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Orthodontic Treatment Combination with Auto Transplantation for the Management of Impacted Maxillary Left Lateral Incisor and Canine: An Interdisciplinary Approach

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Authors' contributions

This work was carried out in collaboration between all authors. Author MKA did the orthodontic treatment, authors SAN, SH and FS also involved in orthodontic treatment, author NBJ did the prosthetic part, authors KP and AP did the surgery part. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aims: For the orthodontic treatment of the complex cases, the interdisciplinary team work is of utmost importance, which leads to the predictable outcome with excellent treatment. The prime aim of this rare case report is to demonstrate the combined orthodontic-surgical-endodontic-prosthodontic interdisciplinary management.

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Presentation of Case: This report describes the case of a 19 years old Malay male patient with the clinical problems of median diastema, mesio-buccally rotated maxillary left 1st premolar, mild mandibular incisor crowding along with impacted maxillary left lateral incisor and canine.
Discussion: With the advantages of the orthodontic fixed appliance, auto-transplantation of maxillary upper left lateral incisor and canine, the case was completed in an ideal orthodontic occlusion along with improved oral condition, masticatory function and esthetics. The treatment outcomes were due to orthodontic-surgical-endodontic-prosthodontic treatment with stable occlusion in sequels visits.
Conclusion: An Interdisciplinary management achieved successful functional and esthetic results in the present case.

Keywords: Auto-transplantation; impacted maxillary left lateral incisor; impacted maxillary left canine; interdisciplinary management.

1. INTRODUCTION

Demand for orthodontic treatment with dentofacial esthetics is increasing day by day among the conscious adult population [1]. In case of any missing teeth, the aim of dentistry is to replace the teeth and to re-establish the functions. Generally, replacement of the missing teeth due to impaction can managed by orthodontic traction with fixed appliances, removable or fixed prostheses, implants and auto-transplantation [2]. However to restore the missing teeth with removable and fixed prostheses sometimes cause uneasiness to the patients and need to compromise one or two vital teeth. Auto transplantation is another way to manage the impacted missing teeth. Although auto transplantation is infrequent due to high success rate of osseo integrated implants. However, in case of growing patients auto transplantation is a feasible option due to the contraindication of placing osseo integrated implants [3].

Here, we report the Interdisciplinary treatment of an adult patient with impacted maxillary left lateral incisor and canine at a same time which is very rarely seen in common practice. In addition, there were median diastema, rotation in maxillary left 1st premolar, midline shifting and mild crowding in lower anterior region. Through the surgical extraction and auto transplantation, the impacted lateral incisor and canine were successfully placed into proper position. The prime aim of this rare case report is to demonstrate the combined orthodontic-surgical-endodontic - prosthodontics interdisciplinary management.

2. CASE REPORT

A 19 years old male patient was referred to the Orthodontic unit with missing maxillary left lateral incisor and canine. According to the patient's mother, there were no teeth erupted at that area since primary teeth exfoliated. And patient has no known medical illness.

The written and verbal Informed consent was processed for the ethical issue, the approval was granted from the both patient and parents. On examination, symmetric facial pattern with a convex soft tissue profile was seen. Patient history along with the orthodontic records such as pretreatment extra and intra oral photographs, orthopantomogram (OPG) and lateral cephalogram were investigated (Fig. 1).

The cephalometric radiographs showed SNA angle 88, SNB angle 84 and ANB angle 4. Which is indicating protrusive maxilla and mandible noted with class I skeletal relationship (Table 1). Thus, the patient was diagnosed with bimaxillary dentoalveolar protrusion, missing left maxillary lateral incisor and canine, median diastema, rotated tooth 24 mesio-bucally, upper midline shifted 2 mm to the right and mandibular incisor crowding.

2.1 Treatment Objectives

Based on the clinical findings, the treatment objectives were to close the median diastema, de rotate the maxillary left 1st premolar, correct lower anterior teeth crowding, correct midline shift, create space for the impacted teeth and replace missing teeth.

