

From Impaction To Eruption: Multidisciplinary Management of A Maxillary Central Incisor Associated With A Mesiodens

Dr. K. Mounika, MDS^{1*}, Dr. Ambili Ayilliath, MDS², Dr. Mridhul. M. U, MDS³, Dr. Sreeyutha. M. B, MDS⁴

¹ 3rd year post graduate, Department of pediatric and preventive dentistry, Mahe Institute of Dental Sciences and Hospital, Email id: mouni94kumar@gmail.com

² Professor and head of Department of Pediatric and preventive dentistry, Mahe Institute of Dental Sciences and Hospital, Email id: dr_ayilliath@yahoo.com

³ Reader Department of Pediatric and preventive dentistry, Mahe Institute of Dental Sciences and Hospital, Email id: dr.mridhul@mahedentalcollege.org

⁴ 2nd year post graduate, Department of Pediatric and preventive dentistry, Mahe Institute Of Dental Sciences and Hospital, Email: sreesreyansh1995@gmail.com

Correspondent Author: Dr. K. Mounika, MDS: Email id: mouni94kumar@gmail.com

Abstract

The impaction of the permanent maxillary central incisor along with the presence of mesiodens can affect the process of eruption, appearance of teeth, and occlusion. This case report describes the step-by-step management of the impacted permanent maxillary left central incisor 21 with the mesiodens in the palatal region in an 8-year-old child. On clinical examination, it was seen that there was retention of the primary maxillary left central incisor 61 and lack of eruption of tooth 21, which was further confirmed on panoramic and cone beam computed tomography scan. Retained tooth 61 was extracted, and the mesiodens was surgically removed, with the observation for spontaneous eruption. Since spontaneous eruption did not occur, orthodontic space was created with the help of Hawley's appliance with active finger spring. Subsequent surgical exposure of tooth 21 was done, and a lingual button along with an elastomeric elastic chain was utilized to apply orthodontic traction through a closed-eruption technique. Once enough eruption was achieved, a 2x4 fixed orthodontic appliance was inserted into the mouth. The teeth alignment was started using a 0.012-inch nickel–titanium archwire, then 0.014-inch NiTi was used after 4 weeks, and finally 0.016-inch NiTi was applied after 8 weeks. A 0.016-inch stainless steel archwire was inserted around 12 weeks for stabilization and used for 4-6 weeks prior to appliance removal. The treatment led to eruption and alignment of tooth 21 in the dental arch with acceptable esthetics, occlusal contact, and intact periodontal structures. No pulp or periodontal issues were noticed on follow-up examination. In summary, it was concluded that early diagnosis, 3D radiographic evaluation, stepwise management, and coordination between pediatric dentistry, oral surgery, and orthodontics proved to be an efficient strategy for mesiodens-related maxillary incisors impaction.

Keywords: Mesiodens; impacted maxillary central incisor; delayed eruption; CBCT; orthodontic traction; surgical exposure; closed-eruption technique; multidisciplinary management.

1. Introduction

The permanent maxillary central incisors serve an essential role in esthetics, phonetics, mastication, and occlusion. Delay in the eruption or impaction of these teeth will affect the functions mentioned above along with the esthetic appearance of the face and psychological health of the child. Among various local factors that cause delayed eruption, the supernumerary tooth is the most significant one, and the most common type among the latter ones is mesiodens, which is the reason for delay or impaction of the permanent maxillary central incisors. Mesiodens is known to be a supernumerary tooth that appears between the two maxillary central incisors[1]. The prevalence of mesiodens is 0.15%–3.8%, with the male-to-female ratio being higher.

Impacted mesiodens acts as an obstacle to the eruptive pathway of the permanent maxillary central incisor[2]. This problem can cause delayed eruption, displaced eruption, rotated eruption, diastema, dilaceration of roots, or even the development of a cyst. Early diagnosis and treatment of the condition are crucial to avoid such problems[3]. Clinical examinations should be accompanied by imaging studies to identify the position and orientation of the supernumerary tooth in relation to the unerupted permanent incisor[4]. Cone-beam computed tomography (CBCT) is highly important in providing a three-dimensional image and helping to understand the relation of the affected teeth with other anatomical structures.

Management of impacted maxillary central incisors in conjunction with a mesiodens involves many considerations including the age of the patient, state of root formation, positioning and angulation of the impacted tooth, available space in the arch, and eruption potential of the permanent incisor[5]. Extraction of the mesiodens at the right time will allow the spontaneous eruption of the incisor as long as there is enough potential for eruption. However, spontaneous eruption may not always take place[6]. In cases where the tooth does not erupt even after the obstruction is removed, surgical exposure and orthodontic traction will allow eruption of the impacted incisor. This means that the choice and sequence of both surgical and orthodontic treatments are very crucial[7].

What makes this case novel is the use of multiple and inter-disciplinary approaches to manage a patient with impacted maxillary left central permanent incisor in the presence of a palatally displaced mesiodens. In the

management of this case, there was a sequence of treatments starting with the extraction of the retained primary maxillary left central incisor and the excision of the mesiodens, followed by spontaneous eruption observation[8]. With no spontaneous eruption, orthodontic space making procedure was done through the use of a Hawley's appliance with active finger spring. The next procedure done was surgical exposure of the impacted permanent incisor, placement of a lingual button, and orthodontic traction using elastic chain with closed-eruption technique[9]. Finally, after adequate eruption, a 2×4 fixed orthodontic appliance was placed to align and level the teeth. This sequence of procedures from pediatric dentistry, surgery, and orthodontics make this case unique.

The main goal of the present case study is the presentation of the diagnostic and comprehensive treatment of an impacted permanent left maxillary central incisor in association with an impacted mesiodens in an 8 -year-old patient. The treatment goals included removal of the obstruction provided by the mesiodens, extraction of the retained primary incisor, creation of the space for the impacted tooth, eruption of the latter tooth as well as achieving its proper positioning and alignment within the dental arch, when spontaneous eruption was impossible.

