

Precision Planning in Autotransplantation of Teeth by Using CBCT – An Effective Prosthetic Approach

Maharjan S¹, Shrestha P²

¹Dental Surgeon, Department of Prosthodontics and Maxillofacial Prosthetics, KIST Medical College, Lalitpur, Nepal

²Associate Professor, Department of Prosthodontics and Maxillofacial Prosthetics, KIST Medical College, Lalitpur, Nepal

Abstract

Auto transplantation can be considered a valid and predictable treatment option for rehabilitating patients with permanent teeth loss when a suitable donor tooth is present. Once thought to have unfavourable prognosis, auto transplantation has achieved high success rates and is an outstanding option for tooth replacement. This case report illustrates autotransplantation of a fully developed third molar in the place of a first molar with the guidance of CBCT (Cone Beam Computed Tomography). The added advantages of CBCT helps to make the process of autotransplantation more predictable, easier and less time consuming which will encourage many dental surgeons to add this treatment to their armamentarium.

Key words: Autotransplantation; CBCT; Fully developed roots; Third molar.

Introduction

Autotransplantation or Autogenous tooth transplantation refers to transplantation of teeth from one site to another in the same individual, involving transfer of embedded or impacted or erupted teeth into extraction sites or into surgically prepared sockets.¹

This treatment is indicated in situations to manage congenitally missing teeth, movement of impacted or severely ectopic teeth, premature loss of permanent dentition (severe caries, trauma, iatrogenic damage, developmental abnormalities), periodontal disease, endodontic failure, growing patient correcting discrepancies between arches and when a suitable donor tooth is available.^{2, 3, 4}

The first reported case of autotransplantation of teeth was in 1950s where third molars were autotransplanted into a first molar position,⁵ since then many articles have been published on this treatment modality. Although many practitioners are familiar with the techniques, these procedures have gained little place in the armamentarium of the general dentist despite its many advantages.¹ A successfully transplanted teeth can function like a totally normal teeth⁶ and offers improved aesthetics, arch form, dentofacial development, mastication and speech and arch integrity.⁴ The total cost of treatment is normally lower than other treatment modalities including dental implants, prosthetic restoration, and/or orthodontic space closure.^{4,7} Formation of a functional periodontal ligament can aid with the continued eruption of the tooth, preservation of the volume of alveolar bone and arch form, as well as maintenance of proprioception to aid masticatory function.^{8,9}

This is a viable treatment option for replacing missing teeth, but as with any surgery, there are complications that can arise including

*Corresponding Author

Dr. Prabhat Shrestha
Associate Professor
Department of Prosthodontics and Maxillofacial
Prosthetics
KIST Medical College, Lalitpur, Nepal
Email: prabhatshresthadr@gmail.com

pulpal necrosis, inflammatory and replacement resorption, poor periodontal healing and ankyloses.⁸ These are complications that can be prevented or decreased by proper planning and following the right protocols

This is a case report showing the treatment planning of autotransplantation of teeth with CBCT (Cone Beam Computed Tomography) imaging, which will aid to reduce any forthcoming complications in the procedure.

Case report

A 35 years old male patient who was residing abroad and was visiting Nepal for limited time presented with pain and swelling with respect to lower right second molar 47 which was previously endodontically treated twelve years ago. An intraoral periapical radiograph showed that the affected tooth had periapical radiolucency, under obturated canals and furcation involvement. Re root canal treatment was performed and even after multiple sessions of treatment and antibiotic therapy, the pain still persisted. The patient was finally advised for the removal of affected tooth due to poor prognosis.



Figure 1: Showing RCT treated 47 and partially impacted 48

The patient wanted to replace the extracted teeth before he returning abroad so implants

and tooth transplantation were given as options to manage the patient's problem as the patient has a partially impacted lower right third molar teeth which could be used as a donor tooth (Fig. 1). The option of fixed partial dentures after straightening the third molar was ruled out due to time constraints. All the risks and benefits of the above procedures were detailed to the patient. The patient opted for autotransplantation of the third molar in place of the extracted second molar instead of implants.

CBCT was advised to explore the cause of failure of the root canal treatment and to plan for further treatment. CBCT scan showed a crack line on mesiobuccal root of 47 which was diagnosed as the cause of failure (Fig. 2).



Figure 2: Arrow showing crack line in mesiobuccal root

Planning

Planning for the autotransplantation site and teeth was done with Planmeca Romexis viewer software.

The mesiodistal dimensions of 47 and 48 were 9.87mm and 9.06mm respectively and buccolingual width was 9.07mm and 9.0mm respectively at the clinical crown root junction (Fig. 3).

