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Management of Unerupted, Inverted and Dilacerated Upper Central Incisor and Restoration with Natural Tooth Pontic and Fiber-Reinforced Resin Bridge

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Abstract

Introduction: This is a case report of the combined orthodontic/surgical and restorative management of a patient with an unerupted central incisor which was inverted, dilacerated with extremely short root. **Method:** A 12-year-old male patient presented with esthetic concerns due to an unerupted upper left central incisor. Examination revealed an Angle's Class I malocclusion, which is complicated by an increased and traumatic overbite, as well as an increased overjet of 6mm, on skeletal base 1. The treatment objectives were set to correct the presenting malocclusion with the possibility of surgical extraction and auto-transplantation of the inverted tooth if adequate root length was observed. The orthodontic treatment was carried out using fixed appliance therapy with Roth 0.022 prescription appliances. **Result:** The orthodontic treatment lasted for 12 months. Upon surgical exposure, the tooth was found dilacerated with an extremely short fused root, thus there was a poor prognosis for auto-transplantation. Consequently, the tooth was extracted and its crown was utilized as a pontic for a long-term provisional bridge, using the fiber-reinforced composite material (Ribbond). This would provide function and esthetics while the patient was being prepared for implant therapy. **Conclusion:** The appearance of the finished result was esthetic and pleasing. The orthodontic treatment objectives were achieved, as the patient and parent were satisfied. Retention was achieved with the resin bridge in combination with upper Hawley's retainer. This is an acceptable method for the treatment of an inverted and dilacerated tooth that has a short root, which was already fused prior to presentation.

Subject Areas

Surgery & Surgical Specialties

Keywords

Inversion, Dilaceration, Central Incisor, Natural Tooth Pontic, Ribbond

1. Introduction

The presence of anterior space in the dentition due to an unerupted permanent central incisor is particularly unaesthetic because the malocclusion is compounded by asymmetry. The affected individual is considered unattractive by peers and this has a possible negative impact on psycho-social well-being and quality of life [1] [2]. The absence of the central incisor also has a negative impact on speech such that the individual is unable to properly articulate labiodental sounds such as "s" and "z" due to the large gap between the teeth leading to a lisp in the speech. [3]

Eruption failure may be due to an obstruction in the path of eruption such as the presence of odontoma or supernumeraries. It can also be due to a dilaceration (a bend in the long axis of a tooth) or inversion (exchange of the normal root-crown orientation) of the tooth bud. [4] Dilaceration and inversion of permanent teeth are not common occurrences and usually occur as a result of trauma to primary teeth between the ages of 3 - 5 years. [5] [6] An inverted tooth, in which incisal and cervical poles have been reversed, rarely erupts spontaneously (resulting in anterior space in the dentition). [7] [8] If the inverted tooth is noticed prior to complete root formation, it can be repositioned in its crypt via a surgical exposure, with a possibility of spontaneous eruption or later brought into occlusion with orthodontic traction. [9] Later presentation worsens the prognosis for possible alignment of the tooth.

The case is discussed of the management of an adolescent male, with a history of trauma to the primary central incisor and presenting with an unerupted left central incisor which was inverted and dilacerated with an extremely short and fused root.

2. Case Report

A 12-year-old Junior Secondary male student was brought to the orthodontic clinic by his father who expressed concerns about the absence of his upper left central incisor (**Figure 1(b)** and **Figure 1(d)**). There was a positive history of trauma to the deciduous central incisor following the forceful insertion of a spoon into his mouth during a febrile convulsion at 3 years of age. This led to intrusion of the upper left primary incisor and eventual mobility and loss of the tooth. No known chronic medical illnesses or allergies were reported.

