Case Report
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Autotransplantation: A Practical Approach for Management of a Difficult Impacted Canine – A Case Report

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Abstract

Following the third molar, the maxillary canine holds the second position of the most frequently impacted tooth. The orthodontic management of the tooth depends on its position and in many cases, the orthodontic guidance is graded difficult with poor prognosis. Autotransplantation of canine is a viable option in such cases if the tooth can be atraumatically removed. The case reports a young female with an impacted maxillary canine, which was graded difficult. The case was managed using auto transplantation and orthodontic alignment.

Keywords: Auto Transplantation, Impacted Maxillary Canine

1. Introduction

Permanent maxillary canines are important teeth in the dental arch, providing lip support, facial aesthetics, and functional occlusion[1]. Following third molars, maxillary canines are ranked as the second most frequent ectopic tooth in the dental arch, having an incidence of 2%[1,2]. 85% of impacted maxillary canines present palatal impaction, with the rest being buccal[2]. Maxillary canine has a long tortuous path of eruption and their impaction has various systemic and local etiology.[3]

An impacted tooth may be associated with migration of neighboring teeth, loss of arch length, internal and/or external resorption of impacted and/or adjacent teeth, cystic development and referred pain[4]. The various pathologic sequelae associated with untreated impacted canine and the improved facial aesthetics and occlusal function provided by a correctly positioned natural canine, makes it important to diagnose and align an impacted canine[5]. Treatment options include periodic observation and monitoring, surgical exposure with or without orthodontic guidance, auto-transplantation, and extraction[3,6]. The decision is dependent on the developmental status, degree of crowding, and difficulty level of the impacted canine[7]. An unfavorable position of the canine may precipitate root resorption of adjacent teeth during an attempt to orthodontic guidance along with prolonged treatment time[6]. In such cases, auto-transplantation can be a viable option if the canine could be extracted without sectioning or damage to the root[1–4]. Recent studies have reported a good long-term prognosis for auto-transplanted canines[1,6].

2. Case Presentation

2.1 Diagnosis

A 25-year-old female reported with the chief complaint of proclined upper left lateral incisor Tooth #22. On clinical examination, the patient had a symmetrical face, straight profile, Class I skeletal bases with Class I molar relation bilaterally, retained maxillary left deciduous canine, Class

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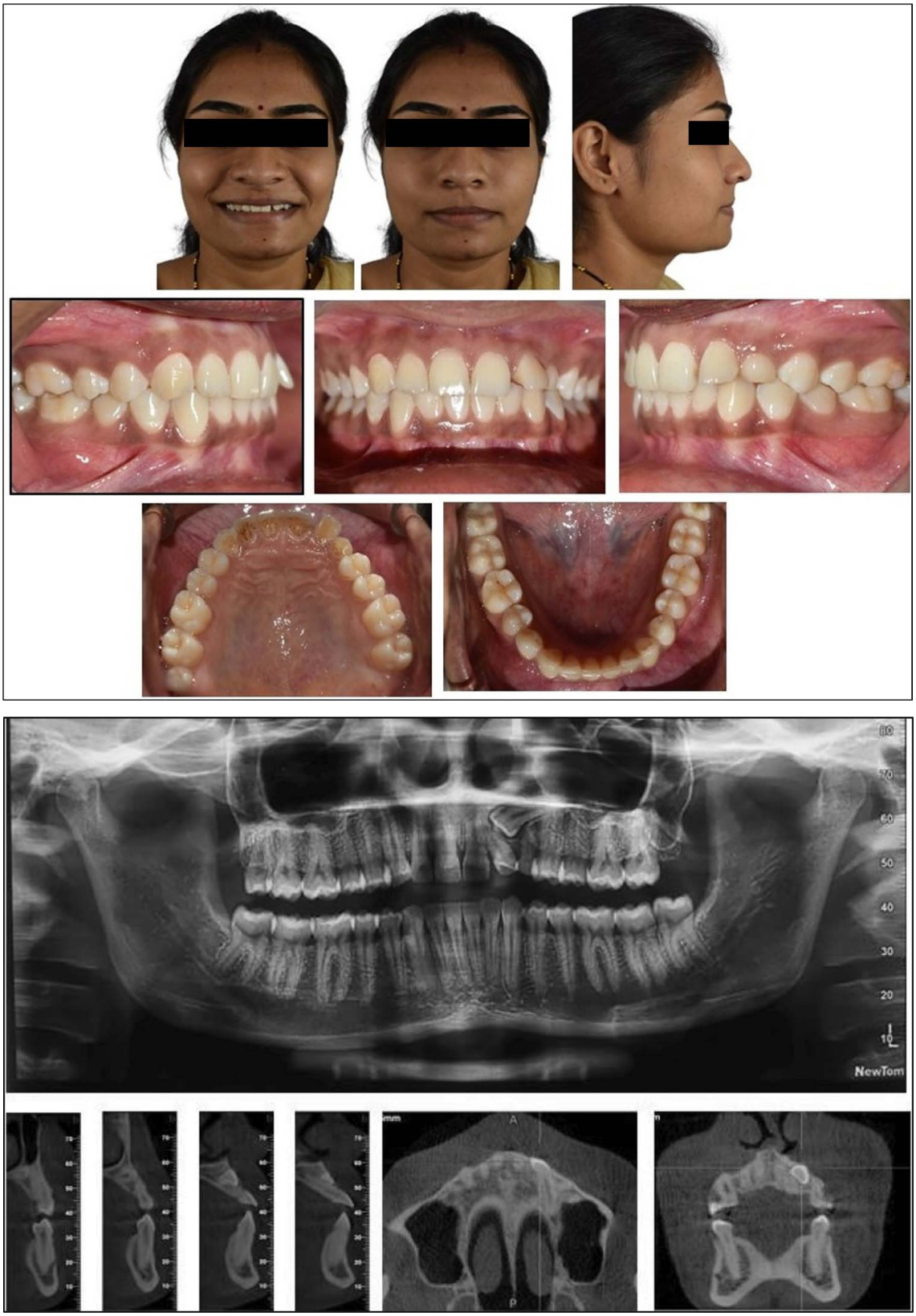