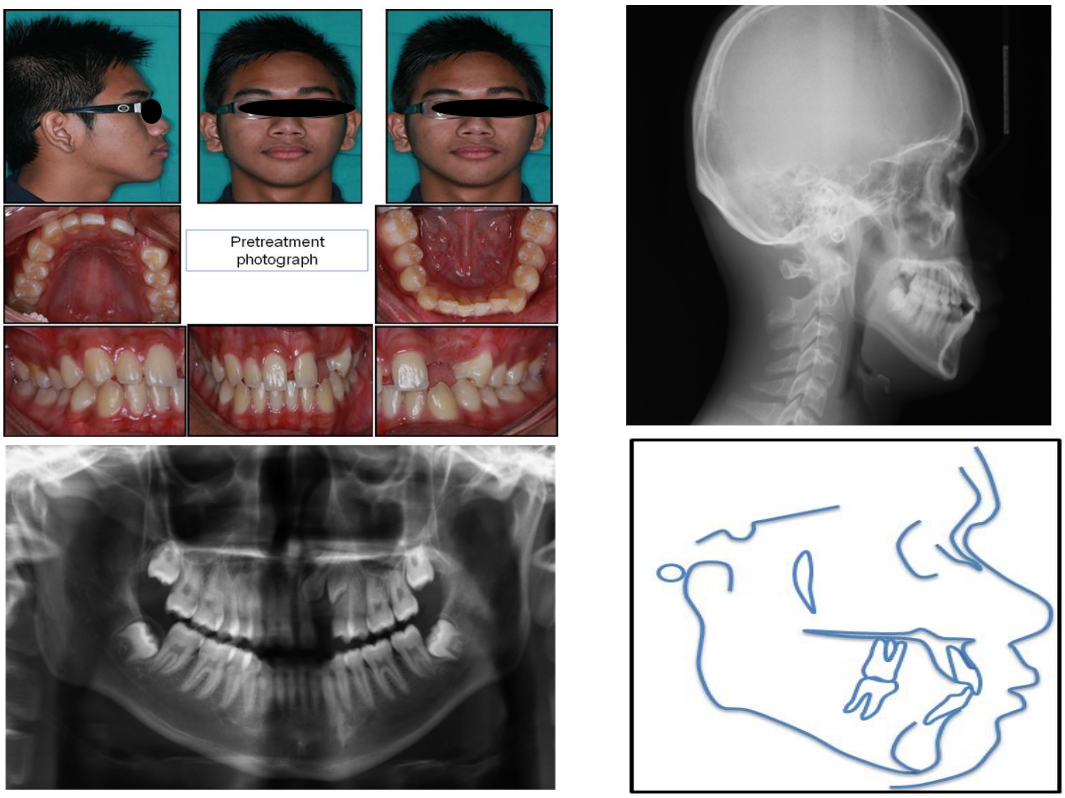

Fig. 1. Pretreatment photograph of intra and extra oral view, OPG, lateral cephalogram and tracing

Table 1. Pre-treatment and post-treatment cephalometric measurements

Variable	Pre-treatment (º)	Post-treatment (º)
SNA	88	88
SNB	84	84
ANB	4	4
Maxillary incisor to maxillary plane angle	115	117
Mandibular incisor to mandibular plane angle	94	97
Interincisal angle	120	120
Maxillary-mandibular angle	28	28
Upper anterior facial height	46.5%	46.5%
Lower anterior facial height	53.5%	53.5%

SNA, sella–nasion–A point angle; SNB, sella–nasion–B point angle; ANB, A point–nasion–B point angle

2.2 Treatment Alternatives

Under the normal circumstances, impaction is corrected by orthodontic traction with fixed appliances, removable or fixed prostheses, implants and auto-transplantation.

In this case specialists decided to extract and auto transplantation. Selection of treatment options explained to patient. However, the amount of space available estimated from dental cast and radiograph was not sufficient to replace the missing teeth. Thus, fixed appliance used for orthodontic correction and space management prior to teeth substitutions. Both the alignment and space acquired provides good outcome for further management of teeth transplantation.

