CASE REPORT

Autotransplantation of Teeth Associated with Dentigerous Cyst: A Case Report

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Abstract This paper discusses the treatment of impacted permanent incisors and unerupted ectopic canine associated with a dentigerous cyst in mixed dentition that was successfully managed by the combined approach of decompression followed by enucleation, primary closure, autotransplantation and endodontic therapy which enabled the utilization of teeth which were hitherto nonfunctional, transferred to an optimal functional and esthetic position. Decompression is a less invasive technique which reduces the cystic pressure, avoids a more stressful surgical procedure and necessity for general anesthesia. It gives more pleasing results as the body's own mechanism heals the defect gradually. Autotransplantation of teeth induces bone formation around the root with the help of viable periodontal ligament on their root surface. In this case, bone lost by cyst was regenerated and lamina dura was appreciable in the follow up radiographs and transplanted teeth are functioning well.

Keywords Autotransplantation · Decompression · Impacted teeth · Dentigerous cyst · Bone induction

Introduction

Autogenous tooth transplantation or dental autotransplantation may be defined as the transplantation of embedded, impacted or erupted teeth from one site to another in the same individual into extraction sites or surgically prepared sockets. It also includes surgical repositioning of tooth within the same socket [1]. Replacement of missing teeth with osseointegrated implants has increased over the years; still their use is contraindicated in growing patients. Autotransplantation of teeth in young individuals has been shown to be a predictable substitution method with potential for bone induction and reestablishment of a normal alveolar process [2]. Cost effectiveness is another obvious advantage of this procedure which enables the utilization of a tooth that is hitherto nonfunctional (usually third molar tooth) to be transferred to a functional position.

Earlier clinical case reports describing successful autotransplantation appeared in the 1950s wherein decayed first molars were replaced with immature third molars [3], [4]. Evidence for the success of transplanting pre molars to the incisor region has been presented by Natiella et al. [1] and Kristerson [5]. Autotransplantation of immature teeth has become an evidence-based procedure with a success rate of almost 98 % if teeth are transplanted in ideal circumstances. It is well documented that avulsed teeth recover optimal function and esthetics after replantation under ideal conditions. Favorable periodontal ligament (PDL) healing is the critical factor for success whether teeth are mature or immature. Pulp regeneration can be expected in immature (developing) teeth but not in mature teeth. Similar healing patterns can be expected in autotransplantation of teeth. In addition, bone induction is an interesting additional benefit of transplantation [6]. In very young patients, autotransplantation may allow osseous development to continue by

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avoiding alveolar bone resorption, and provide proprioceptive stimulation [7]. Transplantation of mature teeth enjoys high levels of success and may be a viable treatment option in the absence of other suitable donor teeth [8]. Decompression causes a reduction in the cyst volume with new bone formation so that the structures like developing tooth bud, nerve or sinus lining are not impinged upon. Exposure to external environment leads to thickening of cyst wall and subsequent removal much easier.

Case Report

A 10 year old female patient visited the Department of Oral and Maxillofacial Surgery, with the complaint of non erupting upper anterior teeth. Intraoral examination revealed discoloured and retained 51, 52 and 53 (the dental notation system used here is Federation Dentaire Internationale),¹ 21 and 22 had erupted (Fig. 1). Diagnostic radiographs showed mixed dentition in upper and lower jaws. 13 was seen near right infraorbital region (Fig. 2). A well defined radiolucency could be appreciated in the right anterior region of the maxilla extending from distal aspect of 21 to the mesial aspect of 54 mediolaterally. Radiolucency was seen involving the cervical 2/3rd of 51, 52 and 53, extending superiorly. The borders were well defined inferiorly but less defined superiorly. Impacted 11 and 12 were seen. Working diagnosis of dentigerous cyst was made and was planned for decompression under local anesthesia. Vestibular incision was given in the maxillary right labial sulcus, mucoperiosteal flap was reflected. The bone over the lesion was pierced with a wide bore needle. Aspiration yielded yellowish brown coloured fluid with yellow coloured particles suspended in it. Bone window of 1.5×1 cm was created by removing the labial cortical plate using HP no 8 round bur. The cystic lining covering the defect was incised with B P blade and sent for histopathological examination. The cystic contents were evacuated exposing impacted incisors. The cystic cavity was packed with betadine soaked gauze. After histopathological confirmation of dentigerous cyst, it was decided to continue with decompression. An acrylic stent was made and placed into the defect. The patient was followed up for a period of 8 months. Follow up radiographs showed reduction in the