Figure 1. Pre-treatment **(A)** Photographs **(B)** OPG and CBCI crews retained tooth #63 **(C)** Impacted tooth #23 (unfavourable).

Table 1. Prognosis of impacted canine for orthodontic guidance

Parameter	Grading	Interpretation
Sector classification [8]	Sector II	Fair prognosis
Angulation with MSR [9]	65^0	Poor prognosis
Difficulty Index [10]	11	Maximum difficulty

I canine relation on the right side, and normally inclined upper and lower incisors except for proclined tooth #22 (Figure 1).

Orthopantomograph revealed an impacted maxillary left canine. The fully formed impacted canine was in close proximity to the root of the lateral incisor (Figure 1) and was placed unfavorably.

CBCT revealed that the canine was impacted almost horizontally with crown labial to the lateral incisor root, with root apex palatal to the root apices of the first and second premolar. The labially positioned canine crown was in close approximation to the lateral incisor root, which showed signs of resorption (Figure 1). Various parameters were explored to determine the prognosis of canine and it was graded poor (Table 1)[8–10].

2.2 Treatment Objectives

The etiology behind the chief complaint of the patient was the impacted maxillary canine, which the patient was unaware of because of the presence of retained deciduous canine. The patient was educated regarding the likely consequences of an impacted tooth and the difficulty index graded for her impacted canine. However, the patient's will to maintain her natural tooth despite the unfavorable position of the impacted canine prompted