2.3 Treatment Progress

After apprehending the conceivable treatment alternatives, at first the MBT prescription

brackets were bonded in both arches. Step by step standard arch wire sequences were followed and open coil spring between left upper central incisor and first premolar were used to gain space of upper left lateral incisor and canine (Fig. 2). The correction of median diastema, de-rotation of tooth 24, correction of upper midline, aligned mandibular incisor and achieved sufficient space for auto-transplantation of upper left lateral incisor and canine, then the patient was referred for surgical extraction and autotransplantation. Orthopantomogram (OPG) (Fig. 2) and Cone Beam Computed Tomography (CBCT) (Fig. 2). were done for the auto transplantation planning with the support of interdisciplinary teamwork.

Crestal incision made on buccal and palatal from 21 to 24. The impacted 22 and 23 removed with the minimal palatal bone loss and preserved in patient's blood. After that socket drilled at the 22, 23 and the teeth were replaced in the proper position. Newly placed teeth then secured with composite and orthodontic coaxial wire as splint, the occlusion examined for occlusal interferences (Fig. 3).

Xenograft with sterile freeze-dried bovine bone (OsteoLEMB from USM tissue bank) placed on buccal and palatal area and secured with sterile human amniotic membrane (AMNION from USM tissue bank).

For the post-surgical period, the patient was prescribed with an antibiotic (Amoxicillin 500 mg thrice per day for 1 week), an analgesic, liquid diet for 1 week and mouth rinses with a 0.12% chlorhexidine solution for the equal period. Endodontic procedures including pulp extirpation, cleaning and shaping of the root canals were done 5 weeks after the surgical procedure. Aseptic technique was followed during the endodontic procedures. After that prosthetic crown were placed on the auto transplanted endodontically treated teeth (Fig. 4).

According to the post-operative radiograph (Fig. 5), after auto transplantation and orthodontic treatment, the alveolar bone of the recipient site seemed to adapt. During the assessment period, there were no sign or symptoms of ankylosis or replacement resorption. The patient was fully satisfied with the functional and esthetic outcome. After the debonding, the results were well maintained and patient is still under regular follow up. The time frame for overall interdisciplinary treatment was two years with the maximum gap of two weeks intervals between different specialties.

Pre and post treatment cephalometric superimposition are showed in Fig. 5. To see the general changes, the cephalometric superimposition was done. According to the cephalometric superimposition (blue line = pretreatment and red line =post treatment), slight proclination of the maxillary incisor to maxillary plane angle and mandibular incisor to mandibular plane angle were observed (Fig. 5 and Table 1).

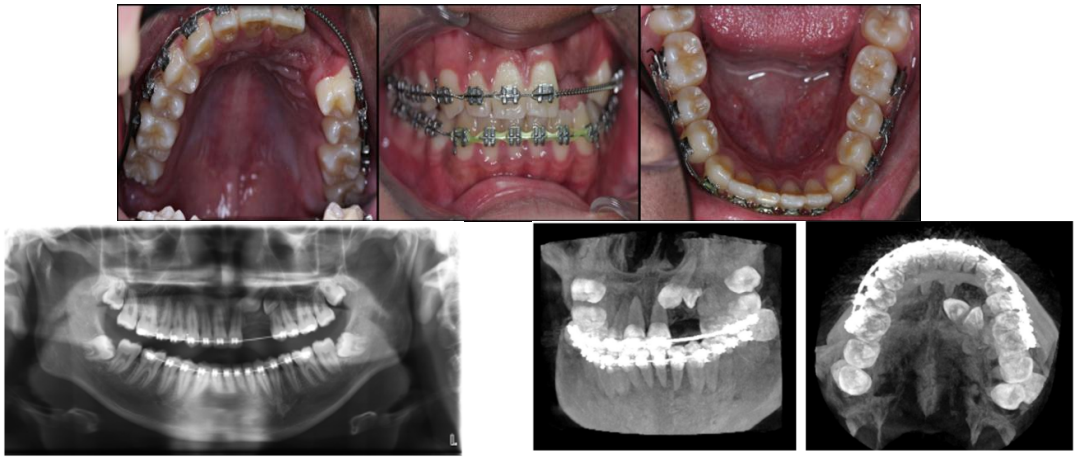

Fig. 2. Fixed appliance on upper and lower teeth with open coil spring between left upper central incisor and first premolar, cone beam computed tomography (CBCT) and orthopantomogram (OPG) during orthodontic treatment