The root length of 47 and 48 was 11.51mm and 10.08 mm respectively (Fig. 4).

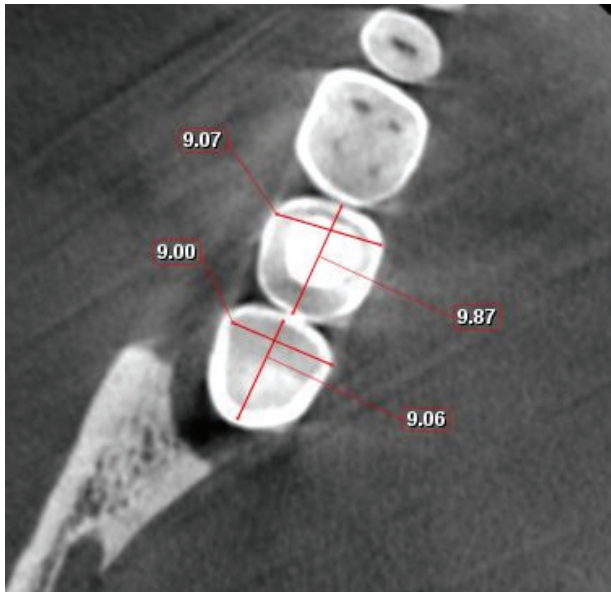


Figure 3: Measuring dimensions of donor tooth and recipient site

For root canal purpose of 48 the canal configuration was checked. 48 had two roots with 2 canals, the mesial canal having a 120.22° angle (Fig. 5).

Surgical Technique

After all aseptic measures were taken, local anaesthesia (lidocaine with 2% adrenaline) was administered. Once sufficient anaesthesia was obtained, the donor tooth (48) was carefully removed to ensure minimal trauma to the

periodontal ligament. Scaling was done on donor tooth to remove calculus on the crown, by holding the crown with a sterile gauze piece keeping in mind not to touch the root portion. Endodontic treatment was performed using protaper files (Dentsply, Maillefer, Switzerland).

The donor tooth was obturated with protaper gutta-percha points with lateral condensation (Fig. 6) and the access opening was restored with glass ionomer cement. The donor tooth was then stored in normal saline and extraction of 47 was performed (Fig. 7).

Granulation tissue was scraped with a curette and the recipient socket prepared by removing the inter radicular bone with bone rongers to accommodate the curved root of 48. The tooth was then placed in the recipient socket. Minimal delay between extraction and transplantation was important to ensure maintenance of periodontal membrane vitality.

Once the transplanted tooth was in the socket with light pressure; occlusion was checked using a bite paper and the high points were adjusted using a high-speed finishing bur extraorally. The tooth was kept slightly infraocclusion level. When proper positioning was obtained, the tooth was stabilized with silk sutures for 1 week (Fig. 8).