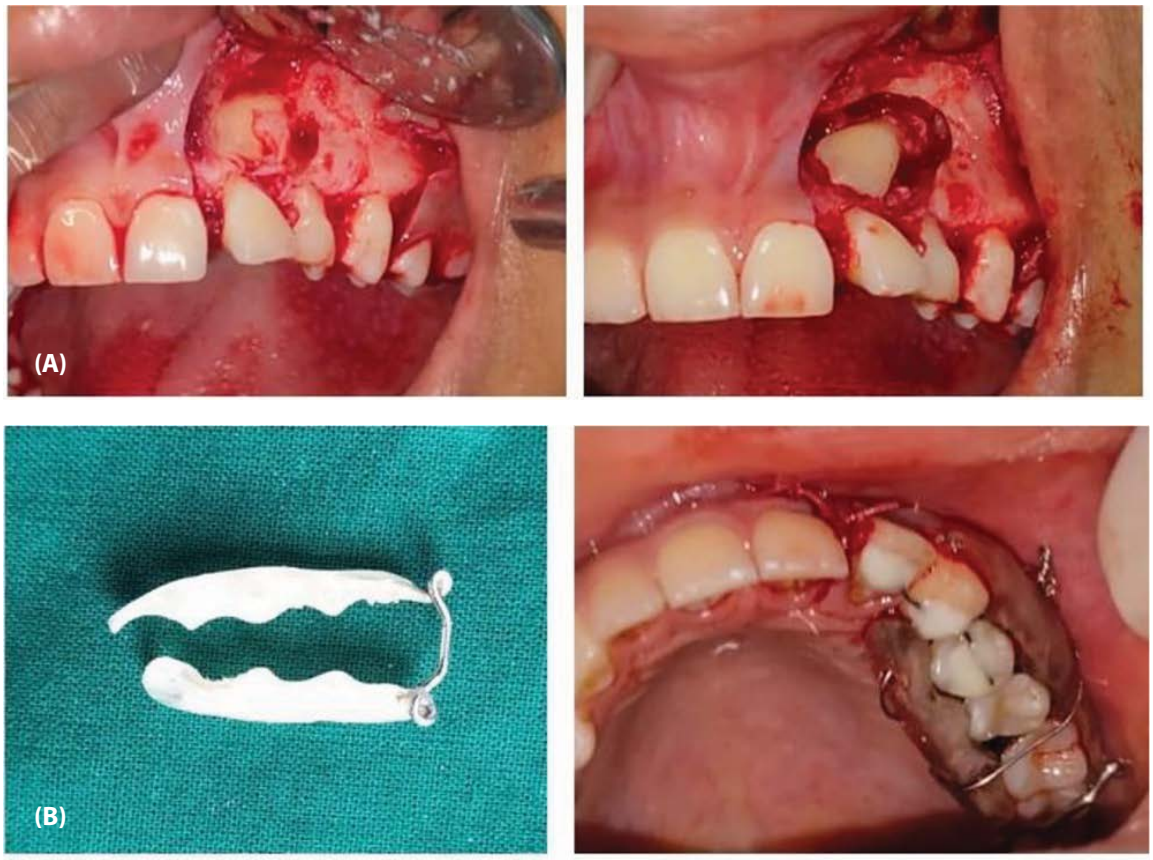


Figure 2. **(A)** Surgical procedure. **(B)** Customized splint for stabilization of repositioned canine tooth #23.