The major contribution from this case report lies in the demonstration of the practical step-by-step approach for the management of impacted maxillary central incisor caused by the presence of mesiodens. The importance of three-dimensional radiographic localization through CBCT; the timing of surgical extraction of the obstructive supernumerary tooth; spontaneous eruption evaluation; orthodontically controlled space management; surgical exposure and orthodontic traction; and finally, aligning with fixed appliances are all emphasized here. The successful use of Hawley's removable appliance, lingual button and elastic chain for guided eruption and 2×4 fixed appliance for aligning demonstrates the integration of various treatment approaches according to the evolving clinical needs of the impacted tooth.

It is therefore evident from the current case the need for early detection and diagnosis, proper treatment planning, and coordinated work of pediatric dentistry, oral surgery, and orthodontics in the treatment of impacted maxillary permanent central incisors with mesiodens. A well-coordinated approach will help the impacted tooth erupt and align in the right position, thereby leading to good cosmetic and functional results.

2. Literature Review

2.1 Mesiodens and Supernumerary Teeth

Supernumerary teeth refer to those teeth which are more than the number of normal teeth present in an individual's mouth. These extra teeth are present either in the primary or in the permanent dentition. Mesiodens is the most common type of supernumerary teeth and are normally present in the upper front midline of an individual's mouth, where they lie in between the two permanent maxillary central incisors[10]. These teeth have a typical shape; they may be conical, tuberculate, supplemental, or even molariform and may be erupted, unerupted, or impacted.

2.2 Prevalence and Clinical Characteristics

Prevalence rates of mesiodens are quite variable among populations, with values usually between 0.15% to 3.8% being reported. More mesiodens have been observed in male patients than in female patients. Asymptomatic mesiodens can be detected through normal radiographic evaluation; however, when they are in association with unerupted permanent incisors, their clinical significance is increased[11]. The location, alignment, shape, and level of eruption of the extra tooth determine the level of clinical importance.

2.3 Mesiodens-Associated Impaction of Maxillary Central Incisors

The impaction and delayed eruption of the maxillary central permanent incisor tooth is one of the key clinical issues in the mixed dentition stage. The existence of impacted mesiodens may serve as a physical impediment in the way of eruption of the permanent incisor tooth. Based on its location and positioning, the supernumerary tooth may lead to problems such as delayed eruption, displacement, rotation, spacing, or even improper positioning of the permanent incisor[12]. More serious cases may have additional issues related to root dilaceration. Therefore, the retention of the primary incisor in conjunction with delayed eruption of the permanent tooth requires the search for a supernumerary tooth.

2.4 Diagnosis and Radiographic Evaluation

Accurate diagnosis and localization of an impacted tooth along with its mesiodens are very important aspects in the process of planning of the treatment. The clinical examination gives valuable information about the retention of deciduous teeth, absence of permanent teeth, asymmetry, and irregularities in the eruption sequence[13]. The conventional radiological methods, such as panoramic and intraoral radiographs, are helpful in finding out the existence of supernumerary teeth and their rough localization. Yet, the overlapping of the anatomical

structures may prevent precise localization of the teeth. CBCT helps in obtaining the three-dimensional view of the impacted tooth, mesiodens, adjacent bone, tooth roots, and other anatomical structures.

2.5 Treatment Planning and Timing of Intervention

The treatment strategy for an impaction associated with mesiodens should be personalized, depending on the age of the patient, the dental development stage, position and angulation of the impacted tooth, root development, arch space availability, and possibility of spontaneous eruption[14]. Prompt treatment can prevent complications and help the permanent incisor erupt spontaneously, after the removal of the blocking supernumerary tooth. In some cases, extraction of the mesiodens only may be enough, if the permanent tooth has eruptive potential.

2.6 Spontaneous Eruption Following Mesiodens Removal

Extraction of mesiodens that obstructs can lead to the opening up of the path of eruption of the permanent maxillary central incisors leading to spontaneous eruption. However, the chances of spontaneous eruption depend on certain other conditions such as age, extent of the development of the root, position of the impacted tooth, angulation, available space and time of impaction[15]. Spontaneous eruption is always preferred since it can avoid extra orthodontic or surgical interventions in the patients. Nevertheless, spontaneous eruption is not always possible in all cases and hence in the absence of enough eruptive movement, orthodontic intervention may be necessary.

2.7 Orthodontic Space Creation

Appropriate space in the dental arch is a necessary condition for the proper eruption and alignment of an impacted permanent central incisor. The lack of space might prevent the tooth from erupting in its proper position even after the removal of the interfering mesiodens. Removable orthodontic appliances like Hawley's appliance could be used to create space and retain it in the anterior region[16]. Active finger spring might give controlled movement to adjacent teeth and facilitate a proper pathway for the impacted tooth.

2.8 Surgical Exposure and Orthodontic Traction

In cases where the eruption is not spontaneous, surgical exposure along with orthodontic traction has been widely recommended for the positioning of the impacted permanent incisor in the dental arch. In the process of surgical exposure, an orthodontic appliance like the lingual button may be attached to the crown during the process[17]. The elastic chain can then be employed in order to provide controlled orthodontic forces to move the tooth into place in the dental arch. Light and controlled forces are crucial for safe movement and avoiding complications.

2.9 Closed-Eruption Technique and Periodontal Considerations

The surgical approach employed for exposure of impacted incisors may affect the final periodontal and esthetic result. Closed eruption method entails positioning of the flap after attaching an orthodontic attachment, resulting in eruption of the tooth slowly through the tissues by use of orthodontics[18]. This procedure may present a good gingival tissue structure if the right approach is selected. It is important to maintain the integrity of the surrounding structures and control the orthodontic force.

2.10 Fixed Orthodontic Alignment

After proper eruption of the impacted tooth is accomplished, fixed orthodontic appliances can be placed to facilitate proper alignment and leveling. The 2x4 appliance is especially helpful for proper alignment of maxillary anterior teeth using proper anchorage from posterior teeth. The use of sequential NiTi archwires may be helpful in proper alignment and then gradually increasing the archwire size with the progress of movement of tooth toward its final position[19]. After achieving proper alignment, the stainless steel archwire may be employed to facilitate increased stability prior to removal of appliance. In this way, the previously impacted tooth can be incorporated into dental arch.