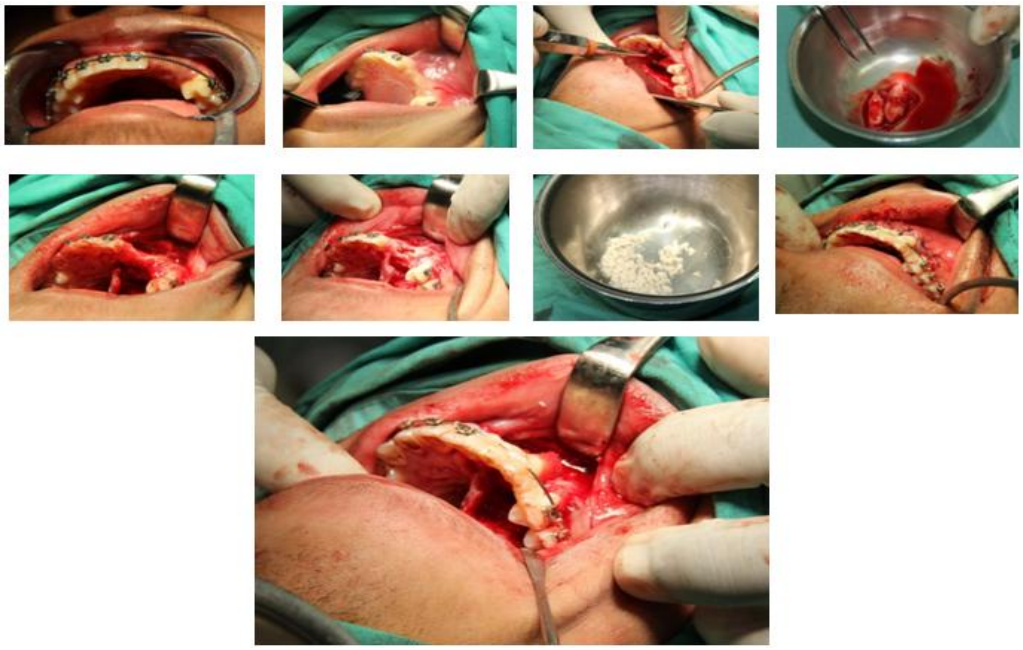

Fig. 3. Surgical extraction and auto-transplantation procedure

3. RESULTS AND DISCUSSION

Relocation of teeth from one site to alternative site in same individual into surgically prepared sockets or sites of extraction is defined as auto transplantation [4]. The rewards of the auto transplantation comprise orthodontic movement and proprioception, alveolar bone, gingival graft with normal outline conservation and capability of periodontal ligament preservation. In case of auto transplantation, it can complete in a single stage without any necessity of prosthesis with the low cost compared to osseo integrated implant. Besides that, this procedure can be applied in growing patients [5].

In the reported case, in spite of the patient's grown-up age and suitability for position of an osseointegrated insert, the autotransplantation was picked on the grounds that it included a solitary surgical stage, the benefactor teeth were in great conditions and the entire method had an ease.

However, auto transplantation is popular now a days but it has some drawbacks too. The procedure is technically challenging since sometimes it may occur injury to the periodontal ligaments due to the surgical trauma. In case of auto-transplantation, the donor tooth should be well- matched with the recipient socket and need the endodontic treatment if the donor teeth are with fully developed roots. Inflammatory root resorption, dental caries and ankylosis are the common complications could occur in auto transplantation [6].

Fig. 4. Crown cut, wax try-in, temporary crown try-in and temporary crown cemented on auto transplanted endodontically treated

Sustainability of periodontal ligament cells and preservation of the uprooted tooth is the main aspect of the successful auto transplantation.