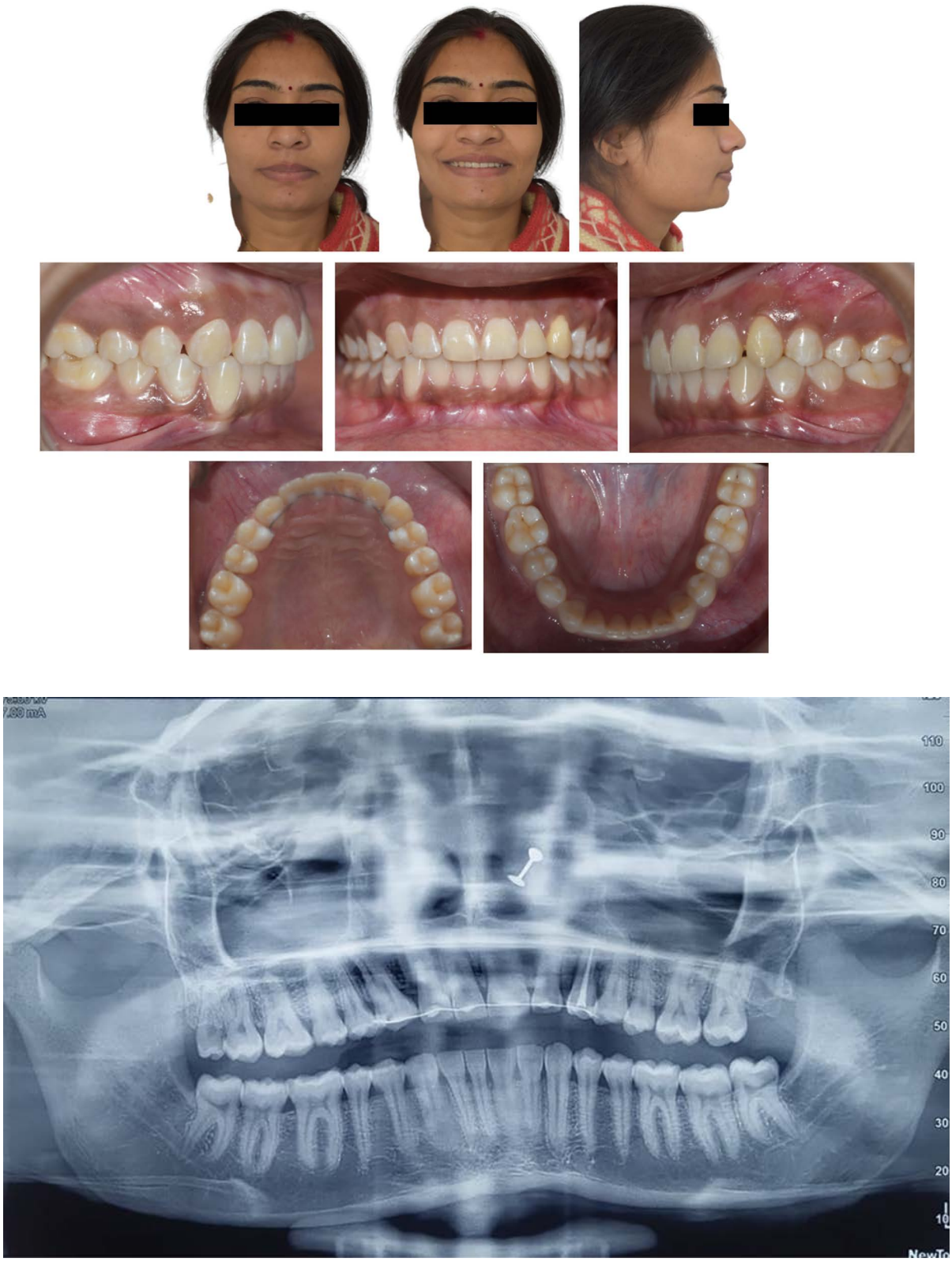


Figure 3. **(A)** Post-treatment photographs. **(B)** Post-treatment OPG.

Table 2. Pink aesthetic score for auto-transplanted canine, with contralateral canine as reference tooth

Variables	Score	Inference (w.r.t reference tooth)
Mesial papilla	1	Incomplete
Distal papilla	2	Complete
Level of soft tissue margin	2	No discrepancy
Soft tissue contour	2	Natural
Alveolar process deficiency	2	None
Soft tissue colour	2	No difference
Soft tissue texture	2	No difference
Total Score	13	good aesthetic outcome

the clinical team to evaluate the feasibility of auto-transplantation.

2.3 Treatment plan

As an interdisciplinary approach, the case was discussed conjointly with the oral and maxillofacial surgery team. The horizontal position of the canine with crown present labially and roots apical to root apices of premolars favored a successful surgical avulsion of the tooth through a labial approach. The possibility of extracting the impacted tooth without sectioning favored auto-transplantation as a therapeutic approach for the patient.

2.4 Treatment Progress

The surgical procedure along with the related complications was explained to the patient and written informed consent was obtained. It was planned to bond the maxillary arch following canine auto-transplantation, with the aim of correcting angulation and inclination of the maxillary left lateral incisor only. The presence of retained deciduous canine maintained the space for the permanent canine, however CBCT revealed that the permanent canine was 1.5mm and 2mm large mesiodistally and buccopalatally than the deciduous canine. The length of the permanent canine was 21.3mm, which was 7.4mm longer than the deciduous canine. Socket preparation was planned to receive the retrieved impacted tooth, in the buccopalatal dimension surgical widening of the socket was planned, however in the mesiodistal dimension it was planned to reduce the mesial contact of the permanent tooth to match the space available. The space present mesial to lateral incisor will be closed orthodontically and will restore the reduced dimension of the permanent canine. Extraction defect produced apical to the deciduous canine would accommodate the longer root of the permanent canine.

The surgical procedure was planned according to the technique described by Andreasen *et al.*,[11]. 2gm oral amoxicillin 1 hr before surgery provided the necessary antibiotic prophylaxis. Oral antisepsis was obtained using 0.2% chlorhexidine mouthwash. A trapezoidal full-thickness mucoperiosteal flap with a crevicular and vestibular incision from the distal aspect of the left maxillary central incisor to the mesial aspect of the second premolar was raised. The labial surface of the canine crown was visible upon flap reflection (Figure 2). The crown was exposed using a ball insert on the sonic handpiece, pericoronal tissue was removed and the tooth was luxated and removed from the ectopic alveolus using straight forceps. The tooth was immersed in 0.9% normal saline solution in a sterile container. The mesial contact area of the canine was reduced to match the mesiodistal dimensions as planned and an extraoral root canal treatment was performed. Meanwhile, the retained deciduous canine was extracted and the socket was prepared.