2.11 Multidisciplinary Management

In order to treat an impacted permanent maxillary central incisor that is accompanied by mesiodens, coordination among pediatric dentistry, oral surgery, and orthodontics is usually needed. Early identification and treatment can be achieved through pediatric dental evaluation. Surgery must be done to eliminate the mesiodens that blocks the impacted permanent tooth. Space creation, controlled traction, and proper alignment of the teeth can be accomplished through orthodontics[20]. The combination of these procedures will help in avoiding undue delays in treatment and increase the chances for favorable outcome.

2.12 Research Gap

Despite the extensive knowledge that is present in literature concerning the prevalence, diagnosis, complications, and individual treatment methods of mesiodens and impacted maxillary central incisors, there is relatively less information about the entire process of pediatric dentistry, surgery, and orthodontics in one treatment pathway[21]. Available literature mostly concentrates on either the eruption of teeth after removing mesiodens or surgically exposing and orthodontically aligning the teeth but rarely does it deal with the process

of going from obstruction removal and observation to space creation, eruption guidance, and orthodontic alignment.

In addition, little information can be found about a properly structured protocol including the extraction of primary teeth, mesiodens removal, observation for spontaneous eruption, space creation using Hawley's appliances, surgical exposure with lingual button and elastic chain, managing closed eruption, and finally, 2x4 fixed appliance treatment with sequential NiTi and stainless steel archwires[22]. The importance of these various stages lies in the fact that treatment protocols might have to be changed depending on the reaction of the tooth being impacted after obstruction removal.

The present case study bridges this gap in the literature by describing the step-by-step treatment approach to the impacted permanent maxillary left central incisor associated with a mesiodens in an 8-year-old child. The case study highlights how progressive modification can be done in treatment based on the response obtained, from mechanical elimination of the obstruction to spontaneous eruption, orthodontic space generation, and surgical-orthodontic traction to the alignment of the tooth using a fixed orthodontic appliance.

3. Problem Statement

The eruption or impaction of the permanent maxillary central incisors in children may hinder the dental development, aesthetics, phonetics, and proper functioning. The presence of the mesiodens could be a mechanical blockage that could cause retention of the primary tooth and also displace the permanent tooth. This could lead to failure of eruption even after the removal of the obstruction[23]. Managing this condition is not an easy task since it involves a proper diagnosis in three dimensions, proper timing of surgery, creation of adequate space and orthodontic traction to achieve eruption and positioning of the permanent maxillary central incisor[24]. For this reason, there is a clinical need to sequence and integrate the following treatments which include; extraction of the retained primary tooth and mesiodens, evaluation of spontaneous eruption, orthodontic space creation, surgical exposure with guided traction and finally fixed orthodontic alignment.

4. Methodology

An 8-year-old individual having retained primary maxillary left central incisor 61 and an impacted permanent maxillary left central incisor 21 along with the presence of mesiodens in this region was clinically examined. The position of the impacted tooth 21 and the mesiodens was evaluated using panoramic X-ray and CBCT. Retained primary tooth 61 was extracted, and after that, mesiodens was surgically removed. The child was followed up from time to time to check for the spontaneous eruption of the tooth 21. Since no significant spontaneous eruption occurred, the Hawley's appliance along with an active finger spring was utilized to create adequate space. Subsequently, the impacted tooth 21 was surgically exposed and lingual button with an elastic chain was bonded to apply the traction force on the tooth using closed eruption technique. After adequate eruption, a 2x4 fixed appliance with NiTi and Stainless Steel wires was utilized for alignment and leveling of teeth.