¹ Federation Dentaire Internationale (FDI), it is also known as ISO 3950 notation. This system uses a two-digit numbering system in which the first number represents a tooth's quadrant and the second number represents the number of the tooth from the midline of the face. For permanent teeth, the upper right teeth begin with the number, "1". The upper left teeth begin with the number, "2". The lower left teeth begin with the number, "3". The lower right teeth begin with the number, "4". For primary teeth, the sequence of numbers goes 5, 6, 7, and 8 for the teeth in the upper right, upper left, lower left, and lower right respectively.

Fig. 1 Pre-operative picture showing retained deciduous teeth

Fig. 2 Pre-operative radiograph showing impacted incisors, cystic cavity and displaced canine near right infraorbital rim

cystic space showing bone formation. Interestingly, canine which was near the infra orbital rim descended downwards into its eruption path. At this stage impacted incisors posed an obstruction in the eruption pathway of canine (Fig. 3). Consultation with orthodontist regarding the possibility of bringing the horizontally aligned incisors into occlusion orthodontically looked difficult and was suggested for extraction.

The impacted incisors were planned for surgical extraction and autotransplantation. Under local anesthesia incision was placed over residual defect and adjoining tissues to expose impacted incisors (Fig. 4). Permanent right central and lateral incisors were luxated and mobilized to permit easy removal. The deciduous incisors on right side were extracted. The sockets for reimplantation were created keeping normal tooth dimensions as a guide.

Fig. 3 Follow up radiograph showing reduction in cystic space and descent of canine tooth

Fig. 6 Autotransplanted incisors

Fig. 4 Surgical incision exposing impacted incisors

Fig. 7 Stabilization of autotransplanted teeth using composite splint

Fig. 5 Extracted incisors showing PDL on root surface

Fig. 8 Post op photograph after 16 months

The permanent incisors were extracted keeping as much as PDL on root surface (Fig. 5) and kept in saline. The entire cystic lining was enucleated and sent for histopathological examination. The permanent incisors were placed into freshly prepared sockets (Fig. 6). The teeth showed fair stability in the socket in spite of loss of bone in middle and

Fig. 9 Post operative radiograph showing bone formation within cystic cavity, formation of lamina dura around transplanted teeth, descent of canine into eruption path

apical third of root by cystic cavity. The teeth were further stabilized with the help of composite wire splint (Fig. 7). The cystic cavity was closed primarily with sutures. Root canal treatment and composite build up was carried out for the transplanted teeth after 21 days. The patient was kept on follow up. Tooth was stable at the transplanted site (Fig. 8). The follow up radiographs taken after 16 months post transplantation shows remarkable bone formation around the roots of transplanted teeth. The cystic cavity is completely filled with bone. The canine has descended into its eruption path. The lamina dura around the transplanted teeth shows successful reattachment of the autotransplanted teeth (Fig. 9).

Biologic Principle of Decompression

Decompression of a cyst involves any technique that relieves the cystic pressure that causes it to grow. Decompression changes the environment by decreasing osmotic pressure, decreasing the pressure resorption [9], release of interleukin, prostaglandins [10] and growth factors.

Biologic Principle of Transplantation

It is well documented that avulsed teeth recover optimal function and esthetics after replantation under ideal conditions. Favorable PDL healing is the critical factor for success whether teeth are mature or immature.