After the canine was placed in its final position in the socket, the flap was sutured back and splinted in position using a custom-made splint (Figure 2). The splinting was reinforced using a 0.016" inch SS wire secured over the occlusal surface using composite resin. Sutures were removed after a week and the splint was removed after 4 weeks and bonding of the upper arch was performed using a 0.022" MBT appliance.

Post-surgical orthodontic objectives were obtained and the patient was debonded after 4 months. Bonded lingual retainers were used as a mode of retention retention (Figure 3).

3. Discussion

The preferred treatment for impacted canines is orthodontic guidance following surgical exposure. This procedure maintains tooth vitality along with healthy periodontal support. Prognosis however depends on the position and angulation of the impacted canine, the patient's age and cooperation, available space in the

arch, and the presence of keratinized gingival tissue[3]. Autotransplantation is a viable treatment option in many clinical situations such as an impacted tooth with a high difficulty index, traumatic avulsion, and replantation of teeth with poor prognosis[12]. The advantages of autotransplantation, compared to prosthetic rehabilitation, are improved aesthetics, function, and mastication; in addition, the alveolar bone volume is preserved, due to maintained proprioception and physiological stimulation of the periodontal ligament[5]. However, it may also culminate into unfavorable outcomes like pulp necrosis and infection, replacement resorption, and arrest of root development of immature teeth[13].

Successful periodontal tissue healing, with a normal PDL space and the appearance of uninterrupted lamina dura on radiographic evaluation, are critical measures for the success of a transplanted tooth. The success rate is higher for teeth with immature apex and the presence of open apex is one of the key factors for clinical success[12–14]. A minimally traumatic surgical operation is the key to successful autotransplantation. Specifically, in the process of extraction, extraoral storage, and replantation, great care should be taken to protect periodontal ligament and pulp vitality[15]. Another important factor that has a profound influence on the success of autotransplantation is the preparation of the recipient bed, utmost care must be taken to avoid thermal damage to the bone as much as possible and to contour the recipient's alveolar bone to be compatible with the donor's tooth. An appropriate amount of cooling liquid must be present at the tip of the drill to decrease the heat produced as a result of friction[16]. The timing of orthodontic treatment following autotransplantation is crucial. The conclusions of studies regarding the timing of orthodontic treatment initiation have been conflicting. Tsukiboshi *et al.,*[5] suggested that orthodontic treatment could be initiated 1 month after surgery, whereas Bauss *et al.,*[17] carried out orthodontic treatment 3–6 months after surgery. Paulsen and Andreasen[18] proposed that 6 months post-transplantation was appropriate, and Czochrowska *et al.,*[19] initiated orthodontic adjustment at 6–9 months after transplantation.

Adequate aesthetics with the aligning impacted canines can also be an important factor when considering treatment options. Furhauser and colleagues presented a rating matrix for evaluating the soft tissue, Pink Esthetic Score (PES). Seven variables are assessed with a 2–1–0 score, with 2 being the best and 0 being the worst score[20]. Following completion of orthodontic therapy, PES for the transplanted tooth in our patients was 13 (Table 2), indicating good aesthetic outcome.

4. Conclusion

Maxillary canine impaction, which was graded poor prognosis for orthodontic guidance was successfully resolved with auto-transplantation. Surgical techniques with atraumatic removal of the impacted tooth have increased the success rate and esthetic outcome of auto-transplanted teeth. Individual success is still difficult to predict and the patient must be informed of the potential for failure and associated risks before undergoing such a procedure.

5. References

1. Grisar K, Nys M, The V, Vrielinck L, Schepers S, Jacobs R et al. Long-term outcome of autogenously transplanted maxillary canines. Clin Exp Dent Res. 2019; 5(1):67-75. https://doi.org/10.1002/cre2.159 PMid:30847235 PMCid: PMC6392819
2. Patel S, Fanshawe T, Bister D, Cobourne MT. Survival and success of maxillary canine autotransplantation: A retrospective investigation. Eur J Orthod. 2011; 33(1):298-304. https://doi.org/10.1093/ejo/cjq071 PMid:20819783
3. Becker A. Orthodontic treatment of impacted teeth. 3rd ed. Chichester (UK): Wiley-Blackwell; 2012. https://doi.org/10.1002/9781118709641
4. Bishara SE. Impacted maxillary canines: A review. Am J Orthod Dentofac Orthop. 1992; 101:159-71. https://doi.org/10.1016/0889-5406(92)70008-X
5. Tsukiboshi M. Autotransplantation of teeth: Requirements for predictable success. Dent Traumatol. 2002; 18:157-80. https://doi.org/10.1034/j.1600-9657.2002.00118.x PMid:12442825
6. Yu HJ, Qiu LX, Wang XZ. Long-term follow-up of autogenous canine transplants with application of guided bone regeneration. Int J Oral Maxillofac Surg. 2014; 43(3):355-61. https://doi.org/10.1016/j.ijom.2013.08.019 PMid:24148825
7. Fournier A, Turcotte J, Bernard C. Orthodontic considerations in the treatment of maxillary impacted canines. Am J Orthod. 1982; 81:236-9. https://doi.org/10.1016/0002-9416(82)90056-2
8. Ericson S, Kurol J. Radiographic examination of ectopically erupting maxillary canines. Am J Orthod Dentofacial Orthop. 1987; 91:483-92. https://doi.org/10.1016/0889-5406(87)90005-9