Examination revealed no obvious facial asymmetry, a normal path of mandibular closure and an incompetent lip seal. Intraorally, all permanent teeth were

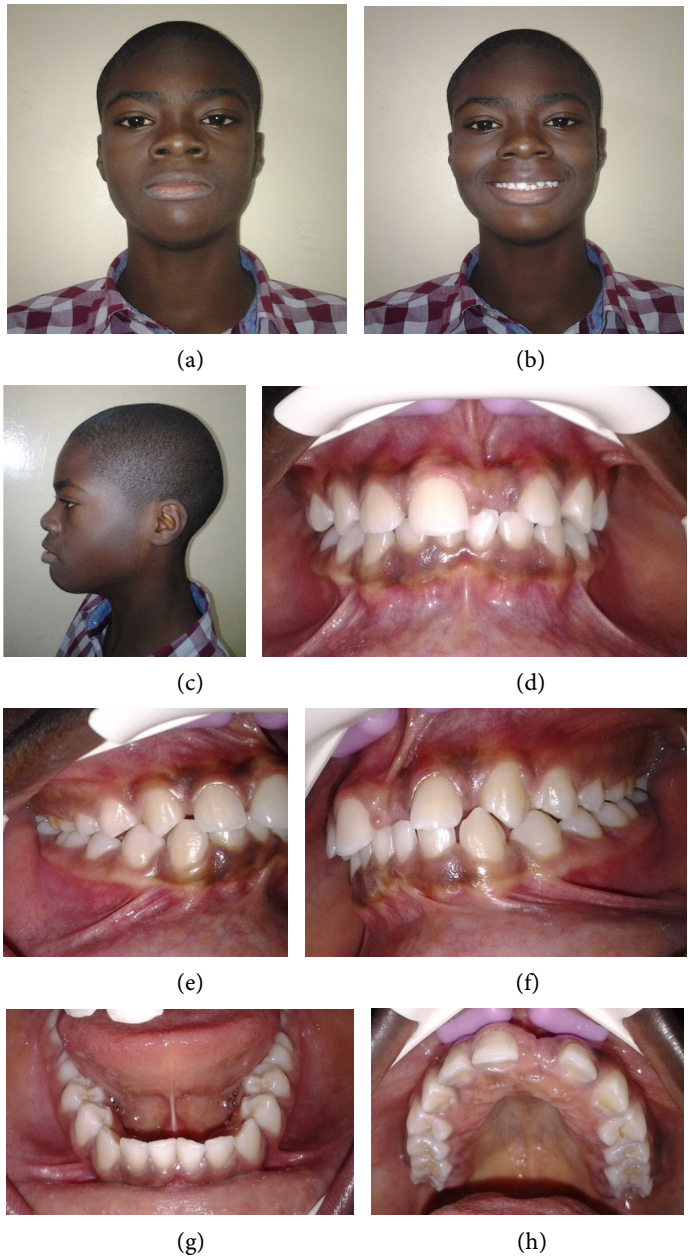


Figure 1. (a) Pre-treatment extra oral front photograph; (b) Pre-treatment frontal smile photograph; (c) Pre-treatment extra oral profile photograph; (d) Pre-treatment intra oral frontal view; (e) Pre-treatment right buccal occlusion; (f) Pre-treatment left buccal occlusion; (g) Pre-treatment lower occlusal photograph; (h) Pre-treatment upper occlusal photograph.

present with the exception of the upper left central incisor. He had an Angle's Class I molar relationship, Overbite of 6 mm and an increased but complete overbite as well as a mild lower arch crowding. On palpation, a prominence was felt on the floor of the left nose.

Available radiographs (Periapical, cephalogram, PA jaws and Occlusal radiographs, **Figure 2(d)** and **Figure 2(e)**) showed an unerupted, inverted upper left