To prevent ankylosis, conservation of epithelial cell rests of Malassez upholds the periodontal-ligament spaces and avoid root resorption [7]. Other causes like, the growing age patients like age under 20, surgical procedure with less

trauma, contributor tooth with unformed root and the experience of the surgeon are correlated with upright prognosis [8]. It also depends on the absence of any inflammation, enough bony support in the receiver site [9].

Permanent teeth impaction is a common incidence in dental arches that can involve any tooth. Nevertheless, most frequently occurs in upper and lower third molars, followed by upper canines lower molars [10].

In the reported case, upper left lateral incisor and canine were impacted at a same time, which is rarely seen in common practice.

At the point when one tooth in an upper dental anterior quadrant is missing, it is possible in a few cases to close the space orthodontically by driving the distally neighbouring teeth mesially. In the event that two teeth are absent, the space cannot be closed, however it might be diminished to the width of one tooth [11].

Maxillary incisors impaction cases are less commonly occur than the maxillary canine impaction. Since tooth do not erupt in case of the maxillary incisor impaction, so that the parents became concerned about it in early mixed dentition period [12]. Many studies showed that with the proper crown exposure and orthodontic traction affected maxillary anterior teeth treated fruitfully [13].

Pinho T [14] described a case of 14 years old boy where both central incisors and a canine were impacted. That case the treatment was done with 2 stages. Firstly unilateral expansion and then involved fixed appliances to make sufficient space for traction of the impacted teeth.

29 years old Japanese woman with missing mandibular left first molar was treated with orthodontic treatment followed by auto transplantation. In addition, the whole treatment took more than 32 months [15].