9. Power SM, Short MB. An investigation into the response of palatally displaced canines to the removal of primary canines and an assessment of factors contributing to a favourable eruption. Br J Orthod. 1993; 20:215-23. https://doi.org/10.1179/bjo.20.3.215 PMid:8399054
10. Chauhan D, Datana S, Agarwal SS, Vishvaroop, Varun G. Development of difficulty index for management of impacted maxillary canine: A CBCT-based study. Med J Armed Forces India. 2022; 78:61-7. https://doi.org/10.1016/j.mjafi.2020.03.013 PMid:35035045
11. Andreasen JO, Paulsen HU, Yu Z, Ahlquist R, Bayer T, Schwartz O. A long-term study of 370 auto transplanted premolars. Part I. Surgical procedures and standardized techniques for monitoring healing. Eur J Orthod. 1990; 12:3-13. https://doi.org/10.1093/ejo/12.1.3 PMid:2318261
12. Kim MS, Lee HS, Nam OH, Choi SC. Autotransplantation: A reliable treatment modality for severely malpositioned teeth. J Clin Pedia Dent. 2017; 41(5):388-91. https://doi.org/10.17796/1053-4628-41.5.388 PMid:28872984
13. Almpani K, Papageorgiou SN, Papadopoulos MA. Autotransplantation of teeth in humans: A systematic review and meta-analysis. Clin Oral Investig. 2015; 19:1157-79. https://doi.org/10.1007/s00784-015-1473-9 PMid:25903060
14. Kafourou V, Tong HJ, Day P, Houghton N, Spencer RJ, Duggal M. Outcomes and prognostic factors that influence the success of tooth autotransplantation in children and adolescents. Dent Traumatol. 2017; 33:393-9. https://doi.org/10.1111/edt.12353 PMid:28612428
15. Andreasen JO. Effect of extra-alveolar period and storage media upon periodontal and pulpal healing after replantation of mature permanent incisors in monkeys. Int J Oral Surg. 1981; 10:43-53. https://doi.org/10.1016/S0300-9785(81)80007-5
16. Benington IC, Biagioni PA, Briggs J, Sheridan S, Lamey PJ. Thermal changes observed at implant sites during internal and external irrigation. Clin Oral Implants Res. 2002; 13:293-7. https://doi.org/10.1034/j.1600-0501.2002.130309.x PMid:12010160
17. Bauss O, Rohling J, Schwestka-Polly R. Prevalence of traumatic injuries to the permanent incisors in candidates for ortho-dontic treatment. Dent Traumatol. 2004; 20:61-6. https://doi.org/10.1111/j.1600-4469.2004.00230.x PMid:15025687
18. Paulsen HU, Andreasen JO. Eruption of premolars subsequent to autotransplantation. A longitudinal radiographic study. Eur J Orthod. 1998; 20:45-55. https://doi.org/10.1093/ejo/20.1.45 PMid:9558764
19. Czochrowska EM, Stenvik A, Bjercke B, Zachrisson BU. Outcome of tooth transplantation: survival and success rates 17-1 years post-treatment. Am J Orthod Dentofacial Orthop. 2002; 121:110-9. https://doi.org/10.1067/mod.2002.119979 PMid:11840123
20. Furhauser R, Florescu D, Benesch T, Haas R, Mailath G, Watzek G. Evaluation of soft tissue around single-tooth implant crowns: the pink esthetic score. Clin Oral Implants Res. 2005; 16:639-44. https://doi.org/10.1111/j.1600-0501.2005.01193.x PMid:16307569