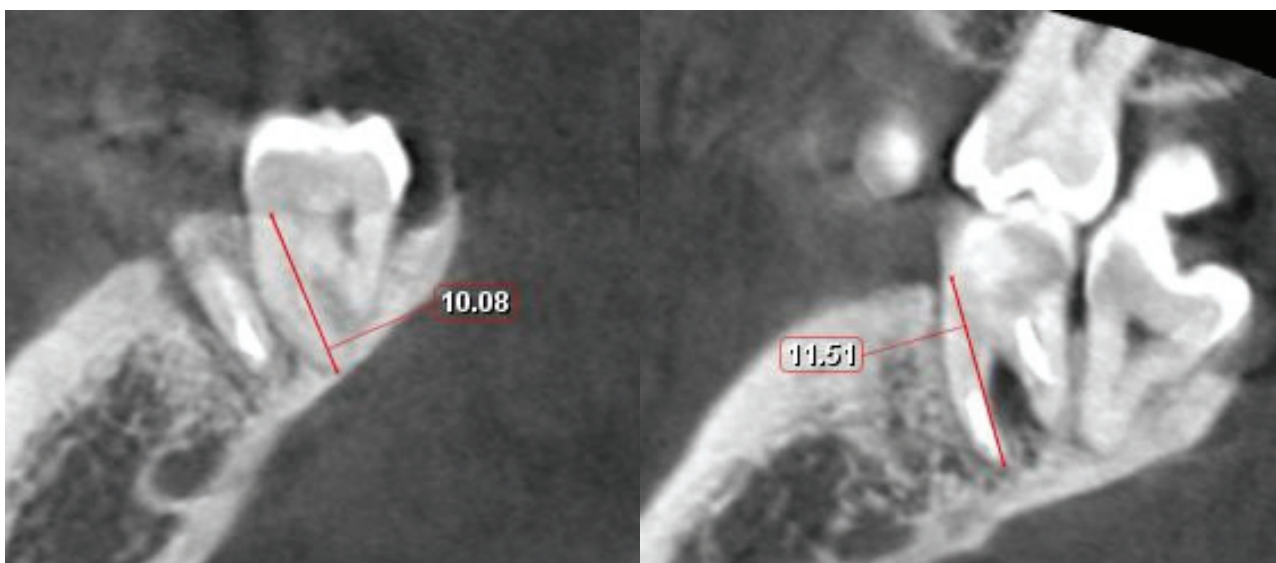


Figure 4: Measurement of height of root 48 and height of recipient site 47

Post-operative instructions similar to those following the removal of an impacted tooth were given. A soft diet was advised for a couple of days after surgery and the patient was instructed to avoid mastication on the transplanted side. Oral hygiene maintenance was given along with instruction to rinse with chlorhexidine gluconate mouthwash as an adjunct to oral hygiene. Patients was also prescribed post-operative antibiotics (Amoxicillin 500mg TDS for 5 days) as a precautionary measure as the socket contained a lot of granulation tissue and ibuprofen for pain management.

Recall after 1 week was done, the teeth had good healing and tissue adaptation to the cemento enamel junction. The suture was removed and splinting was done with Ribbond (Ribbond, Inc. Seattle, Washington, USA) and composite resin (3M ESPE Filtek™ Z250) due to presence of slight mobility of the teeth (Fig. 11).

Second recall was done in two weeks' time, the GIC restoration was replaced with composite restoration. and IOPA was taken which showed new bone formation around the transplanted teeth (Fig. 12). The patient was free from any pain and discomfort. IOPA after a year shows proper bone formation around the donor and no signs of resorption (Fig. 13).



Figure 5: Measurement of angulation of root of 48



Figure 6: root canal of 48 showing the technique of holding the crown with a moist gauze piece



Figure 7: extraction of 47 showing granulation tissue and calculus on roots



Figure 8: Suturing of 48 in socket of 47



Figure 9: IOPA at the day of implantation



Figure 12: IOPA after splinting 2 weeks' recall



Figure 10: one-week recall



Figure 13: After 1 year follow up, IOPA showed proper bone formation absence of resorption



Fig. 11 splinting of 48 to 46 with fibre reinforced composite resin

Discussion

The early autotransplantation procedures during the 1950's results suggested a 50% initial failure rate and there was little widespread acceptance of this technique¹ but now failure rate of autotransplanted teeth to be as low as 2.0%.⁸ This rise in success rate is the outcome of following proper protocols acquired over the years. Accurately predicting the prognosis for tooth autotransplantation is important for clinicians to identify the risks before surgery, and also to help them plan the follow-up of such patients.⁶

Martin, K.et al suggested that two dimensional imaging is usually sufficient for radiographic planning of autotransplantation,² but when it comes to autotransplanting teeth with fully formed roots especially third molars, the authors

suggest to use a three dimensional imaging technique (CBCT). The variety of crown forms seen on impacted mandibular third molars make them candidates for transplantation to other molar sites¹⁰ but they may have variable root morphologies. CBCT will help in recipient site preparation with respect to the root morphology of third molars which cannot be predictable otherwise and if incompatibility between root and socket is present then it may become a cause of loss of buccal plate.⁶ CBCT also helps predetermining the number of canals and its configurations of the donor teeth which helps in endodontic treatment therefore quick and predictable root canal treatment can be done extraorally. This will decrease extraoral time for transplantation procedure which is an important factor for success.¹¹

Usually the recipient socket is prepared a little larger than the donor site¹² but in our case we could accurately measure the dimensions of the site and this information suggested that no enlargement of the donor site was needed preventing preparation of an oversized recipient site. The CBCT however showed difference in root morphology of donor root and recipient root so inter-radicular bone of the recipient site had to be modified to accommodate the curved root of 48.

The literature suggests that splinting teeth post-operatively may help reduce instability and decelerate the rate of destruction of the periodontal ligament,² In our case we used sutures for initial stability and to provide close tissue adaptation.¹³ Even after a week the tooth had slight mobility so we used fibre reinforced composite for further stability as we wanted a good initial stability which showed better initial healing than those with a poor initial stability.¹³ the authors decided to provide rigid fixation for 6 weeks due to poor initial stability.^{14,15}

Conclusions

Autotransplantation of mandibular third molars can be a very predictable option to replace missing teeth when thorough planning is done before the surgery and proper protocols are followed. The use of CBCT, can improve planning¹⁶ and hence increase the success rate of this underutilized procedure