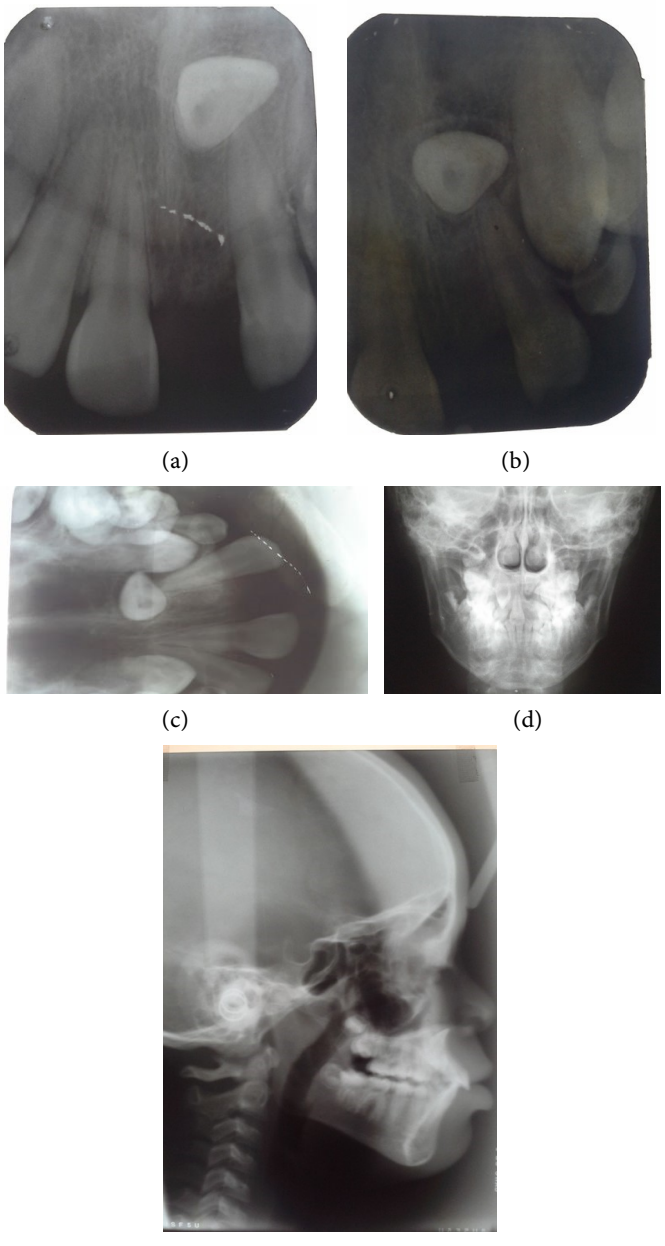


Figure 2. (a)-(b) Pre-treatment Periapical X-rays showing the parallax technique and a buccally placed tooth; (c) Upper occlusal X-ray showing the bull's eye appearance; (d) A view of the jaws; (e) Cephalometric X-ray.

central incisor with the tip of the crown at the floor of the nose, giving the bull's eye appearance. However, the length of the root could not be conclusively determined as CBCT was not available in the centre. Thus, a diagnosis was made of an Angle's class I malocclusion on skeletal pattern 1 complicated by: Unerupted, inverted upper left central incisor; Increased overbite with palatal tissue impingement; Increased overjet of 6 mm; Upper midline shift to the left; Moderate upper arch spacing and Mild lower arch crowding.

The treatment options considered involved

1) Surgical exposure and orthodontic traction or auto-transplantation of the inverted tooth, if root length was adequate.

2) Orthodontic treatment, surgical extraction of tooth and replacement with prosthesis if root length is inadequate.

Orthodontic treatment was commenced with the following objectives:

1) Align upper and lower arches.

2) Correct deep bite.

3) Reduce the overjet.

4) Correct midline shift.

