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Consealing Amputation- A Case Report on Finger Prosthesis

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KEY CLINICAL MESSAGE:

Customized removable silicone finger prostheses reinforced with fiberglass tape offer a durable, aesthetic, and non-invasive solution for restoring function and appearance in patients with distal phalangeal amputations, especially those unwilling to undergo surgery**.**

Abstract

Fingertip amputations, particularly involving the distal phalanges, represent a common yet debilitating form of hand injury that severely impacts manual function, aesthetics, and psychosocial well-being. One growing cause of such injuries is trauma from motorcycle spoke wheels during improper cleaning practices. This case report outlines the prosthetic rehabilitation of a 23-year-old male patient with an Allen's Level IV partial amputation of the left index finger. A novel approach tired hereby incorporating fiber reinforced glass tape during the prosthesis fabrication process to enhance structural strength, achieve aesthetic realism, and ensure functional retention post-insertion. This highlights the value of customized silicone finger prostheses as a viable non-invasive solution for restoring aesthetics and basic hand function in patients averse to surgical options.

Keywords: Amputation, Fiber-Glass Tape, Index Finger, Silicone Prosthesis.

Introduction

The fingertips are the primary contact point for the upper extremities during exploratory and manipulative tasks, playing a vital role in fine motor skills and sensory perception. Due to this critical function, they are highly susceptible to injury (1). The term "amputation," originating from the Latin word amputare (meaning "to excise" or "to cut out"), is defined as the removal of part or all of a body part covered by skin (Online Medical Dictionary) (2). Finger and partial finger amputations are among the most commonly occurring forms of partial hand loss (3). Notably, injuries caused by motorcycle spoke wheels have become more frequent due to the growing use of motorcycles and unsafe cleaning practices. Such accidents often result in amputations, as the crushing, shearing, and thermal damage inflicted by the high-speed spokes leave the fingertips beyond reconstruction (4). Individuals who experience finger amputations may suffer a significant decline in hand functionality, accompanied by social and psychological distress. These limitations negatively impact their overall quality of life (5). The choice of treatment for fingertip injuries depends on factors such as the extent of tissue loss, the condition of the remaining bone, and the involvement of other fingers (6). Various microsurgical techniques including toe-to-hand transfer, foot lengthening procedures, and osteo-cutaneous flaps provide options for reconstructing lost or missing phalanges (7). For patients who were reluctant to undergo microsurgical procedures, standard prosthetic digits made from silicone or acrylic resin offer an alternative solution. These prosthetics can be secured using implants or mechanical methods (8). Removable silicone prostheses, provide a more natural appearance, though their functional benefits remain minimal.

This case report presents the use of a removable silicone finger prosthesis to conceal a traumatically partially amputated index finger.

Case report

A 23-year-old male patient visited the Department of Prosthodontics and Crown and Bridge at Tamil Nadu Government Dental College and Hospital, Chennai, with a primary concern of a partially missing left index finger, leading to both aesthetic and functional impairment.

He reported a history of injury sustained a year ago due to an unsafe bike-cleaning process, where his left index finger was caught in the spokes of a motorcycle wheel. Clinical examination revealed a well-healed, partially amputated left index finger, (Figure 1a,1b). Provisionally diagnosed as traumatic partial amputation of left index finger. Differential diagnosis- auto amputation due to infection, Finger-tip avulsion.

Fig 1a, 1b Amputated finger of the patient with application of petroleum jelly before impression making.

Based on CT findings this condition has been diagnosed as traumatic partial amputation of left index finger and are classified under Allen's Level IV defect, involving the complete distal phalanx. The remaining stump is suitable for a dental implant of size 3.8 × 11.5 mm. The patient was informed about available treatment options, including an implant-retained silicone prosthesis and a removable silicone prosthesis. However, he was

reluctant to opt for the implant-retained prosthesis. Instead, he decided to proceed with the removable silicone prosthesis.

A polythene box of adequate width was selected to accommodate the patient's hand, and petroleum jelly was applied to counteract the exothermic reaction of the plaster. The box was half-filled with Type 2 dental plaster, and the patient was asked to place their left hand over the plaster. Irreversible hydrocolloid material was then poured over the hand, reinforced with gauze impregnated with a thin consistency of Type 2 dental plaster (Figure-2a,2b,2c).

