

Acrylic Finger Prosthesis: A Case Report

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Abstract:

Finger amputations are commonly seen in younger generations making them physically handicapped. Common causes for this are trauma and congenital malformations. This article describes the fabrication of a custom-made finger prosthesis with heat-cured acrylic resin which matched the patient's hand aesthetically. The prosthesis is light weight, durable, easy to use & cosmetically appealing. The acrylic finger prosthesis has the potential to improve the quality of life for amputees.

Key words: Finger amputation, prosthetic finger, acrylic prosthesis.

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Introduction

The human hand is one of the most priceless and commonly used body part which completes our daily chores. Acquired injuries secondary to underlying systemic disease and road / occupational accidents are the most common reasons for amputation of fingers.¹ Both these acquired & congenital defects demand the need for rehabilitation. Regardless of the type of defect; clinical challenges arise on prosthetic rehabilitation.² The psychological traumatic experience after the amputation is often noxious for the patient. Amputation of the tip of a digit itself emotionally upsets the patients³. Even the traumatic loss of one finger can cause serious functional as well as psychological impairment.¹ The highest degree

of disability is suffered by individuals whose profession demands the use of fingers. A musician for example, can be seriously affected professionally. When surgical reconstruction methods are not possible, prosthetic rehabilitation should be taken into consideration.^{4,5} Recent materials such as polyphosphazene, polyurethane, chlorinated polyethylene, silicone and acrylic resins can be used for fabricating a finger prostheses.^{6,7} The prosthetic rehabilitation should also aim to restore functional, emotional and social factors for the patient.⁸ This case report briefly narrates the mending of a missing distal phalange of the index finger with a custom designed acrylic finger prosthesis.

Case Presentation

A 55-year-old male patient came to the Department of prosthodontics complaining of difficulty in having food,



Figure 1: Missing distal phalange of index finger

complaint was associated with missing teeth in the maxillary and mandibular arch. During case history recording procedure it was found that patient was hiding the left hand under the drape. The patient was initially reluctant to show his hands but on further communication he revealed his hands, and it was found that, the left-hand index finger was amputated. (fig:1)

While recording the history it was found that the cause of amputation was occupational which occurred 25 years back while the patient was working with the rubber sheet cutting machine. The patient is still aware of the loss and is emotionally down with the loss. On examination, a healed scar was seen at the base of the amputated index finger, brown in colour with some crusting. The remaining part of the finger was normal and did not show signs of any infection over the wound. Various types of materials for the fabrication of the finger prosthesis were presented to the patient. Finally, the patient opted for a heat-cured acrylic prosthesis considering the cost.

Technique

The patient was treated with a calm and caring attitude. He was asked to keep his hand in a relaxed position. The entire hand was greased with a fine layer of petroleum jelly to allow easy removal of impression material from the finger. A plastic container was reduced to a height, which can accommodate the hand up to the wrist level. Patient was instructed to keep the hand in normal resting position. An impression of the hand on side of amputated finger was made using irreversible hydrocolloid material which was loaded into the prepared plastic container. (fig: 2) After the material



Figure 2: Impression making procedure

sets, patient was instructed to slowly remove the hand from the container. The impression was then disinfected and poured using type III dental stone using a vibrator to prevent voids and thus a working model was obtained. (fig: 3)

The part of model which contacted the wax up of finger prosthesis was then scrapped circumferentially upto 1 mm. This ensures a snug fit for the future prosthesis. (fig: 4) On retrieval, the positive model of the finger was sculpted in modelling wax. A wax try in procedure was done to evaluate for the shape and size with adjoining fingers. (fig: 5)

Patient was satisfied with the fit and form of the trial prosthesis.

In order to match the skin colour of the patient, the colors we used were the ball pen inks different concentration of brown ink were mixed in heat cure acrylic and were cured. The colour obtained after curing were matched with the skin colour of the; patient. The suitable colour for the ventral and dorsal surface were selected from that set. (fig: 6)

A putty was stabilised on to the model with orthodontic wires and trial prosthesis was placed on the top this is done to ensure that the inside of the prosthesis is hollow after processing (fig:7) and the trial prosthesis was sealed with cervical wax. (fig:8)

Flasking was done in conventional flasking method. The base of the flask was flaked with Type II gypsum product. The working model along with the wax trial was immersed in the Type II gypsum up to mark where the dorsal surface and ventral surface meets. The second



Figure 3: Model of hand



Figure 4: Wax up of the finger



Figure 5: Wax try in



Figure 6: Colour preparation & selection



Figure 7: Wax up of the finger

layer was poured using Type III gypsum product and the flasking was completed with the third pour with Type II gypsum product. After the proper setting of the gypsum, regular dewaxing procedure was done. (fig: 9)

The entire wax was completely eliminated leaving the putty intact. The plaster index along the border represents the junction between the dorsal and the ventral surfaces of the finger. (fig:10)

Next was packing, it was done in 2 stages. Packing the ventral surface was critical because of the putty. The acrylic was mixed with previously selected colour for the ventral surface, we loaded the material in the late stringy stage on to a syringe and was injected through the mold space. Simultaneously the acrylic was mixed with the



Figure 8: Wax try in



Figure 9: Investing

colour previously chosen for the dorsal surface and the material was packed. (fig: 11) Bench curing was done under 1000 psi pressure for 20 mins. Followed by acrylization.