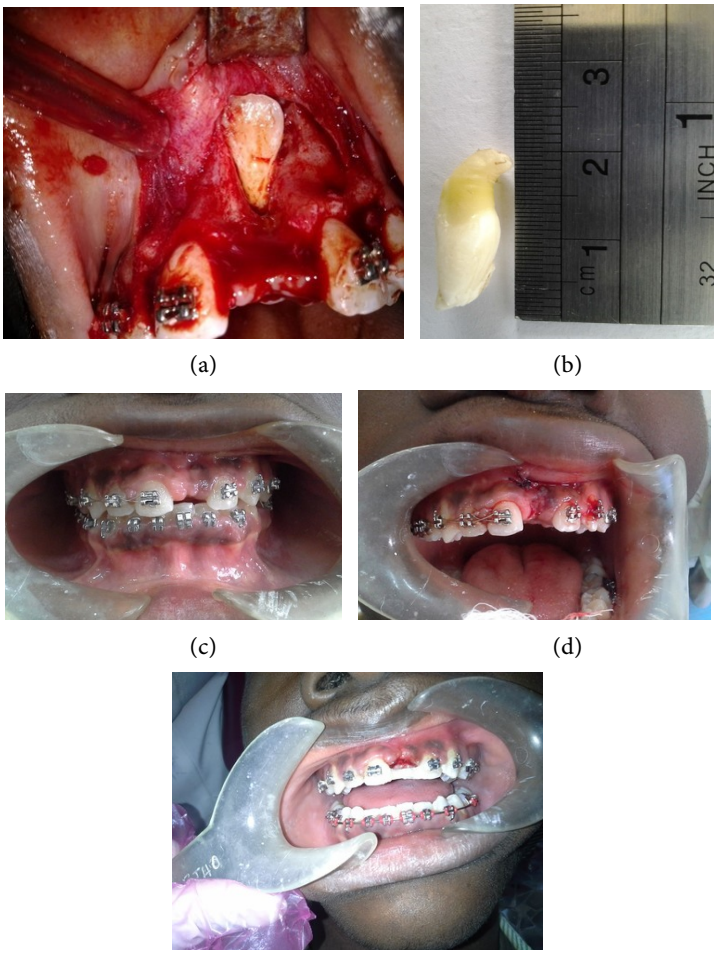
5) Create adequate space for the mesiodistal width of the upper left central incisor.

6) Replace the impacted central incisor.

3. Technique

The patient was commenced on full fixed appliance therapy, with the pre-adjusted edgewise system using Roth 0.022 prescription attachments. He was treated using NiTi 0.014, 0.016, 0.018 and 0.020 wires as well as Stainless-steel wire 0.018 and 0.020 gauge round wires to bring about good alignment in the upper and lower arches. He was subsequently treated with 0.016 × 0.022 rectangular wire with an open coil spring to create adequate space for the mesiodistal width of the upper left central incisor after overbite and overjet corrections have been achieved. Subsequently, a surgical exposure was performed, during which it was observed that the inverted tooth had very short roots which were dilacerated and already fused (**Figure 3(a)**). The tooth had a high crown root ratio (14 mm:7 mm, **Figure 3(b)**). Thus, the decision was taken against orthodontic traction or auto-transplantation of the inverted tooth, in favour of surgical extraction and prosthetic replacement with the natural tooth crown as a temporary pontic, and eventual placement of a dental implant when the patient was older. The inverted tooth was extracted, its root resected and its pulp extirpated and the tooth was thereafter preserved in saline solution in a refrigerator at 4˚C to prevent desiccation of the proposed restorative pontic. The surgical flap was replaced, sutures were placed and the patient was given post-operative, oral hygiene instructions and was reviewed after one week.

His orthodontic treatment continued to the finishing stage of treatment with 0.018 × 0.022, 0.018 × 0.025 and 0.019 × 0.025 stainless steel wires. All through the treatment the patient was reviewed every 4 - 6 weeks with consideration for his academic schedule. He had a periodontologist and restorative dentist review to prepare for the replacement of the extracted tooth. The decision was to replace the tooth with a provisional fiber-reinforced resin bridge using the Ribbond Ultra THM 3 mm Fibers (Ribbond Inc., Seattle, Washington, USA). The replacement is to serve as a long-term temporary bridge until the patient is 18 years, then, he can obtain dental implants as the definitive replacement for the extracted tooth.



(a) (b)

(c) (d)

(e)

Figure 3. (a) Surgical exposure of the inverted tooth; (b) The extracted tooth showing a high crown to root ratio and curved root; (c) Saddle area before frenectomy; (d) Saddle area preparation after frenectomy; (e) Ribbond Framework in place.