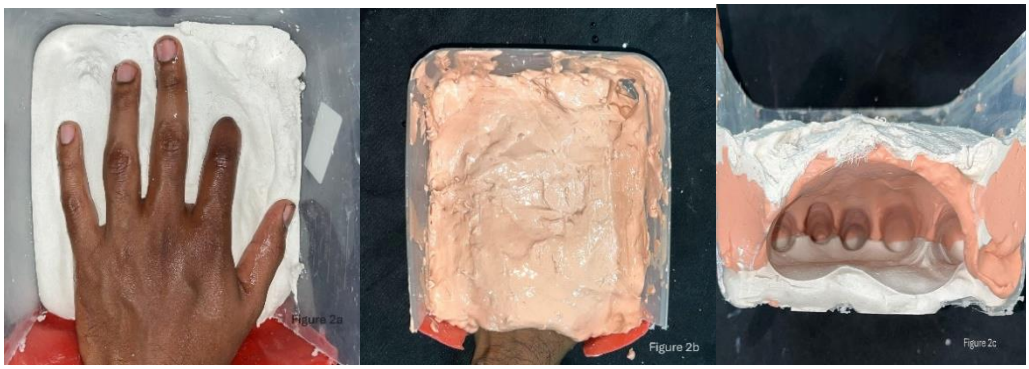

Fig 2a, 2b, 2c. Impression making with Irreversible hydrocolloid material, reinforced with gauze impregnated with a thin consistency of Type 2 dental plaster.

Once the impression was secured, it was poured with Type 3 dental stone (Figure- 3a,3b). A second impression was made using a cone shape tray fashioned from modelling wax, filled with irreversible hydrocolloid. The patient was instructed to insert their amputated index finger into the impression. After setting, the impression of the stump was poured using Type 4 dental stone, and both casts were obtained.

An appropriate donor was selected, and the impression of the donor's left index finger was taken using the same technique. Instead of making a cast, the impression was directly poured with liquid modelling wax to create a wax pattern. A hollow structure was achieved by pouring the liquid wax along the sides of the impression and allowing it to set. After complete setting, the wax pattern was carefully removed, adjusted to match the patient's right index finger, and it was placed in the full hand cast for height verification relative to adjacent fingers.

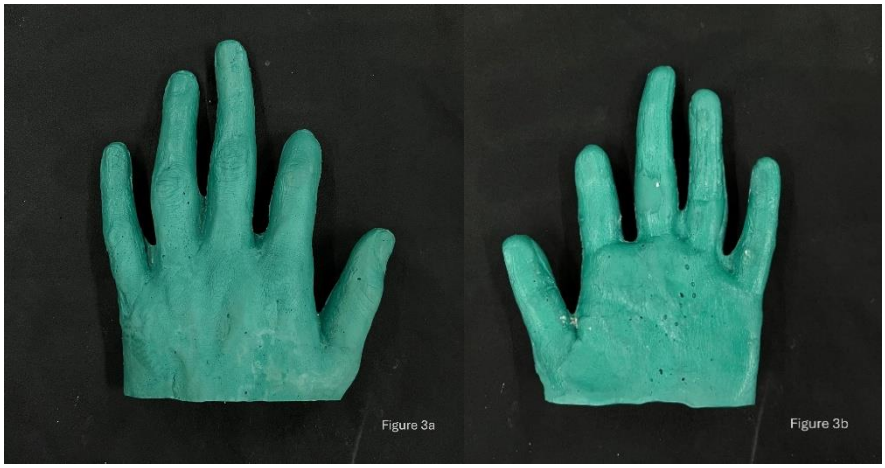

Fig :3a, 3b. Cast poured with Type 3 dental stone

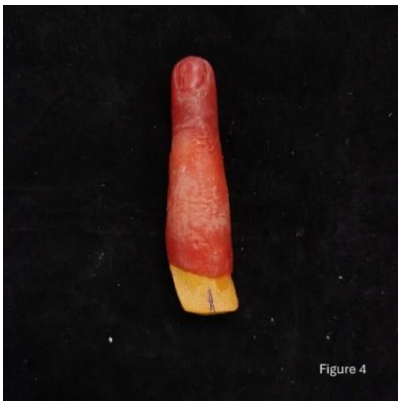

Fig 4. Wax pattern fabrication and trial-in

A wax pattern trial was conducted (Figure- 4). Before processing, the stump model was modified by scraping 0.5 mm from the cast surface. Finally, the wax pattern was subjected to processing. The processing was carried out using the lost wax technique. After dewaxing, an orientation mark was placed using a writing pen. The stump was then removed from the dewaxed flask, and a fibre-reinforced glass tape was positioned over the stump model (Figure-5a). Silicone adhesive primer (DETAX Primo) applied over the fibre reinforced glass tape and allowed it to dry for a minute.