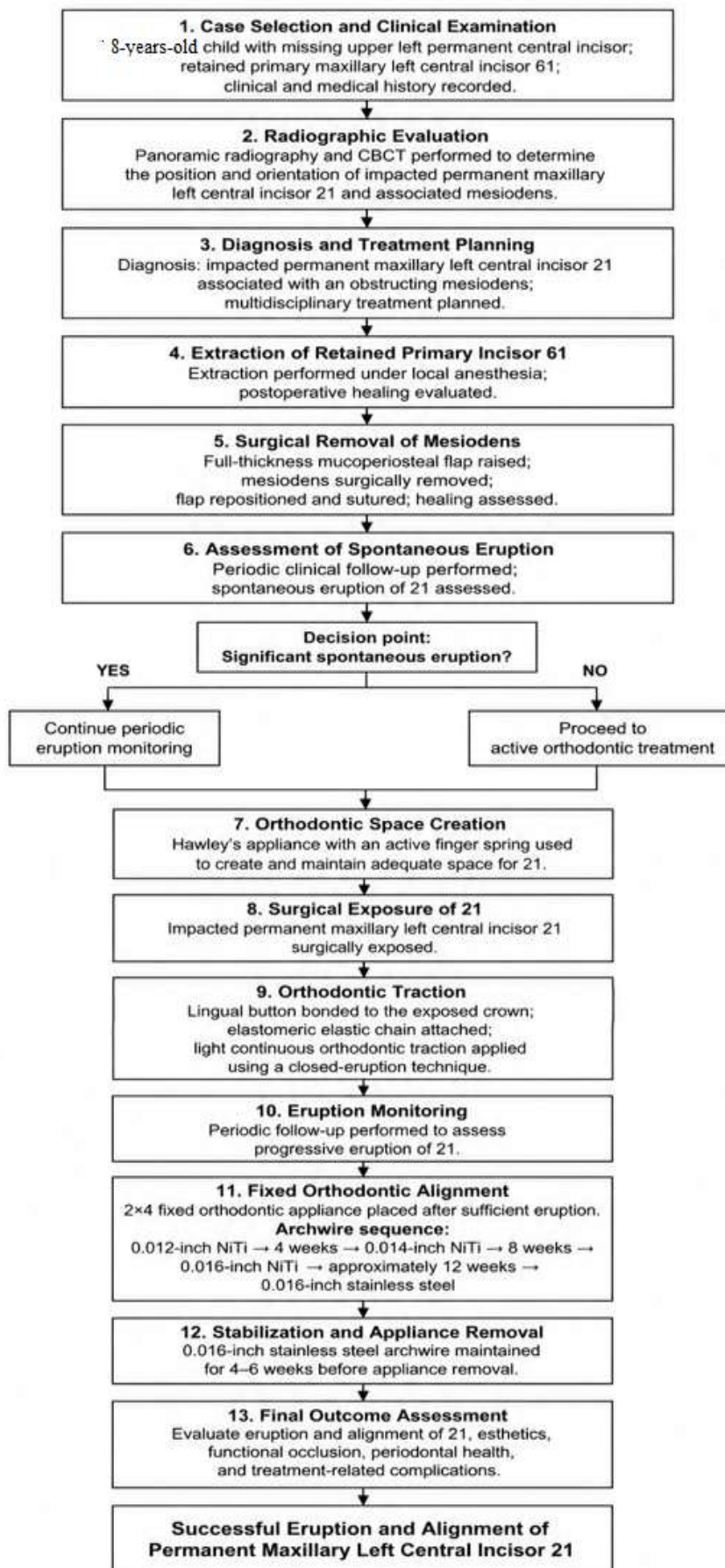


Figure 1: Proposed Methodology

Figure 1 illustrates the proposed methodology to be applied in the multidisciplinary and sequential management of the permanent maxillary left central incisor with mesiodens. The steps include evaluation by both clinical and radiographic examinations, removal of the retained primary tooth, and surgery for removal of the mesiodens. This is followed by spontaneous eruption, space creation using orthodontics, surgery for exposure, and orthodontic traction.

4.1 Study Design and Case Selection

This study is carried out as a clinical case study of the treatment of an impacted maxillary left central incisor associated with a palatal mesiodens in an 8-year-old patient. This case was treated by means of a multidisciplinary approach with the help of pediatric dentistry, surgery, and orthodontics. The treatment was customized depending on the clinical presentation, radiographic position of the teeth, the space available for eruption, and the response to the treatment.

4.2 Clinical Examination

The patient presented with a complaint of the absence of a permanent upper left tooth in the frontal region. The medical and family history of the patient were taken, and found to be non-contributory. There was no history of trauma in the anterior maxilla region. The extraoral examination did not reveal any facial asymmetry. On the intraoral examination, there was retention of the primary maxillary left central incisor (61), while the permanent maxillary left central incisor (21) was non-erupted.

4.3 Radiographic Evaluation

Radiographic evaluation was done using orthopantomograph (OPG) and cone beam computerized tomography (CBCT). OPG revealed the presence of retained primary maxillary left central incisor (61), impacted permanent maxillary left central incisor (21), and mesiodens. CBCT revealed the three-dimensional image of the impacted teeth and their association with the surrounding structures. It was noted that mesiodens was positioned palatally, lying above the impacted permanent central incisor, thereby preventing its eruption path. There was adequate bony support without any pathology or root resorption of the adjacent teeth.

4.4 Diagnosis and Treatment Planning

The diagnosis of impacted permanent left central incisor of maxilla as a result of impacted mesiodens was made in view of the clinical and radiographic findings. Treatment planning was done and it included the following steps: extraction of the retained deciduous tooth, extraction of the mesiodens, monitoring spontaneous eruption, orthodontic spacing, surgical exposure and orthodontic traction of the impacted tooth, and finally orthodontic realignment. Consent from the parent was taken prior to treatment.

4.5 Extraction of the Retained Primary Tooth

The retained primary maxillary left central incisor tooth number (61) was extracted using local anesthetic. The tooth was removed without any problems, and the extraction socket was given enough time to heal properly before the mesiodens was removed.

4.6 Surgical Removal of the Mesiodens

After successful healing, the impacted mesiodens was successfully extracted through surgery after application of local anesthetic. A full thickness mucoperiosteal flap was elevated to ensure proper surgical access. The extraction of the mesiodens was performed carefully without damage to the bone or any other nearby structure. The surgical area was properly irrigated, the flap was replaced and sutured.

4.7 Evaluation of Spontaneous Eruption

The impacted maxillary left central incisor tooth was monitored for its spontaneous eruption following the extraction of the mesiodens. However, there were no movements towards the eruption of the tooth. Hence, orthodontic treatment was done in order to create enough space and erupt the impacted tooth.

4.8 Orthodontic Space Creation

Hawley's appliance fitted with an active finger spring was employed to generate and hold the right amount of space in the upper anterior segment of the mouth. This was done until there was enough space generated to erupt the impacted permanent left maxillary central incisor. This phase was aimed at establishing a good path for eruption before surgery.

4.9 Surgical Exposure and Orthodontic Traction

When sufficient space had been created, surgical exposure of the impacted permanent maxillary left central incisor (21) was carried out. Lingual button was bonded on the crown of the tooth, and an elastic chain was placed in connection with the button for orthodontic traction. Flap repositioning was done using a closed-eruption procedure. Periodic follow-up examinations were done, and orthodontic forces were provided by regular activation of the elastic chain. Eventually, eruption of the impacted incisor into the mouth was accomplished.

4.10 Fixed Orthodontic Alignment

Once satisfactory crown exposure was attained, 2x4 fixed appliance orthodontics were carried out on the maxilla for proper alignment and leveling of the teeth. Metal brackets were attached to the facial sides of the four permanent maxillary incisors. Initially, an 0.012-in. round NiTi wire was used in the slots of the brackets before it was extended into the molar tubes bilaterally. After four weeks, a 0.014-in. NiTi wire was used followed by 0.016-in. NiTi wire after eight weeks. After 12 weeks, a 0.016-in. SS wire was used for stabilization purposes.

4.11 Follow-Up and Outcome Assessment

Patient was followed up throughout the treatment process to evaluate the eruption and alignment of the maxillary left central incisor, periodontal status, and overall response to treatment. Eruption and proper alignment of the impacted tooth in the dental arch was successful. On completion of treatment, a good aesthetic and functional occlusion was obtained with periodontally healthy gingival tissues. No symptoms were present, and pulpal or periodontal complications were not encountered.

4.12 Ethical Considerations

The procedure was done after getting consent from the parent or guardian. Treatment of the patient was done through sequential multidisciplinary treatment, where the decisions were made according to the clinical and radiographic presentations and the behavior of the impacted tooth during treatment.

5. Results

5.1 Initial Clinical and Radiographic Findings

An 8-year-old patient attended the Department of Pediatric and Preventive Dentistry with the chief complaint of missing of upper left permanent front tooth. There was nothing contributory in medical and family history; neither had the patient experienced any trauma to the anterior maxillary region. Extra-oral examination revealed absence of any facial asymmetry or any related anomaly. Intra-oral examination revealed presence of retained primary maxillary left central incisor (61) and non-eruption of the permanent maxillary left central incisor (21). Radiographic examination of the unerupted permanent tooth was done initially. OPG revealed presence of retained primary maxillary left central incisor (61), impacted permanent maxillary left central incisor (21) along with mesiodens.