He had a frenectomy and gingivectomy done to enhance the saddle area of the provisional bridge. During the fabrication of the provisional bridge, the extracted natural tooth was used as the pontic. The tooth root area was modified to fit the saddle area with minimal ridge contact. The extirpated pulp chamber was rinsed with normal saline, dried and restored with composite resin. The palatal aspect of the adjacent teeth 11 and 22 were prepared as abutments for the provisional fiber-reinforced resin bridge. A standard class III preparation with dimensions of 1.5 mm palato-buccal depth, 1.5 mm mesiodistal depth and 2 mm inciso-gingival depth was used for the index case at the level of the middle third of the teeth which provides maximum tooth bulk. A trough was made in the middle third of the palatal aspect of the natural tooth pontic to receive the Ribbond fiber according to the manufacturer's instruction. [10] The trough measured 1.5 mm palato-labial and 2 mm inciso-gingivally. The adequate lengths of Ribbond fibre required were measured using the supplied tin foil. The first length

of fibre extends from the preparation on tooth 11 across the pontic area, to the preparation on the abutment tooth 12; while a second length of fibre extends just across the pontic area. The Ribbond fibres (Ribbond THM 3 mm width) were cut (with its scissors) and wetted with an unfilled bonding adhesive (Integra bond T universal light cure bonding agent, Premier Dental Co., USA) and the excess adhesive was blotted off. The abutment teeth and the natural tooth pontic were etched with 37% phosphoric acid, rinsed and dried. A thin layer of filled composite resin (Light Bond T Light cure adhesive Reliance Orthodontics) was placed in the preparation on the abutment teeth, the already wetted Ribbond fiber was secured in the layer of composite and cured. A thin layer of composite about 0.5 mm was applied on the lingual aspect of the already cured Ribbond fiber in the pontic area. Then the second length of fibre was adapted to the pontic area according to manufacturer's instruction [10] and then light-cured for 30 seconds. This completed the Ribbond fiber framework (see **Figure 3(e)**). Some filled composite resin was placed in the palatal trough prepared in the tooth pontic and it was secured on the Ribbond framework and the composite light cured for 30 seconds according to manufacturer's instruction. [10] All exposed fiber was subsequently covered with composite resin, occlusion was checked and excess material was trimmed off. Oral hygiene instructions were re-emphasized.

4. Result

The patient was satisfied and was debonded and given an upper Hawley's retainer. The post-treatment appearance had good esthetics and was pleasing as seen in **Figures 4(a)-(h)**; and the set out orthodontic objectives were achieved.

There was no change in vertical bone height between pre and post-treatment values. This was expected since no extraction nor any other bone remodeling procedure was done in the alveolar bone region. The inverted tooth was at the base of the nose which would cause Antero-posterior bone reduction following its extraction and not vertical bone loss.

Measurements obtained from the X-rays in these regions are as follows:

1) Distance from the deepest point of the saddle area to tip of the normally erupted central incisor

Pre-gingivectomy: 7.87 mm; Post-gingivectomy: 9.14 mm

2) PNS (Posterior nasal spine) to A point (subspinale) anteroposterior measurement

Pre-treatment: 30.23 mm Post-treatment: 29.46 mm

3) Alveolar bone vertical height as measured from ANS to CEJ of the saddle area:

Pre-treatment: 12 mm Post-treatment: 12 mm

5. Discussion

The insertion of a spoon into the mouth of a convulsing child is a harmful practice noted among locals in Nigeria. [11] [12] It is said to prevent the child from