Figure 5a- Shade Matching. Fig 5b- Fibre glass tape incorporation for the reinforcement of silicone material.

Fig 5c- Processing

Medical-grade(techno-vent) silicone was prepared, and shade matching (Figure- 5b) was performed for the dorsal surface of the finger. The silicone was poured into the mould cavity (Figure- 5c), after which the stump model was repositioned, ensuring alignment with the orientation mark in the flask. Shade matching for the ventral surface was then completed, and the silicone was poured into the mould cavity on the opposite side. The flask was tightly closed and left for 24 hours at room temperature for vulcanization. Following this, the flask was placed in the acrylizer, where the temperature was set to 100ºC for one hour.

After curing, the flask was opened, and the silicone prosthesis was carefully retrieved. Excess margins were trimmed using sharp scissors (Figure- 6a). The prosthesis was then inserted into the patient's amputated finger. External stains were applied to the silicone prosthesis during the same visit and allowed to dry for an additional two hours.

Outcome and Follow Up

Upon insertion, retention was assessed (Figure- 6b,6c), and the silicone prosthesis demonstrated adequate stability on its own. The patient was able to grasp a pen and other lightweight objects and could flex the finger to some extent.

At 1 week, 1 month, and 3 months, the prosthesis showed stable adaptation without tissue irritation. Minor extrinsic stain loss was noted, requiring routine maintenance. The patient was advised regular half-yearly reviews for prosthesis assessment, shade refinishing, and monitoring stump health.

Discussion

According to Pilley M.J, when surgical reconstruction of lost finger is contraindicated, unsuccessful or unavailable, prosthesis can provide and offer great psychological help. A precisely fitting prosthesis can improve function

Kent G et al stated that "For the prosthesis to become an integral part of the person's body image, it must not only replace the missing part of the body but it also has to be functional and cosmetically acceptable. As highlighted in various literatures, Rehabilitation of the amputated finger entail intricate clinical planning and execution in terms of achieving both functional and aesthetic outcomes. Although there are various ways to medically and surgically manage digital amputations, the goals of rehabilitation remain the same: preserve the functional length, preserve useful sensitivity, prevent symptomatic neuromas, prevent adjacent joint contractures, achieve short-duration morbidity, and enable the patient to perform tasks of daily life as quickly as possible.

Based on the above considerations, we proceeded with the fabrication of a finger prosthesis using a patient-specific approach to ensure both functional adaptation and cosmetic acceptance. Retention of the Finger prosthesis is necessary to ensure that it not only fits but also restores the patient's quality of life. In this case, we made a stump model by reducing the circumference of the finger stumps accurately by 1-1.5mm and vertical grooves are created to provide snug fit.

Medical grade Techno-vent silicone was selected for the fabrication of the finger prosthesis due to its flexibility, biocompatibility, and life like texture, making it ideal for prosthetic rehabilitations requiring superior aesthetic and functional outcomes.

In this case, as we are doing rehabilitation of the finger which will subjected to repeated stress during daily activities, reinforcement becomes essential. For reinforcement of the silicone material, Fibre glass tape was incorporated during the processing stage to enhance the tear strength and overall durability of the prosthesis.

Despite the satisfactory aesthetic outcome, the prosthesis had certain limitations. It was not fully functional for activities requiring fine motor skills. Furthermore, the extrinsic stains showed gradual fading with regular use, requiring periodic maintenance to preserve the natural appearance.

Conclusion

Fabrication of a finger prosthesis requires a comprehensive understanding of anatomy, materials, and patient expectations. Through proper planning, material selection, and reinforcement, a functional and aesthetically pleasing prosthesis can be achieved, restoring not just form but confidence.

Author contributions:

Vinoth kumar. J, Sriramaprabu. G, Vinayagavel. K, Filomeena. I, conceptualization, data curation, format analysis, investigation, methodology, project administration, software, supervision, validation, visualization, writing – original draft, writing – review and editing.

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Ethics Statement: In this case report non-invasive procedure followed and no other ethical review was required.

Consent: Written informed consent was obtained from the patients for the publication of this case report.

CONFLICTS OF INTEREST: The author declares no conflicts of interest.

DATA AVAILABILITY STATEMENT: The data used in this article are available upon request from the authors.

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