Results of Managing Transtibial Amputations With a Prefabricated Polyethylene Rigid Removable Dressing

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ABSTRACT

The postoperative management of the residual limb after transtibial amputation is challenging. Multiple dressing and rehabilitative systems are available. Often, practices are based on locally available skills in dressing fabrication. This study evaluates the effects of a commercially available prefabricated polyethylene removable rigid dressing (RRD) system on wound healing. A retrospective comparison was conducted of transtibial amputation wound healing using a prefabricated RRD system and a control group receiving standard soft dressings. The number of days between amputation and casting for the first custom prosthesis was the measure to assess wound healing. Twelve facilities contributed data to this study. The results of 76 patients receiving the prefabricated RRD were compared with those of 28 patients treated with the soft dressings. Results indicated that the patients in the prefabricated RRD group were casted for their first custom prosthesis an average of 58 days after surgery versus 84 days for those in the soft dressing group, a statistically significant difference. It was concluded that the clinical outcome of wound healing was improved with the prefabricated RRD compared with the soft dressings. The rationale for using a rigid dressing for postoperative management of the residual limb after transtibial amputation is reviewed and the advantages and disadvantages of custom versus prefabricated dressing systems are presented. (*J Prosthet Orthot.* 2007;19:2–4.)

KEY INDEXING TERMS: immediate postoperative prosthesis, soft dressing, transtibial amputation

The removable rigid dressing (RRD) for transtibial amputation was reported by Wu and Krick[1] in 1987. Still used today, the plaster RRD consists of a cast with an angled brim suspended by stockinet and a thermoplastic supracondylar cuff, a design that allows for knee flexion. A cotton tube sock or prosthetic sock is worn under the cast and cuff.

The advantages of the RRD or thigh-length postoperative cast in transtibial amputation have been well documented.[2–9] These include prevention of knee flexion contractures, protection from injury, edema control, decreased wound pain, uniform tissue compression, soft tissue immobilization to facilitate healing, and decreased healing time. Faster healing times may result in quicker fitting with a custom prosthesis, decreased length of hospitalization, and decreased rehabilitation time as compared with use of the soft dressings.[10] Potential problems with use of these systems include pressure sores, weight of the cast, lack of access to the incision, and malodorous exudates absorbed into the cast. Another concern is the mental and emotional capacity of the patient to comprehend and comply with RRD use.

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Recently, multiple commercially available prefabricated versions of a thermoplastic RRD have been developed. These RRDs have the advantage of being lightweight, easy to clean, nonabsorptive, removable, and provide advantages of the plaster RRD and immediate postoperative prosthesis (IPOP).

This study began in response to a less than ideal outcome using a plaster IPOP for transtibial amputation management. Challenges encountered included weight, difficulty in cleaning, and vulnerability of the residual limb to injury during the interval between casting for a custom prosthesis and fitting. It was suspected that the prefabricated RRD would provide the sought-after residual limb protection. However, because it was removable and more flexible than plaster, would it be as effective as the use of soft dressings in limb healing and maturation? This study seeks to answer the question of whether the reported benefits of the plaster RRD extend to the prefabricated system. Our focus was on the clinical outcome of wound healing.

MATERIALS AND METHODS

The study format was a multicenter retrospective study of the efficacy of a prefabricated protective prosthetic socket (Flo-Tech-Tor, Flo-Tech O&P Systems, Inc., Trumansburg, NY) used as a RRD on transtibial amputees. Twelve Hanger Patient Care Centers were queried for data on identifiable uses of this prefabricated RRD in transtibial amputation. Data collected included age, gender, principal disease, date of surgery, date of application of the postoperative socket, and date of casting for a custom prosthesis. St. Agnes Medical Center Institutional Review board in Fresno, California, monitored the study.

Table 1. Characteristics of RRD and soft dressing groups

	RRD	Soft Dressing
Average age (y)	63.5	58.2
Male (%)	78	67
Female (%)	22	33
Amputations due to diabetes (%)	67	80
Amputations due to peripheral vascular disease (%)	12	10
Amputations due to trauma (%)	21	10

During the study period, the protocol recommended by the manufacturer consisted of a light dressing over the wound, a postoperative sock, reticulated end pad, a second postoperative sock to secure the end pad, and finally the prefabricated thermoplastic socket with suspension belt. The alternate protocol involved placing the transtibial shrinker over the first sock in the sequence. If weight bearing was allowed, an outer frame incorporating a pylon with a foot was secured over the socket. Thus, there was some blending of protocols in this descriptive study, primarily use or nonuse of a shrinker sock in the sequence of donning, and whether the unit was used for weight bearing with a pylon or simply for protection and edema control.

Eighty-seven patients received this prefabricated RRD. Eleven of these never received a definitive custom prosthesis in the following 6 months because of deterioration in health, death, or loss to follow-up and were dropped from analysis. Results of the remaining 76 were analyzed.

The control group consisted of a simple random sample of all transtibial amputees who received prostheses during 2000 to 2001 through the Fresno Hanger Patient Care Center. This sample group was matched for age, gender, and principal disease process. Thirty-three charts were reviewed. Five patients began prosthetic fitting beyond the 6-month postamputation limit set for the study and were dropped from the study. Data from the remaining 28 patients were analyzed.