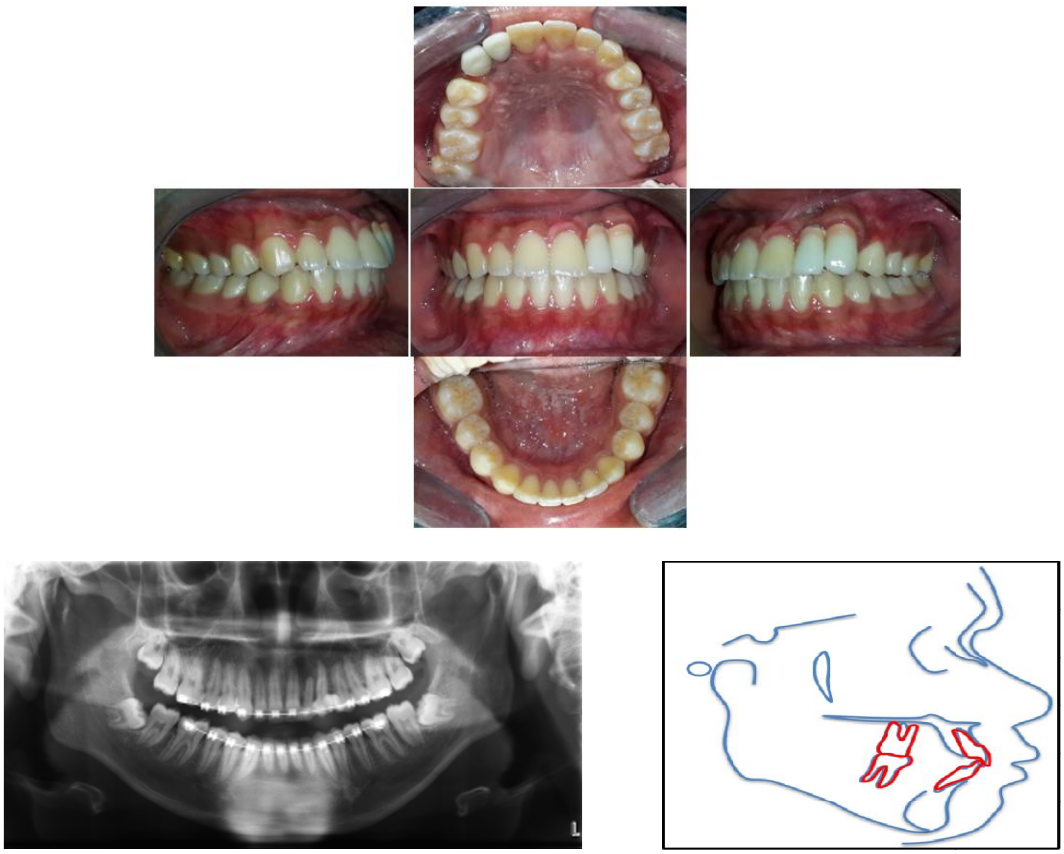

Fig. 5. Post-orthodontic intra-oral photographs, OPG and cephalometric superimposition land marks red (teeth) blue (soft tissue profile and hard tissue tracing)

One case report discussed two cases of impaction where in first case both mandibular premolars on left side and in second case mandibular left permanent first molar were impacted. Both cases are by the orthodontic traction and subluxation procedures. These cases took 24 months and 27 months respectively to complete [16].

Lin Y-TJ treated the impacted left maxillary central incisor was effectively placed into proper position through the two stages of crown exposure and the elastic traction [17].

Different studies also showed that in case of missing teeth autologous tooth transplantation or auto transplantation is easier and can perform in one stage. A 19-year-old Caucasian female patient with remaining roots of the right mandibular second molar and a partly erupted third molar in the same quadrant was chosen to do auto transplantation to avoid the bone resorption at the site of the mandibular second molar. The technique was performed in one stage. The third molar was extracted and positioned back into the extraction second molar socket until the remaining roots were removed [18].

In case of auto transplantation, receiver socket preparation is required according to the donor tooth. After extracting the donor tooth, it should be engaged into the recipient socket. If additional alteration of the receiver socket needed then donor should be retuned back to extracted socket or preserve in saline [19]. In the reported case, after extracting, the donor teeth were kept in patient's blood and after preparing the receiver socket, they placed back to the expected site.

The various kind of bone grafting materials are autogenous bone grafts, allografts, alloplasts and xenografts. Autogenous bone grafts are osteoinductive and osteoconductive, however required harvesting from other locations producing second wound. The substitute commonly chosen is the xenografts, such as in this case, the bone mineral derived from bovine produced locally by the Universiti Sains Malaysia (USM) was used. The combination of bone grafts (deproteinized bovine bone mineral-DBBM e.g. Bio-Oss®) and guided tissue regeneration (GTR) using resorbable barrier membranes showed improved result with periodontal regeneration [20].

Compare to orthodontic traction procedure, auto transplantation is more time saving. In auto transplantation, in any case, no immunologic issues are included. The similarity between tooth transplants and the tissues in the receiver area appears to be no problem [11].

Dental specialist like oral surgeon, orthodontist and prosthodontist are required for the successful auto transplantation. In the present case surgical crown exposure, replace back to its position with bone deposition, endodontic treatment followed by orthodontic spacing has been performed.

Current study and the literature review of showed that auto transplantation of teeth is a reliable method [21].

In this case, the periodontal status showing satisfactory gingival outline and attached gingiva. No advance muco gingival surgery is suggests. As most of the orthodontist aims to finish the orthodontic cases with ideal occlusion, anterior guidance rather than group function, in current case the ideal occlusion with proper interdigitation and anterior canine guidance were achieved [22].

