

A Novel Technique to Fabricate a Dental Implant-retained Finger Prosthesis: A Case Report

Anil Kumar Komuravelli*, Soniya Niras, Varsha Joteppa, Gunjan Daphale

Department of Prosthodontics, Crown and Bridge, Saraswati Dhanwantari Dental College, Parbhani, Maharashtra, India.

Abstract

Fingers as organs of manipulation and expression play an important role in function and esthetics. The unfortunate loss of all or part of a finger caused by traumatic amputation many times has a negative impact on physical and psychological well-being of a person. Another problem with the prosthetic replacement of a partially amputated finger is an inadequate retention of the prosthesis. The numerous means by which retention can be enhanced are adhesives, adhesive tape, magnets, and implants. This case report presents the use of osseointegrated dental implants for the retention of finger prosthesis. The possibility of using osseointegrated implant-retained prosthesis offers a real effective alternative for the reconstruction of fingers.

Keywords: Dental implant, Partial finger amputation, Prosthesis, Retention system.

Key message: Restoring self-esteem in the patient and static and functional rehabilitation.

INTRODUCTION

Loss of an organ, such as finger not only affects an individual functionally; the manifestations of such a physical loss leave a psychological trauma to the patient. Total and partial finger amputations are some of the most frequently encountered forms of partial hand loss. The commonest causes of these amputations may include trauma, accident, congenital absence or malformations, work-related accidents with dangerous machinery, road traffic accidents, and animal bites as well as systemic diseases such as diabetes.^[1,2]

The effective management of such cases is a challenge to the maxillofacial prosthodontist. Aesthetic finger prosthesis is an effective treatment option for the restoration of the handicap. However, retention of such prosthesis has always been an area of concern. Osseointegrated implants provide firm retention for prosthesis. Originally, the use of osseointegrated implant technique was limited to a few very select cases. However, it is generally agreed that such retention is more secure than the retention obtained using conventional adhesives or undercuts.^[3,4] In the case report that follows, the replacement of traumatically amputated digit using osseointegrated dental implant-retained prostheses is presented.

CASE REPORT

A 25-year-old male patient reported to the Department of Prosthodontics and Implantology with a chief complaint of

missing middle finger digit till second phalange in the left hand after sustaining a traumatic amputation in an accident at work 1 year back. The loss was till the level of middle interphalangeal joint. The amputated stump presented a well healed site (Figure 1). The patient complained of decreased motor capacity and low self-esteem, which led to reduced social interaction. A bone anchored implant-retained prosthesis was planned for the restoration of the digit and a schedule for the treatment was planned. The patient's consent for the treatment was obtained.

Following the clinical and radiographic examination of the reminiscent stump (Figure 2), a treatment proposal was elaborated. A pre-operative impression was made to record the amputated finger and a stump mouldage was made with Type V dental stone. The width and length of the implant were determined through radiographic evaluation. The surgical procedure commenced with the reflection of an ellipsoid flap under local anesthesia (ring block). Osteotomy site was prepared in the medullar canal of the middle phalange of the

Address for correspondence: Dr. Anil Kumar Komuravelli,
Department of Prosthodontics, Crown and Bridge, Saraswati Dhanwantri
Dental College, Parbhani - 431 401, Maharashtra, India.
Email: draniilk4@gmail.com

Received: Jun. 12, 2023; **Accepted:** Jul. 06, 2023; **Published:** Jul. 30, 2023

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

How to cite this article: Komuravelli AK, Niras S, Joteppa V, Daphale G. A Novel Technique to Fabricate a Dental Implant-retained Finger Prosthesis: A Case Report. J Res Adv Dent 2023;14(5):1-4.

Access this article online

Website:
www.jrad.co.in

DOI:
<https://doi.org/10.53064/jrad.2022.14.5.400>

amputated finger. An intraosseous implant measuring 4.2 mm in diameter and 13 mm in length (MIS implant) was inserted into the middle phalanx of the middle finger. The flap was approximated and sutured. Radiographic evaluation after 6 months confirmed the osseointegration around the implant with no evidence of infection or any other complications (Figure 3). The healing abutment was placed in the second stage surgery. The impression of the right middle finger was done using irreversible hydrocolloid and poured in wax to obtain the wax pattern of the right middle finger. Modifications were made on this pattern to simulate it like the middle finger for the left hand.

The pattern was flaked using dental stone. After dewaxing procedure, the mould was packed with medical grade silicone after precise shade selection. Appropriate shades were chosen and the colors were added to the mold in the related areas. The base color silicone and further applications of localized swatch color were applied for the best color match possible. The moulds were closed following this step and the curing process was performed according to the

manufacturer's instructions. The prosthesis was removed gently after the molds had been opened and it was trimmed and finished.

A ball and O-ring attachment was chosen for retention of the finger prosthesis. The finger prosthesis was hollowed from inside. An acrylic housing with retention grooves was fabricated and attached in the hollowed out prosthesis using silicone. This acrylic housing would further hold the O-ring attachment. The ball attachment was secured to the implant (Figure 4) and the O-ring was incorporated into the acrylic portion of finger prosthesis (Figure 5).