Figure 2: Preoperative panoramic radiograph (OPG) showing a retained primary maxillary left central incisor (61), impacted permanent maxillary left central incisor (21), and an associated mesiodens.

Figure 2 represents the pre-operative panoramic radiograph showing the retention of the primary maxillary left central incisor 61 and non-eruption of the permanent maxillary left central incisor 21. A mesiodens was noted in the anterior region of the maxilla and it contributed to the obstruction of the normal eruption path of 21. The above radiographic findings helped make the clinical diagnosis of the mesiodens related impaction of the permanent maxillary left central incisor.

The CBCT imaging was done to get the three-dimensional details on the position of the impacted tooth. From the CBCT sagittal image it is apparent that there is horizontal impaction of the permanent maxillary left central

incisor (21), which was situated in labial position. The mesiodens that was palatal to the impacted tooth was seen coronally to the impacted incisor. The retained primary maxillary left central incisor (61) was also seen. There was an obstruction of the eruption path of 21 by the mesiodens. Bone support was sufficient.

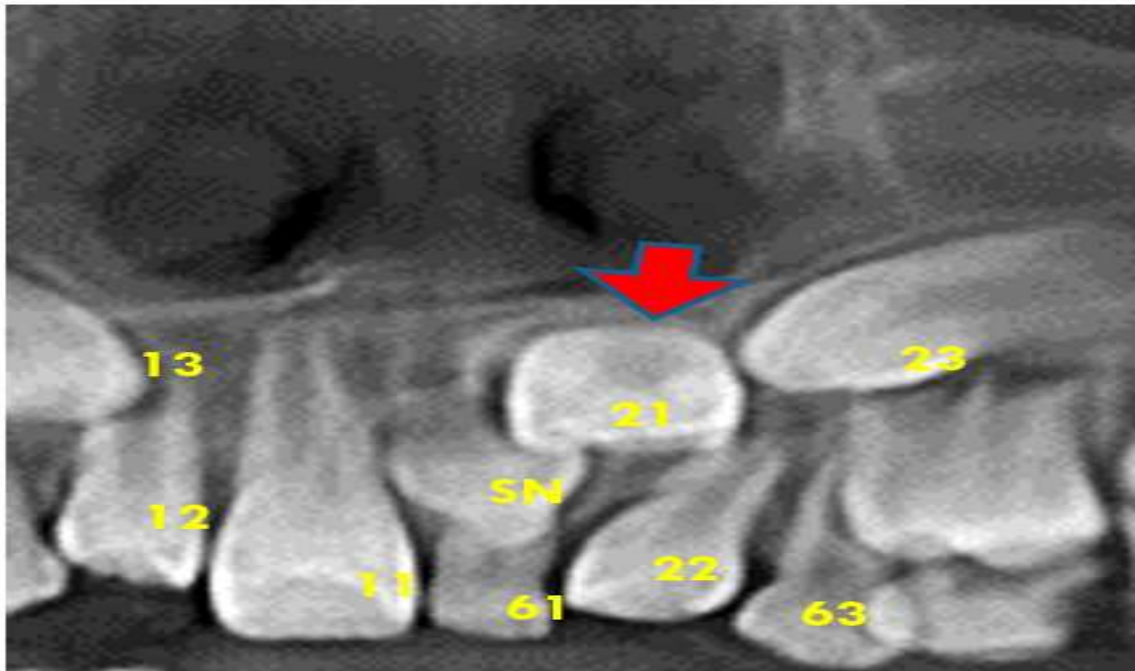


Figure 3: CBCT sagittal section showing a horizontally impacted permanent maxillary left central incisor (21) positioned labially, with a palatally placed developing mesiodens (arrow) and retained primary maxillary left central incisor (61)

This is illustrated in Figure 3 as the sagittal section from the CBCT scan depicting the presence of horizontal impaction of the permanent maxillary left central incisor 21 in a labial orientation. There was a mesiodens developing in the palatal orientation and located near the crown of 21, which contributed to the blocking of the eruption pathway of this tooth. The retained primary maxillary left central incisor 61 was also depicted.

5.2 Extraction of the Retained Primary Incisor

In view of the clinical and radiological features, the retained primary maxillary left central incisor (61) was successfully removed under local anesthesia. The removal procedure went well, and the removal site healed properly.



Figure 4: Clinical view following extraction of the retained primary maxillary left central incisor (61)

Figure 4 illustrates the clinical view after the extraction of the retained primary maxillary left central incisor 61. The tooth was extracted in order to extract the primary tooth and prevent any possible obstruction for the eruption of the permanent maxillary left central incisor 21. There were no apparent problems with the extraction site, which was kept in good condition.

5.3 Surgical Removal of the Mesiodens

After satisfactory healing following the extraction of the 61, removal of the impacted mesiodens under local anesthesia was carried out. A full-thickness mucoperiosteal flap was reflected to facilitate adequate exposure of the mesiodens. Removal of the supernumerary tooth was done by preserving the associated anatomical structures and bone around the supernumerary tooth. The surgical wound was irrigated, the flap repositioned, and sutures placed. Aftercare was done. Healing was satisfactory.

After the removal of the mesiodens, the impacted permanent maxillary left central incisor (21) was regularly observed.

5.4 Assessment of Spontaneous Eruption

Clinical monitoring after extraction of the mesiodens was carried out to evaluate spontaneous eruption of the impacted maxillary left permanent central incisor. Nevertheless, no movement in the eruption of 21 was detected during the follow-up period. Given the poor results with spontaneous eruption, an orthodontic approach was planned to create enough space for eruption of the impacted tooth.

5.5 Orthodontic Space Creation

The use of the Hawley appliance with the active finger spring resulted in the creation and maintenance of adequate space in the upper anterior region. This was done through adjustments made clinically until adequate space was achieved for the impacted maxillary left central incisor.



