior sectional twin bracket appliance	Modified 2*2 appliance (utility arch)	Modified Essix appliance
Feature					
Type of appliance	Removable	Fixed	Fixed	Fixed	Removable
Treatment duration	1.5 months	4 weeks	20 days	15 days	1.5 month
Tooth involved	22	11,12,22,21	21	21,22	21
Age	7 years	9 years	8 years	7 years	8 years
Patient compliance*	Partial refusal (2)	Passive consent (5)	Passive consent (5)	Periodic reluctance (4)	Moderate participation (6)
Patient comfort	Least comfortable	Comfortable	Comfortable	Less comfortable	Very comfortable
Cost	Inexpensive	Less expensive	Less expensive	Less expensive	Expensive
Unwanted movements	None	Canines moved labially	None	None	Slight labial inclination of incisors
Components	Hawley appliance and posterior bite plane	Orthodontic brackets, NiTi wire	Orthodontic brackets, NiTi wire	Orthodontic brackets, Cu-NiTi wire , buccal sleeve	Thermoplastic sheets
Activation	Z-spring to be activated once every week	Wire was changed twice	No activation	Helix was activated	No activation
Review and recall	Fortnightly	Every 15 days	Weekly	Fortnightly	Every 20 days

*Clinical rating of compliance scale (POK)

TABLE 1: OVERVIEW OF THE VARIOUS FACTORS INVOLVED IN THE TREATMENT PROVIDED

CONCLUSION

Anterior crossbite in the mixed dentition represents a developmental challenge that warrants timely and individualized intervention. The cases presented demonstrate successful correction can be achieved through a range of treatment modalities when tailored to specific clinical needs. Early interceptive management promotes favorable dentofacial development and may reduce future orthodontic complexity.

DISCLOSURES

Human Subjects: All participants involved in this study provided informed consent, or consent was appropriately waived in accordance with the applicable ethical guidelines.

Conflict of Interest : The authors declare that no financial support or funding was received from any organization for the conduct or publication of this work.

Financial Relationships: The authors report no current financial relationships, nor any within the past three years, with organizations that could potentially have an interest in the outcomes of this study.

Other Relationships: The authors affirm that there are no additional relationships, affiliations, or activities that could be perceived as influencing the content or findings of this work.

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- **Drafting of the manuscript:** Dr. Vartika Jain , Dr. Manisha Jain.
- **Critical review of the manuscript for important intellectual content:** Dr. Vartika Jain , Dr. Manisha Jain, Dr. Tarun Sethi, Dr. Divya Gera.
- **Supervision:** Dr. Tarun Sethi, Dr. Divya Gera

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