For that purpose, the O-ring was placed over the ball attachment with a rubber separator in between to prevent the contact of acrylic with the tissues. Autopolymerizing acrylic resin was added in the hollowed prosthesis and O-ring was picked up by the acrylic housing after the initial set. All the excess acrylic was then trimmed and finished. The finger prosthesis retained with the help of ball and O-ring attachment was thus delivered to the patient (Figure 6a and b). Instructions for home care were



Figure 1: Pre-operative radiograph

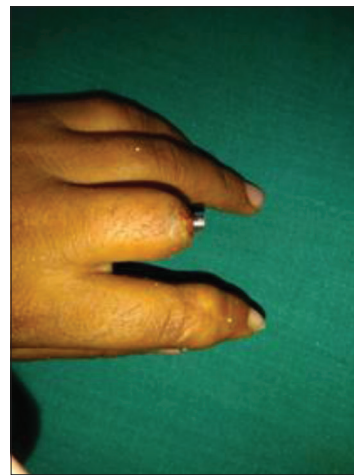


Figure 3: Ball attachment secured to the implant



Figure 2: Post operative radiograph after six months



Figure 4: Pre-operative amputated stump with healed site

given to the patient, including the debridement of the skin and cleaning of the removable prosthesis with a soft toothbrush and soap under flowing warm water.

After 3 months, further clinical and radiographic reviews were performed and no complications were found. The skin was healthy and the retention of the attachments was unchanged. The patient said that he had not encountered any problems or unwanted detachments and he was happy with the results. A final follow-up session was carried out 6 months after the second surgical procedure and it was seen that the skin around the attachments was healthy, the prosthesis was in good shape, and there was no need for any repairs.

DISCUSSION

Loss of a finger usually causes functional as well as psychological consequences. Even if the remaining stump is adequate for day to day functions, poor appearance remains the main concern for the patient. The reconstruction of an amputated finger may be performed by surgical procedures but a digital prosthesis provides an esthetic and less invasive

treatment protecting the reminiscent stump. Several materials and techniques have been used in the process of prosthetic rehabilitation, such as resin and silicone, which present some advantages and disadvantages; nevertheless, they are still the most frequently used.^[5,6]

Originally, the use of osseointegrated implant technique was limited to a few very select cases. Lundborg *et al.* (1997) suggested that for grip function and strength, a level comparable to the one measured for the uninjured hand was reached.^[7] Sierakowski *et al.* also reported that the three patients in their study experienced some kind of pain, described as night pain, cold intolerance, or pain on activity, but this situation did not prevent them using the prostheses.^[8] Aydin *et al.* reported the use of osseointegrated dental implants with custom-designed attachments for retention of digital prosthesis.^[9]

Retention is the main determinant factor for the success of prosthetic restoration of any part of the body. It is essential for the aesthetic attribute, functionality, and comfort, thus enhancing the quality of life of the patient. It can be improved by different methods including the use of rings at the restoration – skin junction and modification of the stump mould for a better vacuum effect.^[10]

In the present case, the O-Ring system was indicated due to its practicality, as it does not require the melting phase done in the laboratory, and low cost. Factor II brand medical grade silicone was employed for fabrication of the prosthesis. It has high tear strength, good electrical, and thermal stability, is easy to pour, and possesses remarkable color stability. It cures at room temperature and does not require any special equipment for processing. It maintains its dimensional stability after curing. The grooved acrylic housing interlocked with the silicone provided adequate retention. So far, the patient uses his prosthesis during his day-to-day work and social activities without any problems and he is happy with the appearance.



Figure 5: O ring incorporated into the acrylic portion



Figure 6: (a and b) Finger prosthesis ball and O ring attachment

CONCLUSION

Thus, the use of osseointegrated dental implants to retain finger prosthesis shows to be a viable method for restoring amputated fingers as it provides comfort, stability of function, and generally excellent cosmetic results.

REFERENCES

1. Beasley RJ. General considerations in managing upper-limb amputations. *Orthop Clin North Am* 1981;12:743-9.
2. Michael J. Partial-hand amputation: Prosthetic and orthotic management. In: Bowker JH, Michael JW, editors. *Atlas of Limb Prosthetics: Surgical, Prosthetic and Rehabilitation Principles*. St. Louis: CV Mosby; 1992. p. 217-26.
3. Doppen P, Solomons M, Kritzing S. Osseointegrated finger prostheses. *J Hand Surg Eur* 2009;34:29-34.
4. Manurangsee P, Isariyawut C, Chatuthong V, Mekraksawanit S. Osseointegrated finger prosthesis: An alternative method for finger reconstruction. *J Hand Surg* 2000;25:86-92.
5. Cabibihan JJ. Patient-specific prosthetic fingers by remote collaboration-a case study. *PLoS One* 2011;6:e19508.
6. Goiato MC, Mancuso DN, Ferreira PP, dos Santos DM. Finger prosthesis: The art of reconstruction. *J Coll Physicians Surg Pak* 2009;19:670-1.
7. Lundborg G, Brnemark PI, Rosén B. Osseointegrated thumb prostheses: A concept for fixation of digit prosthetic devices. *J Hand Surg* 1996;21:216-21.
8. Sierakowski A, Watts C, Thomas K, Elliot D. Long-term outcomes of osseointegrated digital prostheses for proximal amputations. *J Hand Surg Eur Vol* 2011;36:116-25.
9. Aydin C, Karakoca S, Yilmaz H. Implant-retained digital prostheses with custom-designed attachments: A clinical report. *J Prosthet Dent* 2007;97:191-5.
10. Shanmuganathan N, Maheswari MU, Anandkumar V, Padmanabhan TV, Swarup S, Jibran AH. Aesthetic finger prosthesis. *J Indian Prosthodont Soc* 2011;11:232-7.