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SILICONE FINGER PROSTHESIS TO REHABILITATE AMPUTATED FINGER RESULTING FROM MINE BLAST INJURY

Dental Science

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ABSTRACT

The hand is one of the most important parts of the human body whether in terms of function or aesthetics. The hands primary function is to adapt and manipulate the environment such as grasping and touching objects. The loss of upper limb function, specially the use of the hands is a devastating for an individual. The loss of a finger produces significant functional deficiencies and prevents the completion of basic activities such as self-feeding, dressing, bathing and toileting. The prosthetic rehabilitation of amputated finger is considered when micro vascular reconstruction is contraindicated, unavailable, unsuccessful or unaffordable. The prosthetic rehabilitation with finger prosthesis helps patients to adjust to their loss and permit them a more normal professional and social life.

KEYWORDS:

Silicone finger prosthesis, Mine blast, Amputation

Introduction

Loss of any part of the human body may limit essential functions specific to the missing part. Fingers form the important component of hand which is required to execute day-to-day functions. Absence of fingers may be due to trauma, congenital or due to surgical excision resulting from any infections. Irrespective of the cause; complete or partial loss of digit of hand would cause functional deficiency, aesthetic and psychological problems.

The type of reconstruction is based on amount of tissue lost, systemic condition of the patient, local bone health and patient's acceptance of procedure. Numerous microsurgical procedures have been attempted in reconstruction of fingers. If surgical reconstruction is not feasible then the prosthetic option would be chosen. Essentially all prosthetic fingers should closely resemble the finger of contra lateral side; color of the prosthesis should match the surrounding tissues. Material used must be biocompatible, strong, easy to clean, repairable and dimensionally stable[1].

Retention of the prosthesis plays a vital role in success of the rehabilitation. Finger prosthesis can be retained either by mechanical aids[2] or by chemical adhesives[3] .Although osseointegrated implants can also be used, but its selection is dictated by patient's willingness to undergo surgical osteotomy, systemic health and economical feasibility. This case report presents prosthetic rehabilitation of surgically amputated finger resulting mine blast injury using silicone finger prosthesis.

Case Report

A 45 yr old male serving soldier reported to dental OPD with a chief complaint of lost left index finger. His past medical history revealed surgical amputation of his left index finger resultant to mine blast injury 2 years back. Clinical examination revealed that the index finger had been amputated up to the middle of middle phalanx and the tissue around the amputation appeared healthy with no signs of infection (Fig 1). After diagnosing and considering various rehabilitative options, it was decided to fabricate glove type silicone finger prosthesis extending up to the metacarpal-phalangeal joint and retained using metal ring.

Fig 1: Healed Amputed Left Index Finger

The patient amputated finger was lubricated with a thin layer of petroleum jelly. A thin mix of irreversible hydrocolloid impression material was poured in plastic glass and the patient instructed to insert the finger in the impression material and to keep the finger in the normal resting position without stretching while the impression sets .The impression was then poured in dental stone, which was used as the master cast.

To improve the retention of the silicone prosthesis, the circumference of the finger stumps were reduced accurately by 1 mm to create vacuum chambers in order to provide a snug fit of the prosthesis and aid in vacuum retention.

An impression of the index finger of the unaffected right hand was made, into which molten modeling wax was poured to get the wax pattern of the prosthesis. The fitting portion of the wax pattern was hollowed from inside and softened by placing in warm water. Subsequently the wax pattern placed on the fitting surface of the cast and modifications in sculpting were carried out to resemble the finger of the other hand.

Clear acrylic resin material was used to fabricate custom made acrylic nail for the prostheses. Color and shade matching was done with the nail of adjacent fingers and features like integral half moons, white margins and other details were incorporated (Fig 2a). The size and position of the acrylic nail was established and the nail bed was prepared in the wax pattern. The custom made acrylic nail was adapted into place. The wax pattern was tried on the patient's hand and the length and fit was verified and patient's approval was taken (Fig 2b).

Fig 2a Custom Acrylic Nail

Fig 2b: Try in of wax pattern

The acrylic nail was separated from wax pattern and preserved. The wax pattern was then invested and dewaxed. Intrinsic pigments were mixed to Room Temperature Vulcanized (RTV) silicone to match patient's skin. Color matching was done in natural light. After getting the desired shade the silicone material was packed into the mold and light pressure was applied to remove excess material. After polymerization, the prosthesis was carefully retrieved; finished and

required extrinsic staining was done. The acrylic nail was fixed on the prostheses with a cyanoacrylate resin.

A wide metal ring was placed over the junction of the prosthesis and the remaining stump to aid in retention. The final prosthesis was inserted on the residual stump. Fit and color matching was reevaluated. The patient was instructed about the use and maintenance of the prostheses. (Fig. 3) Subsequent to adaption of present prosthesis, its planned to provide titanium implants in the remaining finger stump and to incorporate attachments to provide best retention for the prosthesis.

Fig3: Completed Prosthesis in situ

Discussion

Amputated finger can be restored surgically by numerous procedures such as reconstructing by secondary intention, revision amputation, microreplantation, skin graft, and composite grafting[4]. Pilley MJ[5] suggested that when surgical reconstruction of lost finger is contraindicated, unsuccessful or unavailable, prosthesis can provide and offer great psychological help.

Historically finger prosthesis was fabricated using wood, clay, leather, metal, enameled porcelain, acrylic resin and medical grade silicone. Acrylic resin is durable, have good strength and can be easily characterized, however, they are hard and not comfortable to the patient. Silicone, on the contrary provides texture and consistency similar to skin, giving life-like appearance to the prosthesis. The can be colored and are well accepted by the patients[6].

Retention of the prosthesis was achieved by creating a vacuum effect by scoring the cast of the remaining stump. In the suction-fitted prosthesis, the elastic and nonporous silicone rubber allows an airtight "cupping" of the stump such that an accidental slippage of the prosthesis is immediately followed by an internal vacuum effect that checks further displacement. Michael EL[7] suggested in his study that, a 5-7% circumference reduction in the finger model showed good fit of a thimble type prosthesis for distal finger amputation. The custom made silicone finger prosthesis helped the patient overcome anxiety and lead a better life. A wide metal ring was also used to augment the retention and to provide better aesthetic results by disguising the junction of prosthesis and the remaining stump.

Fabrication of finger prosthesis in the forward area would allow the soldier to get into action immediately without sending him to tertiary rehabilitation centre. In addition early rehabilitation allows him to be a part of his unit and his services are utilized for the betterment of the unit and the country. Availability of rehabilitation options near the active zone would have a positive impact on the morale of the troops. Implant retained finger prosthesis have been documented to provide better retention to the finger prosthesis. Implant placement will be carried out as early as the finger prosthesis is accepted by the patient.

Conclusion

Aesthetic rehabilitation of lost finger using silicone finger prosthesis is a viable option when surgical reconstruction is ruled out. These prosthesis primarily improve patient's appearance fulfill the functional deficiency and provide better social acceptance. In addition for a soldier it would enhance his confidence and moral.

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