References

1. Natiella JR, Armitage JE, Greene GW. The replantation and transplantation of teeth. *Oral Surgery, Oral Med Oral Pathol* [Internet]. 1970 Mar;29(3):397–419. Available from: <https://linkinghub.elsevier.com/retrieve/pii/003042207090143X>
2. Martin K, Nathwani S, Bunyan R. Autotransplantation of teeth: An evidence-based approach. *Br Dent J* [Internet]. 2018;224(11):861–4. Available from: <http://dx.doi.org/10.1038/sj.bdj.2018.432>
3. Almpani K, Papageorgiou SN, Papadopoulos MA. Autotransplantation of teeth in humans: a systematic review and meta-analysis. *Clin Oral Investig* [Internet]. 2015 Jul 24;19(6):1157–79. Available from: <http://link.springer.com/10.1007/s00784-015-1473-9>
4. Mendes RA, Rocha G. Mandibular Third Molar Autotransplantation — Literature Review with Clinical Cases. *Jcda* [Internet]. 2004;70(11):761–6. Available from: <http://www.cda-adc.ca/jcda/vol-70/issue-11/761.html>
5. Miller HM. Transplantation and reimplantation of teeth. *Oral Surgery, Oral Med Oral Pathol* [Internet]. 1956 Jan;9(1):84–95. Available from: <https://linkinghub.elsevier.com/retrieve/pii/0030422056901773>
6. Sugai T, Yoshizawa M, Kobayashi T, Ono K, Takagi R, Kitamura N, et al. Clinical study on prognostic factors for autotransplantation of teeth with complete root formation. *Int J Oral Maxillofac Surg* [Internet]. 2010 Dec;39(12):1193–203. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0901502710002997>

7. Reich PP. Autogenous Transplantation of Maxillary and Mandibular Molars. *J Oral Maxillofac Surg* [Internet]. 2008 Nov;66(11):2314–7. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0278239108010720>
8. Chung W-C, Tu Y-K, Lin Y-H, Lu H-K. Outcomes of autotransplanted teeth with complete root formation: a systematic review and meta-analysis. *J Clin Periodontol* [Internet]. 2014 Apr;41(4):412–23. Available from: <http://doi.wiley.com/10.1111/jcpe.12228>
9. Marques-Ferreira M, Rabaca-Botelho M, Carvalho L, Oliveiros B, Palmeirao-Carrilho E. Autogenous tooth transplantation: Evaluation of pulp tissue regeneration. *Med Oral Patol Oral y Cir Bucal* [Internet]. 2011;16(7):e984–9. Available from: http://www.medicinaoral.com/pubmed/medoralv16_i7_p984.pdf
10. Nilesh K. Case report Autotransplantation of impacted third molar. *KDJ* [Internet]. 2011;34(3):355–7. Available from: https://www.researchgate.net/publication/283514544_Autotransplantation_of_Impacted_Third_Molar/stats
11. Hupp JG, Mesaros S V., Aukhil I, Trope M. Periodontal ligament vitality and histologic healing of teeth stored for extended periods before transplantation. *Dent Traumatol* [Internet]. 1998 Apr;14(2):79–83. Available from: <http://doi.wiley.com/10.1111/j.1600-9657.1998.tb00815.x>
12. Tsukiboshi M. Autotransplantation of teeth: requirements for predictable success. *Dent Traumatol* [Internet]. 2002 Aug;18(4):157–80. Available from: <http://doi.wiley.com/10.1034/j.1600-9657.2002.00118.x>
13. Kim E, Jung J-Y, Cha I-H, Kum K-Y, Lee S-J. Evaluation of the prognosis and causes of failure in 182 cases of autogenous tooth transplantation. *Oral Surgery, Oral Med Oral Pathol Oral Radiol Endodontology* [Internet]. 2005 Jul;100(1):112–9. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1079210404006195>
14. Bauss O, Zonios I, Engelke W. Effect of additional surgical procedures on root development of transplanted immature third molars. *Int J Oral Maxillofac Surg* [Internet]. 2008 Aug;37(8):730–5. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0901502708001781>
15. Teixeira CS, Pasternak B, Vansan LP, Sousa-Neto MD. Autogenous transplantation of teeth with complete root formation: two case reports. *Int Endod J* [Internet]. 2006 Dec;39(12):977–85. Available from: <http://doi.wiley.com/10.1111/j.1365-2591.2006.01170.x>
16. Cross D, El-angbawi A, McLaughlin P, Keightley A, Brocklebank L, Whitters J, et al. Developments in autotransplantation of teeth. *Surg J R Coll Surg Edinburgh Irel* [Internet]. 2013;11(1):49–55. Available from: <http://dx.doi.org/10.1016/j.surge.2012.10.003>