Figure 5: Surgical exposure of the impacted permanent maxillary left central incisor (21) after extraction of 61 and removal of the mesiodens, with orthodontic traction initiated by placement of a lingual button on 21

This is illustrated in Figure 5 where the exposure of the impacted permanent maxillary left central incisor 21 after the extraction of the retained primary tooth 61 and the mesiodens has been performed. A lingual button has been bonded to the exposed tooth 21 to serve as an anchor for orthodontic traction. This will enable the application of orthodontic force to move 21 to its proper position.

5.6 Surgical Exposure and Orthodontic Traction

Once sufficient space was created, exposure of the impacted permanent maxillary left central incisor (21) was done. Lingual button was placed on the crown of 21 to enable orthodontic traction. Elastomeric e-chain was then fixed to the lingual button in order to apply orthodontic traction.

Closed eruption method was used for repositioning of the flap. Follow up visits were done, and light orthodontic forces were applied with periodic activation of the elastic chain. Movement of the impacted permanent central incisor to the oral cavity was noted.



Figure 6: Elastomeric e-chain attached to the lingual button for orthodontic traction of the impacted permanent maxillary left central incisor (21)

Figure 6, Hawley's appliance was used for orthodontic space management, with a looped labial bow and elastics to facilitate space development and establish an eruption pathway for the impacted permanent left upper central incisor (21).



Figure 7: Hawley's appliance with an incorporated loop in the short labial bow, showing brackets and elastics engaged in the loop and brackets

Figure 7 demonstrates the elastomeric e-chain which was applied to the lingual button on the impacted permanent maxillary left central incisor 21. This e-chain allowed for controlled and constant orthodontic forces to erupt tooth 21 into the mouth and its correct place in the dental arch. It helped achieve progressive eruption and at the same time regulate orthodontic force during routine visits.

5.7 Eruption and Fixed Orthodontic Alignment

The impacted left maxillary permanent central incisor slowly erupted following orthodontic traction. When sufficient crown exposure was accomplished, a 2×4 fixed orthodontic appliance was started for maxillary anterior teeth alignment and leveling.

Metallic brackets were fixed on the labial surfaces of all four maxillary permanent incisors. Initially, 0.012-inch round NiTi archwire was fixed in the bracket slots and was extended bilaterally to the molar tubes. After 4 weeks, the archwire was replaced with a 0.014-inch NiTi archwire. In the eight-week follow-up, a 0.016-inch NiTi archwire was utilized. Approximately 12 weeks later, a 0.016-inch stainless steel archwire was fixed for stabilization of the appliance.



Figure 8: Mid-treatment clinical view showing initiation of 2×4 appliance therapy for alignment and leveling of the maxillary anterior teeth

Figure 8 depicts the intraoral status at midtreatment stage when there is complete eruption of the permanent maxillary left central incisor 21, with the use of 2×4 orthodontic fixed appliance treatment. The appliance was employed in order to attain alignment and leveling of the maxillary anterior dentition. Initially, a light round NiTi archwire was placed to apply mild orthodontic forces on tooth 21.

5.8 Final Clinical Outcome

The eruption of the maxillary left central incisor occurred successfully after the completion of the multidisciplinary treatment sequence. The result obtained in terms of dental aesthetics as well as the function of occlusion is satisfactory. The health of the periodontal tissue remained intact and there was no sign of symptoms on the part of the patient.



Figure 9: Post-treatment clinical view showing successful eruption and alignment of the permanent maxillary left central incisor (21) within the dental arch, with satisfactory esthetics and occlusion

Figure 9 is the post-treatment clinical image which portrays the successful eruption and alignment of the permanent maxillary left central incisor 21. The tooth in question was appropriately aligned to the other anterior maxillary teeth, thus giving improved anterior alignment and esthetics. There was a satisfactory esthetic and occlusal outcome as a result of the multidisciplinary treatment modality applied.

5.9 Summary of Treatment Outcome

The multidisciplinary treatment was done in sequence, which included extraction of the retained primary tooth, removal of the mesiodens obstructing the eruption, observation for spontaneous eruption, making of an orthodontic space by Hawley's appliance, surgical uncovering of the impacted tooth, placement of lingual button and e-chain for orthodontic traction, closed eruption, and finally 2x4 fixed appliance treatment.

This treatment plan led to successful eruption and alignment of the impacted tooth with good aesthetics and functionality as well as healthy periodontal tissues.

Table 1. Clinical and Radiographic Findings

Parameter	Finding
Patient age	8 years
Retained primary tooth	61
Impacted permanent tooth	21
Associated supernumerary tooth	Mesiodens
Mesiodens position	Palatal
Impacted 21	Horizontally positioned and labially located
Eruption obstruction	Present
Bone support	Adequate
Adjacent root resorption	Absent
Pathological changes	Absent
Surrounding tissues	Healthy

The table represents the key clinical and radiographic observations made during the initial examination of the 8-year-old child. These consisted of retention of tooth 61, impaction of 21, and the presence of a mesiodens which was palatally positioned, causing obstruction to the eruption pathway. Good bone support was evident, with no signs of root resorption or pathology.

Table 2. Sequential Treatment and Clinical Outcome

Treatment stage	Intervention	Outcome
1	Extraction of 61	Uneventful healing
2	Surgical removal of mesiodens	Satisfactory healing
3	Observation for spontaneous eruption	No significant eruptive movement
4	Hawley's appliance with active finger spring	Adequate space established
5	Surgical exposure of 21	Crown exposed
6	Lingual button and elastomeric e-chain	Orthodontic traction initiated
7	Closed-eruption technique	Gradual eruption achieved
8	2×4 fixed appliance	Alignment and leveling achieved
9	Final stabilization	Satisfactory final position

Table 2 illustrates the different steps undertaken during the treatment process of the impacted permanent left maxillary central incisor 21 in relation to the mesiodens. The treatment plan began with extraction of tooth 61 and surgery on the mesiodens followed by observation, space creation, surgical exposure, and orthodontics. Closed eruption technique was used to ensure eruption of the tooth into its proper place, and thereafter 2×4 appliance treatment was carried out for alignment and leveling.