4. CONCLUSION

This case report explains the diagnosis and treatment process of a patient with impacted maxillary left lateral incisor and canine, median diastema, mesio-bucally rotated maxillary left 1st premolar, upper midline shift 2 mm to the right and mandibular incisor crowding. Orthodontic-surgical-endodontic-prosthodontic treatment improved aesthetics, changed it in to beautiful smile and restored the function by utilizing the novel concept of auto transplantation.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Proffit W. Special considerations in comprehensive treat- ment for adults. IN: proffit W, fields hw, eds. Contemporary orthodontics. 3rd ed. St louis, mo: mosby; 2000.
2. Lacerda M, Chaves M, Campos CN. Autotransplantation of a mandibular third molar: a case report with 5 years of follow-up. Braz Dent J. 2013;24(3):289-94.
3. Thomas S, Turner SR, Sandy JR. Autotransplantation of teeth: Is there a role? Br J Orthod. 1998;25(4):275-82.
4. Tsurumachi T, Kuno T. Autotransplantation of a maxillary first premolar to replace an ankylosed maxillary incisor: 7-year follow-up. Int Endod J. 2011;44(9):863-75.
5. Baviz JB. Autotransplantation of teeth: A procedure that gets no respect. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;110(4):441.
6. Teixeira CS, Pasternak jr. B, Vansan LP, Sousa-neto Md. Autogenous transplantation of teeth with complete root formation: Two case reports. Int Endod J. 2006;39(12):977-85.
7. Struys T, Schuermans J, Corpas L, Politis C, vrielinck L, Schepers S, et al. Proliferation of epithelial rests of malassez following auto- transplantation of third molars: A case report. J Med Case Rep. 2010;4:328.
8. Tirali R, Sar C, Ates U, Kizilkaya M, Cehreli BB. Autotransplantation of a supernumerary tooth to replace a misaligned incisor with abnormal dimensions and morphology: 2-year follow-up. Case Rep Dent. 2013;2013:1-2.
9. Heer J. Calcium hydroxide therapy and bony regeneration following autogenous tooth transplantation: Case report and three year follow up. Br Dent J. 2007;203(7): 403-5.
10. Aitasalo K, Lehtinen R, Oksala E. An orthopantomographic study of prevalence of impacted teeth. Int J Oral Surg. 1972;1(3):117-20
11. Slagsvold O, Bjercke B. Applicability of autotransplantation in cases of missing upper anterior teeth. Am J Orthod. 1978;74(4):410-21.
12. Bishara SE. Impacted maxillary canines: A review. Am J Orthod Dentofacial Orthop. 1992;101(2):159-71.
13. Wasserstein A, Tzur B, Brezniak N. Incomplete canine transposition and maxillary central incisor impaction: A case report. Am J Orthod Dentofac Orthop. 1997;111(6):635-39.
14. Pinho T. Impaction of both maxillary central incisors and a canine. Am J Orthod Dentofacial Orthop. 2012;142(3):374-83.
15. Watanabe Y, Mohri T, Yoshida R, Yamaki M, Saito I. Orthodontic treatment combined with tooth transplantation for an adult patient with a missing mandibular first molar: Long-term follow-up. Am J Orthod and Dentofacorthop. 2014;145(4):114-24.
16. Sato C, Nomura J, Matsumura Y, Kato H, Yanase S, Tagawa T. Two cases of recovery of occlusion by a combination of surgery and orthodontic therapy for adult mandibular impacted teeth. Orl Sci Int. 2013;10(1):44-7.
17. Lin Y-Tj. Treatment of An Impacted Dilacerated Maxillary Central Incisor. Am J Orthod Dentofac Orthop. 1999;115(4):406-9.
18. Chagas E, Silva MH, Lacerda MF, Chaves M, Campos CN. Autotransplantation of a mandibular third molar: A case report with 5 years of follow-up. B Dent J. 2013; 24(3):289-94.
19. Akiyama Y, Fukuda H, Hashimoto K. A clinical and radiographic study of 25 autotransplanted third molars. J Oral Rehabil. 1998:25(8):640-44.
20. Stavropoulos A, Karring T. Guided tissue regeneration combined with a deproteinized bovine bone mineral (bio-oss) in the treatment of intrabony periodontal defects: 6-year results from a randomized-controlled clinical trial. J Clin Periodontol. 2010;37(2):200-10.

21. Lundberg T, Isaksson S. A clinical follow-up study of 278 autotransplanted teeth. British Journal of Oral and Maxillofacial Surgery. 1996;34(2):181-85.

22. Thornton LJ. Anterior guidance: Group function / canine guidance. A literature review. J Prosth Dent. 1990;64(4):479-482.

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