After deflasking, trimming, finishing and polishing were done. Skin creases were created with a bur. Extrinsic coloration was also done to mimic the tissue shade in the finished prosthesis. This was done in front of the patient in natural daylight to gain his approval. (fig: 12). Nail part was very critical, because the adjacent nails were disfigured. We could have given some artificial nails, or nail paints. Here We prepared nail bed by trimming around 1mm to create space for artificial nail. Initially acrylic colour was painted in the nail bed in order to mask the brown skin colour then packable composite of shade A3 was placed evenly and then a trimmed artificial nail was placed on top of this composite layer and was cured. (fig: 13) Along with the finger prosthesis, we were able to deliver a complete denture prosthesis as well. So, we were able to re define the smile of the patient in a better way. Patient was satisfied with the fit and the form of the prosthesis. (fig: 14)

Post-delivery instructions were given to the patient. He was advised to maintain hygiene of the prosthesis using soap and lukewarm water. The patient was also advised to keep the prosthesis away from strong solvents to make it last a long time. The patient revealed a satisfaction in both function and esthetics using the prosthesis during the three-month, six-month, and one-year follow-ups visits.

Discussion

Fingers play a crucial role in daily tasks, social interaction, as well as aesthetics. Finger amputations are commonly associated with trauma, infection, congenital defects, and infections.⁵ Prosthetic rehabilitation is considered when patients cannot afford it or surgical reconstruction is not possible. A stock or custom made finger prosthesis replaces a part or all of the finger.^{6,7} In this present case, the patient was presented with various advanced materials such as polyphosphazene, polyurethane, chlorinated polyethylene, silicone and acrylic resins. Nowadays, three-dimensional-printed finger prosthesis can be manufactured which is quick and

easy to fabricate. Due to economical reasons, the patient opted for a finger prosthesis made in heat cured acrylic resin. Reddy et al. successfully used an acrylic finger prosthesis for a partially missing right-hand index finger.¹⁰ Retention of finger prostheses is a prime requisite for proper function and aesthetics. It depends on meticulous planning, proper impression, and scraping of the cast. Retention can also be achieved with the help of implants, finger rings, medical-grade adhesives, and proper scraping of the cast to achieve good contact with the tissues.^{4,6,9}

Recent advancement includes osseointegrated implants with myoelectrically active finger prosthesis. These



Figure 10: Dewaxing

Figure 11: Packing separately on dorsal & ventral surfaces

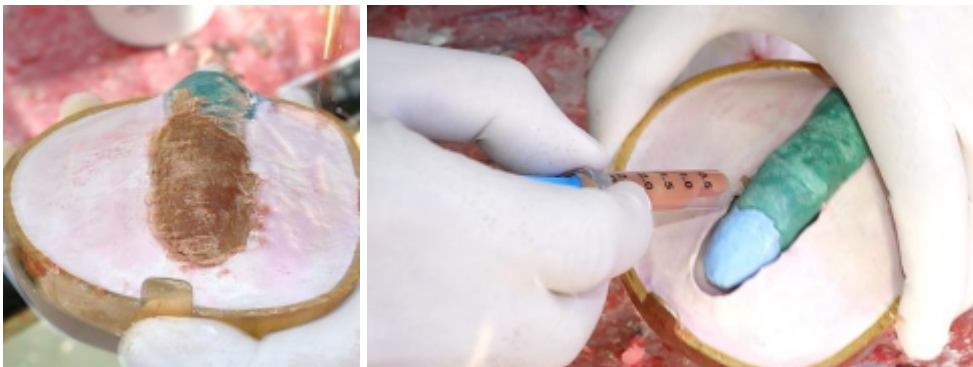


Figure 12: Final prosthesis



Figure 13:
Nail preparation
with artificial nail & composite



Figure 14: Patient with finger prosthesis

improves the function by providing movements of the prosthesis. Incorporation of motor sensory devices into the implant, which contains a bidirectional interface using electrodes improve control of the osseointegrated prosthesis. e-Opra is an implant system targeted for rehabilitation of amputees. Osseointegrated prosthesis for the rehabilitation of amputees. Basically, these are implanted electrodes, they provide long term bioelectric signal for the movement of the prosthesis.¹¹ Furthermore, we have CAD systems, they have been shown to be a viable alternative for fabrication of functional 3D printable prostheses, which are highly customized.¹² In both of these cases the cost of the prosthesis is high which makes it difficult for normal patient to afford.

Conclusion

For most of the amputee patients, aesthetics are more important than function. With the advancement in skill, technology and materials available today, the rehabilitation of an amputated finger is no more aesthetically challenging. When fabricated with the recent technology and skills, they can be made life-like. A well fabricated prosthesis which is esthetically and functionally pleasing always fulfills the patients mind with psychological support.

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Source of support: Nil

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