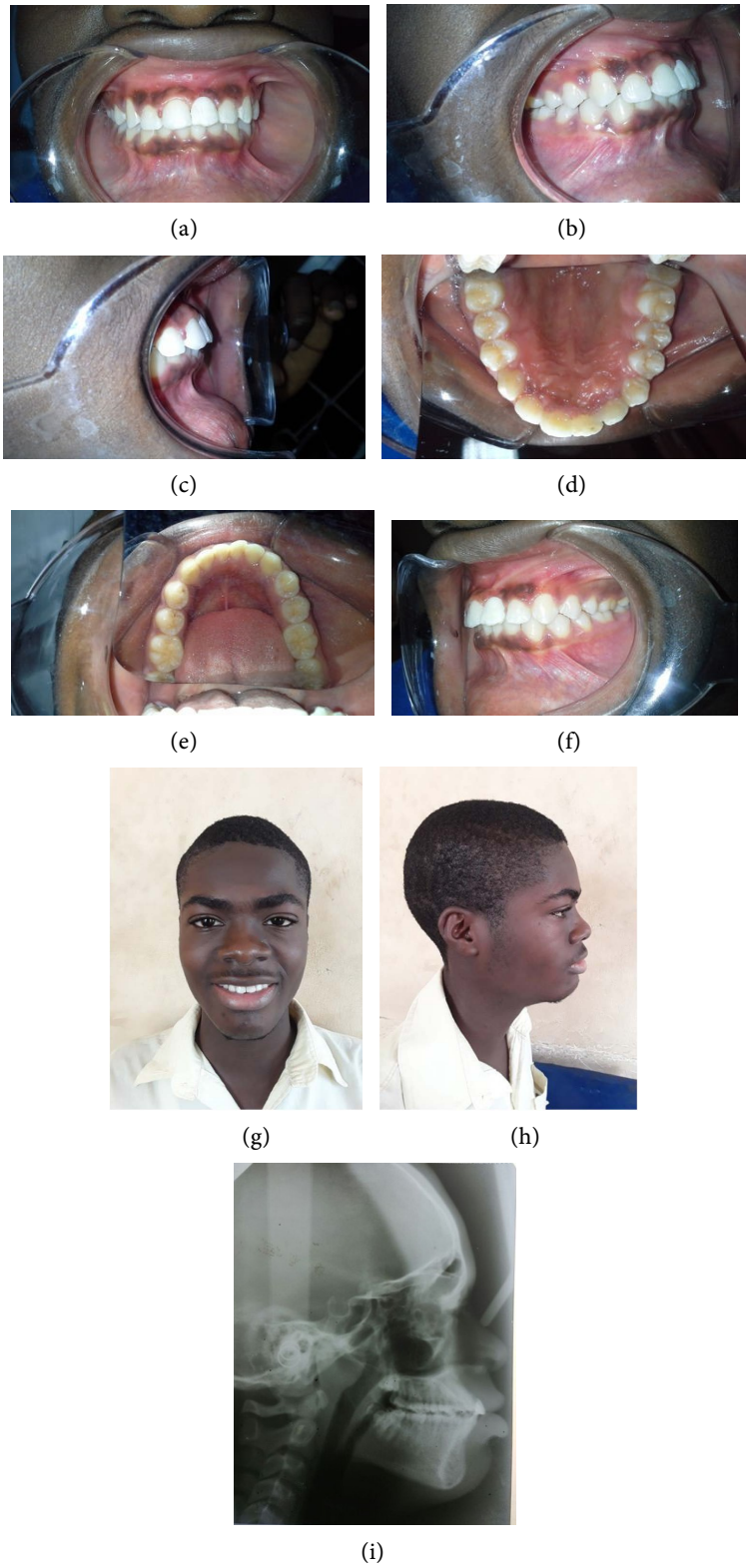


Figure 4. (a) Post-treatment intra oral frontal photograph; (b) Post-treatment Right buccal Occlusion; (c) Post-treatment overjet; (d) Post-treatment upper occlusal photograph; (e) Post-treatment Lower Occlusal photograph; (f) Post-treatment Left buccal occlusion; (g) Post-treatment extra oral frontal photograph; (h) Post-treatment extra oral profile photograph; (i) Post-treatment cephalometric X-ray.