Periodontal Ligament Healing

Favorable healing of the PDL depends on how many viable cells are preserved on the root. Mechanical trauma during

extraction or bio-chemical injury due to various extra-oral conditions such as variable pH, osmotic pressure, dehydration can damage PDL cells. When an avulsed tooth is immediately replaced into its own socket, reattachment occurs in 2 weeks between the periodontal tissues of the root surface and the connective tissue of the recipient socket wall. When a donor tooth placed into artificially created socket, it needs more time, the prognosis is a little poorer [6].

Pulp Tissue Healing

Pulp regeneration can be expected in immature (developing) teeth but not in mature teeth. If the pulp space becomes infected, the bacteria in the canal act as a constant stimulus for inflammation, thus preventing it from advancing to the healing stage. This process has been termed inflammatory root resorption [6]. Inflammatory resorption can be arrested if found in its early stage and treated with endodontic treatment.

Bone Healing

Periodontal ligament of a transplanted tooth appears to be able to induce bone production. Genetically, PDL cells can differentiate into three types of cells: fibroblast, cementoblast, and osteoblast. The differentiated osteoblast may generate bone around the transplant [6]. Bone induction is observed as rapid bone regeneration and the emergence of lamina dura around the autotransplanted tooth [6]. Bone induction around a transplanted tooth is a significant advantage for this procedure compared to the use of implants.

Root Development

Root can continue to develop in an immature tooth with intact Hertwig's epithelial sheath. So, due care to be taken to preserve the epithelial sheath.

Discussion

This paper discusses the treatment of impacted permanent incisors and unerupted ectopic canine associated with a dentigerous cyst in mixed dentition that was successfully managed by the combined approach of decompression followed by enucleation, primary closure and autotransplantation.

Growth of cysts is believed to occur by a combination of osmotic pressure and pressure resorption [9], coupled with release of prostaglandins [10] and growth factors. Decompression relieves the pressure within the cyst that

causes it to grow. Several studies have shown that decompression by making a small opening into the cyst and inserting a grommet, or drainage tube, can result in substantial reduction in the size of the cyst. This is recommended to decrease the size of the cyst and to take it away from important structures such as teeth and the inferior alveolar nerve and to reduce the chance of pathologic fracture or bony discontinuity with definite treatment. With this decompression technique, subsequent enucleation of smaller lesion is then usually performed.

In this case the cyst was associated with impacted incisors. Growth of the cyst not only hampered the descent of canine but also pushed the canine up till the infraorbital margin reducing the chances of normal eruption sequence and path. Timely intervention of this situation through cystic decompression technique served dual purpose of carrying out an incisional biopsy and decompressing the lesion. This allowed the cystic cavity to shrink in size allowing bone formation around the periphery of the cyst. Presence of the newly formed bone in eruption path of canine facilitated descent of canine towards the alveolus. Reduced cystic cavity facilitated enucleation without damaging the adjacent structures. Complementary orthodontic therapy would align the canine and the transplanted permanent teeth in the esthetic and functional position.

Autologous tooth transplantation is supposed to be a biologically superior method to other treatments such as restoration with dental implants or other prosthesis such as dentures. Umbilical cord mesenchymal stem cells have shown excellent pluripotent and proliferation potential which have ability to form cementum like tissue and may be used as a source of periodontal healing after autotransplantation of teeth [11]. Autotransplantation has been tried in grafted alveolar clefts with success [12]. Ectopic teeth may be treated by various strategies such as exposure and orthodontic treatment, or excision and replacement by fixed prostheses. The alternative of osseointegrated implants is also not appropriate in the growing skull because development of the alveolar process can be impaired. In the younger patient, autotransplantation of the ectopic tooth may be considered.

Conclusion

Autotransplantation can be considered as a treatment option when teeth are lost or ectopically positioned, as the biological principles for success are well understood. It is an extremely successful treatment form with significant savings in time and cost compared to implants. The patient can have his natural tooth and dentition rather than a mechanical prosthesis.

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