Use of Fiberglass Splints in Management of Burns and Post Burn Contractures: An alternative to Plaster of Paris splints

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Abstract

Aims: The traditionally used POP splints for prevention of Post burn contractures are found to be heavy and cumbersome to use, and have a short life. Fiberglass has long been used for management of fractures by orthopedic surgeons as a superior option to plaster cast. Here the authors describe their experience of use of fiberglass splints for prevention and management of PBC.

Methodology: The authors recount their experience of preparation of the Fiberglass splint and protocol for patients of PBC using this splint.

Results: Fiberglass splints have been used in more than 100 patients for the period of ten years, of which about two-thirds were operated for post burn contractures, (having been treated primarily elsewhere) and the rest were acute burn patients. Less than 10 % patients required a second surgery for re-contracture.

Conclusion: Fiberglass splints may have a role in splintage in plastic surgery, mainly, post burn contractures and hand surgeries.

INTRODUCTION

Burns is a major social and medical problem in the developing world. With the advances in medical science today, higher percentage burns are being salvaged than ever before. But along with this increased survival comes an increase in post burn sequelae of scarring and contractures. The functional disability affects daily activities of the patients and renders them vocationally compromised [1]. These sequelae are completely avoidable but demand strict adherence to splinting, pressure garments and mobilization exercises, which might at times be painful and uncomfortable for the patients. This may eventually compromise compliance and may lead to re-contractures.

Thermoplastic splints are used for splinting in the post-operative period in many units, but molding the splint is cumbersome, requires specialized instrumentation and requires expertise. Plaster of Paris splints (POP) have also been used for prevention of Post burn contractures (PBC), are found to be heavy and cumbersome to use, and have a short life. Fiberglass has long been used for management of fractures by orthopedic surgeons as a superior option to plaster cast. Here the authors describe their experience of use of fiberglass splints for prevention and management of PBC.

METHODS

All burn patients presenting at a tertiary care burns center of Mumbai, India were treated using the Fiberglass splints for PBC over a period of ten years. Prior ethics clearance and patient consent was taken. The patients were given the splint as soon as the graft settles or the burn wound heals, and after setting, it was lined with a layer of soft foam or multilayered soft cloth and patients were asked to use the splint for at least 6 months along with pressure garments. Patients were followed up regularly at 7 days, 15 days, 1 month, 3 months, 6 months and 1 year, and evaluated for occurrence of contractures of all the involved joints. Passive and Active ranges of motion were observed and compared with the observations at discharge and follow up.

Technique of making the fiberglass splint

After the wound has healed or the graft is settled after the release of contracture site, the patient is made to lie on table and given adequate anti-contracture position. Coconut oil is applied on the skin and it is covered with Vaseline gauze to prevent direct contact between the fiberglass material and patient’s skin. It is imperative that everybody handling the material wears gloves at all times lest the fiberglass material sticks to the skin. A single 10 cm x 3.6 m roll of fiberglass used by the senior author is enough to make two splints for a patient. The roll is cut...
into multiple strips of suitable length and made wet in plain tap water. Wet strips are placed over the Vaseline gauze placed over the patient’s skin and molded to adequate contour. Generally, a 3-layered splint has been found to provide adequate strength. When it is partially set, margins are cut with scissors to avoid sharp edges and the splint is then left to dry for an hour. If the splint is allowed to harden completely, it can be cut later using a saw which is a cumbersome procedure. The patient is asked to wear the splint all day long under a well-fitting pressure garment or crepe bandage with a cotton cloth or foam padding below the splint (Figures 1 a-d).

RESULTS

These splints have been used in 110 patients for the period of over ten years (2006 to 2016), of which about two-thirds were operated for post burn contractures, (having been treated primarily elsewhere) and the rest were acute burn patients. Most common contracture to require surgery in this series was the neck contracture (Figure 2 a,b), others being axilla (Figure 3), hand (Figure 4) elbow, knee, ankle (Figure 5) and foot (Figure 6). Less than 10 % patients required a second surgery for re-contracture. These were essentially those patients who were resistant to suggestion and had low compliance with the therapy regimen. 90 % patients reported using the splint for twenty hours or more daily. During the early period, 3 patients experienced mild ulceration over pressure sites at the laryngeal prominence and over the chin because of not using adequate padding under the splint. These were managed by small dressings and did not require discontinuation of the splint.

DISCUSSION

Splinting, along with active and passive mobility exercises, is essential to prevent and treat joint contractures and deformities, and is an integral part of a comprehensive rehabilitation programme [2]. Splinting helps maintain anti-contracture positioning particularly for the patients experiencing pain, difficulty with compliance or with burns in an area where positioning alone is insufficient. It can provide an advantageous stretched position, thereby providing a more favourable starting point for exercise and mobilisation regimes [3].