Table 3. Orthodontic Archwire Sequence

Treatment period	Archwire	Purpose
Initial stage	0.012-inch round NiTi	Initial alignment and controlled movement
4 weeks	0.014-inch NiTi	Continued alignment and leveling
8 weeks	0.016-inch NiTi	Further alignment and positioning
Approximately 12 weeks	0.016-inch stainless steel	Stabilization
Following stabilization	Appliance maintained for 4–6 weeks	Final stabilization before removal

The archwire sequence applied during the alignment and stabilization of the impacted permanent maxillary left central incisor 21 is given in Table 3 below. The orthodontic treatment started with 0.012-inch round NiTi archwire, followed by 0.014-inch NiTi archwire at 4 weeks and 0.016-inch NiTi archwire at 8 weeks, respectively. After about 12 weeks, a 0.016-inch stainless steel archwire was employed for stabilization. This was retained for further 4-6 weeks for stabilization.

5.10 Discussion

Mesiodens is the most prevalent supernumerary tooth and represents a significant local factor that is involved in causing delayed eruption or impaction of the permanent maxillary central incisors in children. The presence of this supernumerary tooth in the anterior maxillary region may pose an obstruction to the normal eruption path and can cause the retention of the deciduous tooth, malposition or rotation of the permanent tooth, space problems, and poor dental esthetics.

For the current case, the retained primary left central maxillary incisor 61 and unerupted left maxillary central permanent incisor 21 were found on clinical examination. No evidence of trauma involving the maxillary anterior region or other medical or familial history contributed to the classification of a localized developmental eruption disturbance. Imaging findings obtained from panoramic radiography and CBCT were useful in assessing the location and direction of the impacted permanent incisor and the related mesiodens. CBCT in particular was helpful in providing a 3D image of the impacted teeth and how they relate to the surrounding anatomy and helped identify the location of the mesiodens and its obstructing relation to the eruption path of 21.

The initial extraction of the retained primary maxillary left central incisor 61 aimed at removing the retention of the tooth and creating the eruptive pathway. Subsequently, surgical removal of the impacted mesiodens was done. Removal of the supernumerary tooth is essential during the treatment process due to the fact that the mechanical obstacle is removed, and eruption of the impacted tooth may occur spontaneously, especially in presence of favorable conditions for eruption. Nonetheless, spontaneous eruption of the tooth is not always expected because the eruption probability is dependent on such factors as the position of the impacted tooth, its orientation, amount of space, root development, and eruption potential.

In this particular case, repeated control after the removal of the mesiodens showed that there were no signs of spontaneous eruption of 21. Therefore, the orthodontic intervention was essential. Such a step-by-step approach to the problem was justified from the clinical point of view since it provided enough time to observe the natural eruptive potential of the tooth.

Subsequently, sufficient space was created and maintained through the use of Hawley's appliance that included an active finger spring. Sufficient space creation was crucial to guided eruption as the impacted tooth needed enough pathway to erupt into the dental arch. Creation of space also played a role in the creation of good position for the subsequent orthodontic traction. Use of a removable appliance made it possible to create another advantage that enabled oral hygiene to be achieved during the process of space creation.

Once sufficient space had been achieved, surgical exposure of the impacted permanent maxillary left central incisor 21 was done. Bonding of lingual button and use of elastomeric elastic chain to provide orthodontic traction was achieved. Orthodontic traction involved application of light and continuous forces to ensure that the impacted tooth erupts towards the oral environment. Closed eruption technique was used once the orthodontic component had been attached to enable the eruption of tooth through the soft tissue without damaging the existing gingival architecture. This technique is highly applicable in the maxillary anterior region.

With appropriate eruption of 21, a 2x4 fixed orthodontic appliance was installed to ensure proper alignment and leveling of the maxillary anterior teeth. An initial archwire of 0.012 inch diameter round NiTi was installed to effect proper alignment. After 4 weeks, the archwire was changed to a 0.014-inch NiTi archwire to facilitate further alignment and leveling. At the end of 8 weeks, an archwire of 0.016-inch NiTi was installed to assist with establishing the alignment of the erupted incisor. Approximately after 12 weeks, with proper alignment, the NiTi archwire was changed to 0.016-inch stainless steel archwire to provide more rigidity and stability.

The treatment sequence in this particular case clearly illustrates the usefulness of a stepwise treatment process rather than using a single modality. The treatment started with removal of the retained primary teeth and mesiodens, continued with observation for spontaneous eruption, orthodontic space creation, surgical exposure, controlled orthodontic traction and finally the fixed orthodontic alignment. Every step was aimed at a particular objective and made the patient ready for the next phase of treatment. Such stepwise approach made it possible to adjust the treatment process in accordance with the eruptive reaction of the impacted incisor.

The eruption and alignment of 21, good aesthetics and occlusion and healthy periodontium can be considered as a sign of a positive clinical result. There were no complications of pulp or periodontal origin during the follow up. This case also clearly shows the importance of a proper coordination between pediatric dentistry, oral surgery and orthodontics. Pediatric dentistry is important for early diagnosis and treatment of dental development problems, oral surgery is crucial for the safe removal of the obstacle of mesiodens and surgical exposure of the impacted tooth, and orthodontics gives possibilities for controlled space creation, traction and alignment.

In conclusion, the current report emphasizes the significance of early diagnosis, precise three-dimensional localization on radiographs, proper timing of the intervention, and personalized planning of the procedure in managing impaction of permanent maxillary incisors in association with mesiodens. The sequence of procedures included mesiodens removal, evaluation of spontaneous eruption, provision of adequate space, surgical exposure followed by orthodontic traction, and finally treatment in 2x4 fixed appliances. All these procedures resulted in the successful eruption and positioning of the permanent maxillary left central incisor 21.

6. Conclusion and Future Work

Management of impacted permanent maxillary central incisors due to mesiodens involves early diagnosis and localization by means of radiographs, right timing of the treatment procedure and cooperation of all relevant specialists. In the present case, successful management included sequential procedures such as extraction of the retained primary maxillary left central incisor 61, removal of the impacted mesiodens, space opening through orthodontic treatment using a Hawley's appliance with an active finger spring, exposure of the impacted permanent maxillary left central incisor 21 with the application of a lingual button and elastic chain for traction, and finally alignment using a 2x4 fixed orthodontic appliance. The result of successful eruption and alignment of the maxillary left central incisor 21 has demonstrated the clinical importance of the sequential procedure of treatment.