RESULTS

There were no statistically significant differences between the makeup of the prefabricated RRD group and the soft dressing group in age, gender, or percentage of amputations for diabetes, peripheral vascular disease, or trauma (Table 1).

Analysis revealed a mean time to casting for custom prosthesis of 58.4 days (standard error of the mean [SE], ±3.6 days) for the prefabricated group. The control group had a mean time to casting of 84.4 days (SE, ±7.9 days; Figure 1). These differences in mean time to casting were significantly different ($p = 0.001$) by t testing.

DISCUSSION

The use of rigid dressings and IPOP continues to be limited, particularly in the community hospital setting. The prevailing belief is that "a skilled surgical and prosthetic team is required for successful application and rehabilitation of patients treated with rigid dressings or IPOP, thus this technique may not be feasible in hospitals lacking these trained personnel" (p 297).[5]

The rigid dressing technique has been reported to have shorter times to rehabilitation.[11] Choudhury et al.[5] found the plastic RRD easier and quicker to apply than plaster or fiberglass, acceptably simple to instruct staff and patients in use, and permitting observation of the wound and effects of weight bearing, if allowed. Wu and Krick[1] found, as have the current authors, that the RRD was helpful in aiding the healing of open incisional wounds, thus avoiding additional surgery. Another advantage of the prefabricated RRD is that it can be used merely for protection and containment of the

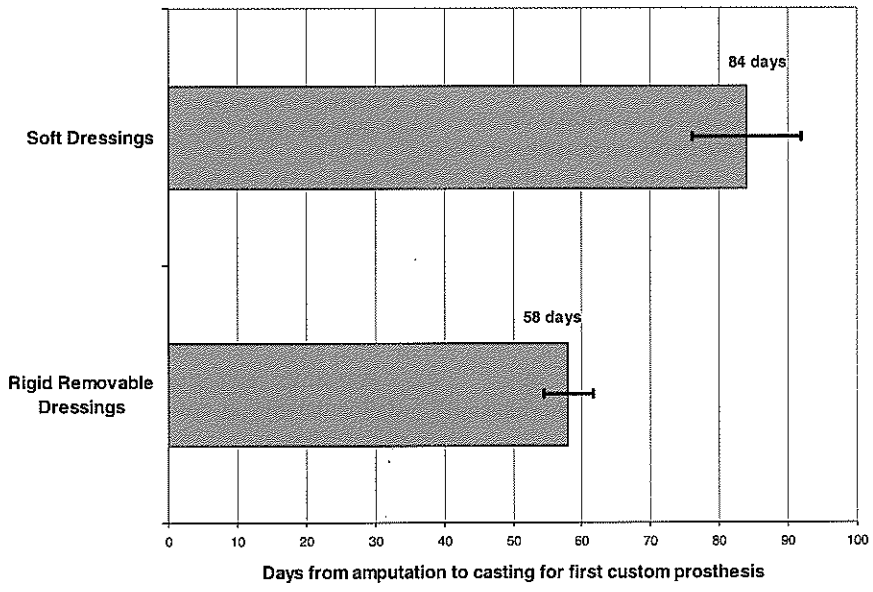

Figure 1. Wound healing time.

tissues initially and "later as the healing process continues can be snugly secured, providing auxiliary compression and shaping of the residuum" (p 64).[12]

Pain, edema, healing, and mobility are all integral parts to be addressed in rehabilitating transtibial amputees, most of whom are geriatric and have comorbidity issues. The observation of Folsom et al.[13] that "an increase in the emphasis on the functional recovery of amputees is mandatory to improve the lifestyle of the segment of the population while controlling the cost of rehabilitation" (p 322) is applicable today. Malone et al.[14] cited a potential cost savings when providing a device that facilitates wound healing and rehabilitation.

The protocols used in dressing and garment sequence, timing of RRD application, and the presence or absence of early weight bearing were limitations of this study. The retrospective nature of the study was also limiting.

Smith et al.,[15] in their review of strategies for postoperative residual limb care, found most of the studies on prefabricated pneumatic postoperative prostheses to be supportive. However, nonpneumatic prefabricated postoperative prostheses and sockets, such as the one studied here, were not addressed. The current study strives to fill that void in knowledge.

Possible areas for future study include the use of a shrinker versus no shrinker in the postoperative RRD dressing sequence, or the documentation and evaluation of fall protection of the thermoplastic RRD as compared with soft dressings. Another area of interest may be to question the effect of dressing rigidity on wound healing.

The hope of this team is that new tools for postoperative care of the residual limb such as the one studied will promote better clinical outcomes through faster healing and speedier resumption of an active lifestyle.

CONCLUSION

This study was undertaken to learn if benefits ascribed to rigid dressings and custom-made RRDs extend to the prefabricated (nonpneumatic) RRD. The findings show that the use of the prefabricated plastic RRD was associated with faster healing time (58 days) when compared with traditional dressings (84 days), as measured by the time between surgery and the limb being ready to cast for the first custom prosthesis. The conclusion was that the use of prefabricated plastic RRDs can promote better clinical outcomes than soft dressings and can extend the benefits of the rigid dressings to more amputees.

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