Traditionally, Plaster of Paris (POP) splints have been used, specifically for post operative immobilization of post burn contracture (PBC) patients and their use has been riddled with problems galore. The use of POP for immobilization entails heavy and cumbersome splints which decreases compliance and finally increases the rates of re-contracture in the long term. Under the plaster, the skin becomes dry and scaly. Also, POP splints can result in various cutaneous complications including maceration, ulceration, infections, rashes, itching, burning sensation, and allergic contact dermatitis, probably owing to the presence of formaldehyde within the plaster bandages [4,5]. As time passes, the plaster splint becomes extremely dirty, even up to the degree of affecting the patient’s compliance to splinting. A major limitation of plaster splints is their weight, which can be quite considerable, thus restricting mobility of the concerned joint.

The numerous limitations of POP have spawned the search for, and necessitated the use of alternative materials for splinting. One such material is fiberglass.

Figure 1a Molding the fiberglass splint for a patient with burns over face, neck and upper chest, taking care to avoid pressure over nasal dorsum and nasal alae.

Figure 1b Neck splint, ready to use.

Figure 1c Splint for the face.

Figure 1d Splints applied to the patient with crepe bandage.

Figure 2a Fiberglass splint being moulded for post burn contracture of neck and upper chest released with placement of skin graft.
Fiberglass is a lighter, synthetic alternative to Plaster of Paris. Variously alluded to as glass reinforced plastic (GRP) or glass fiber reinforced plastic (GFRP) or GFK (from German: Glasfaserverstärkter Kunststoff), fiberglass is a fiber reinforced polymer made of a plastic matrix reinforced by fine fibers of glass [6]. As compared to traditional plaster of Paris splint, fiberglass is lighter and more durable. Being three times stronger than POP and only a third in weight, fiberglass splints score highly with surgeons and patients alike. These splints have a lower maintenance than those made with plaster, and are also washable, thus allowing their use for longer periods. The POP splints are white in color while fiberglass splints are available in many different colors, which are esthetically more pleasing. Fiberglass sets quickly; therefore, experience is required to time the application well.

It is hygroscopic (absorbs water) and the setting time decreases with humidity and warmth, so once brought out of the packet it cannot be stored as it absorbs the ambient moisture and hardens [7]. Generally, a fiberglass bandage roll costs more than POP bandage but a single roll of fiberglass yields up to two splints as compared to plaster roll where up to three rolls may be required for a single splint. When combined with the longevity of fiberglass splints, this disadvantage is offset with the longevity of fiberglass splints, this disadvantage is offset by the cost of the fiber glass. In a study by Kowalski et al. [8], compared the fiberglass casts with Plaster of Paris and found that fiberglass short leg casts were superior to POP in getting dressed, odor, sweating under the cast, work and school accomplishments, and overall fewer restrictions and comfort. They also found that fiberglass casts scored better in measures of activities of daily living and comfort and were significantly better than POP in weight of the cast. Though no similar study has been done in post burn contracture patients, it is reasonable to believe that fiberglass splints are similarly advantageous in the setting of PBC patients too.

An ideal splint should not cause pain, be designed with function in mind, be cosmetically appealing easy to apply and remove, lightweight, washable, low profile, and allow for ventilation in preventing skin or wound maceration [9]. The fiberglass stands true on most of these standards. Thermoplastic splints are also used for splinting in the post-operative period by many units, but molding the splint is cumbersome, and requires specialized instrumentation and expertise. The fiberglass splint combines the light weight of the thermoplastic and sturdiness of the POP splint thus providing best of both the worlds. It is particularly useful in situations when making a thermoplastic splint is not a practicable option owing to dearth of material or prowess. The senior author has used the fiberglass splints for postoperative immobilization and to prevent contractures in acute burns, for many patients in the last ten years, and has had excellent results.

**CONCLUSION**

It is thus apparent that the use of fiberglass for splinting in post burn contracture patients may go a long way in improving favorable results, increasing the patient compliance and reducing the rates of re-contracture surgeries. It has been used since a long time in orthopedics for fracture stabilization and can be considered a useful alternative to the traditional POP because of...
its many advantages. It is time that we add this material to our armamentarium for benefit to the patients of post burn contractures and also to other plastic surgery settings where long term splinting is required.

**DECLARATIONS**

**Authors’ contributions**

AV: concept, design, definition of intellectual content, clinical studies, data acquisition, data analysis, statistical analysis, manuscript preparation, manuscript editing, and manuscript review

SA: definition of intellectual content, clinical studies, definition of intellectual content, clinical studies, manuscript preparation

RS: literature search, data acquisition, data analysis, statistical analysis, manuscript preparation

**Patient consent:** Taken

**Ethics approval:** Taken from Institutional Ethics Committee

**REFERENCES**