It is important that future studies be carried out using the same protocol on a larger number of patients with mesiodens-related impaction of their permanent maxillary incisors. In addition, prospective studies can be done to investigate the variables involved in eruption of teeth following excision of the mesiodens, such as the position and orientation of the impacted tooth, availability of space, the stage of root formation, and the eruption capability. In addition, further studies can compare the various techniques of exposure and orthodontic traction. It is hoped that such studies will be useful in establishing the best timing for carrying out orthodontic traction.

References

- [1] E. Ayers, D. Kennedy, and C. Wiebe, "Clinical recommendations for management of mesiodens and unerupted permanent maxillary central incisors," *Eur. Arch. Paediatr. Dent.*, vol. 15, no. 6, pp. 421–428, 2014.
- [2] T. Nangia, G. Kalra, and C. Langpoklakpam, "Comprehensive Management of an Impacted Maxillary Central Incisor: A Case Report," *Cureus*, vol. 16, no. 10, 2024.
- [3] P. S. Fleming, P. Scott, N. Heidari, and A. T. DiBiase, "Influence of radiographic position of ectopic canines on the duration of orthodontic treatment," *Angle Orthod.*, vol. 79, no. 3, pp. 442–446, 2009.
- [4] K. A. Russell and M. A. Folwarczna, "Mesiodens-diagnosis and management of a common supernumerary tooth," *J.-Can. Dent. Assoc.*, vol. 69, no. 6, pp. 362–367, 2003.
- [5] D. Di Biase, "Midline supernumeraries and eruption of the maxillary central incisor," *Dent. Pract. Dent. Rec.*, vol. 20, no. 1, pp. 35–40, 1969.
- [6] V. Allareddy, J. Caplin, M. R. Markiewicz, and D. J. Meara, "Orthodontic and surgical considerations for treating impacted teeth," *Oral Maxillofac. Surg. Clin.*, vol. 32, no. 1, pp. 15–26, 2020.
- [7] Y. Maruya et al., "Orthodontic management of severe inversely impacted maxillary central incisors: a case series," *Front. Oral Health*, vol. 5, p. 1474190, 2024.
- [8] M. T. Garvey, H. J. Barry, M. Blake, and others, "Supernumerary teeth-an overview of classification, diagnosis and management," *J.-Can. Dent. Assoc.*, vol. 65, no. 11, pp. 612–616, 1999.
- [9] L. Rajab and M. Hamdan, "Supernumerary teeth: review of the literature and a survey of 152 cases," *Int. J. Paediatr. Dent.*, vol. 12, no. 4, pp. 244–254, 2002.
- [10] G. L. Pedroso, G. L. Puls, A. P. V. de Almeida, F. C. P. Valera, F. L. Romano, and others, "Surgical exposure and orthodontic traction of impacted maxillary central incisor after alteration of eruption sequence: a case report," *Contemp. Pediatr. Dent.*, vol. 6, no. 1, pp. 70–78, 2025.
- [11] A. Becker, *The orthodontic treatment of impacted teeth*. Martin Dunitz, 1998.
- [12] V. K. Kulkarni, S. Reddy, M. Duddu, and D. Reddy, "Multidisciplinary management of multiple maxillary anterior supernumerary teeth: A case report," *Quintessence Int.*, vol. 41, no. 3, p. 191, 2010.
- [13] E. Yetkiner, "Multidisciplinary Management and Long-Term Follow-up of Mesiodens: A Case Report," *J. Clin. Pediatr. Dent.*, 2008.
- [14] H. Pourheidary, "A Rare Case of Bilateral Mesiodens With Dens Invaginatus Obstructing Permanent Incisor Eruption," *Clin. Case Rep.*, vol. 13, no. 11, p. e71452, 2025.
- [15] A. Kupietzky, I. Rotstein, and D. Kischinovsky, "A multidisciplinary approach to the treatment of an intruded maxillary permanent incisor complicated by the presence of two mesiodentes," *Pediatr. Dent.*, vol. 22, no. 6, pp. 499–516, 2000.
- [16] A. C. Orcera, "Evaluation of early diagnosis of mesiodens and impact on dental development—a systematic".
- [17] A. Lo-Casto et al., "Radiological features of double and inverted mesiodens: a systematic review of the literature and presentation of two cases," *Med. Oral Patol. Oral Cir. Bucal*, vol. 30, no. 6, p. e906, 2025.
- [18] B. Rahadian, V. Julia, and L. D. Sulistyani, "Surgical management of mesiodens based on characteristics and complications of the condition: A systematic review," *J. Stomatol.*, vol. 73, no. 5, pp. 261–269, 2020.
- [19] V. Shetty, R. Y. Shetty, D. Mehrotra, A. Usman, and N. Prabhu, "Management of impacted and inverted mesiodens-a report of two cases," *J. Pharm. Bioallied Sci.*, vol. 16, no. Suppl 4, p. S4120, 2024.
- [20] P. Brar, S. Bhandari, and R. K. Verma, "Multidisciplinary Management of Severe Iatrogenic Injury to the Maxillary Incisors Following Mesiodens Extraction," *Cureus*, vol. 18, no. 6, 2026.
- [21] C. Pavuluri and S. Nuvvula, "Management of traumatic injury to maxillary central incisors associated with inverted mesiodens: a case report," *Int. J. Clin. Pediatr. Dent.*, vol. 6, no. 1, p. 30, 2013.
- [22] S. G. Pisevska, M. M. Arsovska, M. P. Gorovska, and E. Chadikovska, "DIFFICULTES IN FIRST INCISORS ERUPTION CAUSED BY MESIODENS," *J. Morphol. Sci.*, vol. 2, no. 1, pp. 29–36, 2019.
- [23] R. Ephraim, N. Dilna, S. Sreedevi, and M. Shubha, "A labially positioned mesiodens and its repositioning as a missing central incisor," *J. Int. Oral Health JIOH*, vol. 6, no. 5, p. 114, 2014.
- [24] H. Kashiwamura et al., "Relationship between developmental stage of the maxillary central incisor tooth germ at the time of mesiodens extraction and spontaneous eruption," *Pediatr. Dent. J.*, vol. 36, no. 2, p. 100374, 2026.