biting his tongue during an episode of convulsion. This deleterious practice can cause a child to aspirate saliva and also traumatize the oral tissues [13] as in the present case causing intrusive luxation of the primary central incisor. Efforts are being made to educate caregivers and eliminate this practice. [14]

Trauma to primary teeth commonly leads to developmental disturbances to the underlying permanent successor tooth germ [15], and the negative developmental effect observed depends on certain factors [5] [16] [17] most important of which are the severity of the trauma of the primary tooth, and the age of the child at the time of injury. Intrusion is a severe tooth injury that occurs as a result of an axial force causing a vertical displacement of the tooth into its socket. [18] Due to the close proximity of the developing permanent tooth germ to the apex of the root of the primary tooth, intrusion injury can lead to disturbance of amelogenesis (and consequently enamel hypoplasia), crown dilacerations, root dilacerations and even disturbance in eruption. [5] [12] [14] [16] In the index case, the intrusive injury led to a deflective displacement of the tooth germ and consequently inversion of the tooth with root dilacerations and eventual eruption failure of the tooth.

On observation that the root of the incisor was very short and fused, during the surgical exposure, the decision was made in favour of surgical extraction as opposed to surgical repositioning and/or orthodontic traction. This was because further root development was no longer possible as the root apex was already fused. Also, the tooth would not have sufficient periodontal support if brought into the oral cavity via orthodontic traction due to its high crown-root ratio. Inverted teeth discovered prior to root completion have a better prognosis following repositioning in the crypt [9] [19] [20] [21] as further root development and spontaneous eruption or orthodontic traction to bring them into the correct position in the oral cavity is possible. Orthodontic traction can also be employed alone or in combination with surgical/swinging repositioning to bring the tooth into the correct position in the arch. These have been reported to be used successfully in patients younger than our index case and in whom further root development is possible. [21] [22] This highlights the need for early presentation for orthodontic checkups in children.

At the end of orthodontic treatment to align other teeth and create space for the missing central incisor, there was a need for replacement of the extracted central incisor to provide retention and maintain esthetics and psychological well-being of the patient. Dental implants remain the choice restorations but are not usually prescribed to patients less than 18 years of age. Placing a dental implant prior to this time leads to an implant appearing submerged [23] [24] creating another aesthetic problem. The patient was less than 15 years at the time, hence the decision to offer him a long-term provisional restoration with a resin-bonded bridge made with his extracted tooth as the pontic and fiber-reinforced composite (Ribbond). This provided the benefit of minimal tooth preparation, unlike what obtains with porcelain fused to metal bridges. The nat-

ural tooth crown provided a pontic with the matching shape, tooth shade and width for the edentulous space which produced an esthetic outcome with no tooth colour change even after one year of placing the restorations, unlike what obtained with a composite or acrylic pontic. [25] It also provided the patient with the psychological boost of having his natural tooth still "in place". Since the procedure was performed on the chair side, laboratory costs were eliminated.

Fiber-reinforced composites are resin-based materials which contain fibers that enhance their physical properties. The fibers can be made from glass, ultra-high molecular weight polyethylene or Kevlar fibers, arranged in a parallel fashion or a weave. They could be pre-impregnated with resin or require chairside resin impregnation. The fibers act as crack stoppers or fracture resistance thereby increasing the strength of restoration while the resin/composites protect the fibers and hold their arrangement at the predetermined position. [26] Ribbond is a bondable reinforcement ribbon made of ultra-high molecular weight polyethylene fibers arranged in a patented leno weave pattern. It requires a chairside impregnation with resin and bonded to composites. [10] It was used for the patient in the fabrication of a single visit resin bonded bridge with minimal tooth preparation and an esthetic result.

6. Conclusion

The use of the natural tooth as a pontic and fiber-reinforced resin bridge should be considered as a viable option for long-term provisional restoration in children requiring replacement for unerupted anterior teeth as it saves cost and time, especially in developing countries where cost and material availability is a concern.

Conflicts of Interest

The authors declare no conflicts of interest.

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