

COMPARISON OF RECTIFIED AND UNRECTIFIED SOCKETS FOR TRANSTIBIAL AMPUTEES

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INTRODUCTION

The traditional strategy for fabricating a transtibial amputee (TTA) socket is based upon the assumption that the residual limb is not uniform in its ability to tolerate load.¹ Thus, the contours of the residual limb mold are modified by the prosthetist (i.e., rectified socket). We have investigated a new method of shaping the socket using alginate gel.² Except for a distal end pad, the mold is shaped to the contours of the patient's residual limb (i.e., unrectified socket). The purpose of this investigation was to objectively compare rectified and unrectified sockets in adults with a TTA.

METHODS

Forty-three adults with a TTA participated (mean age 47±10 years, 36 males 7 females, height 176±8 cm, mass 84±17 kg). Subjects had mature residual limbs. Except for the socket shape, the prostheses were the same.

The prosthetist fabricated the rectified socket using the traditional method. The positive mold was made from a plaster cast and modified by filing down and building up different regions to account for the residual limb's inability to uniformly tolerate load. No more than three check sockets were permitted. In the unrectified socket fabrication process, the positive plaster mold was made using an alginate casting method. The subject placed his/her residual limb into alginate liquid and stood for approximately 5 minutes while the alginate gelled to a semi-solid state. The subject removed the residual limb from the gel leaving a negative mold. Plaster was immediately poured into the mold. This positive plaster mold was removed and very slightly smoothed with sanding screen. A distal end pad was included during socket fabrication, but no other modifications were made.

Subjects were tested after wearing the first randomly assigned socket for at least 4 weeks. They then wore the second socket and were tested after another 4 weeks. Data were collected: 1) from a gait analysis, 2) during a sub-maximal treadmill test (energy expenditure), and 3) from a Prosthetic Evaluation quality of life Questionnaire [PEQ].³ After participation, the subject chose the socket he/she wished to have on the final prosthesis. Repeated measures ANOVA

Table 1. Means and standard deviations () for key variables.

Socket	Gait Speed	P/NP VGRF ratio	Minimum stance knee flexion (deg)		VO ₂	PEQ Total	Final Socket Selection ^c
			P	NP			
	cm/s	%			ml/(kg*min)	%	
Rectified	125 (22)	95 (7)	11 (6)	11(5)	13.4 (2.3)	82 (11)	16
Unrectified	125 (22)	96 (6)	10 (5)	11 (6)	13.5(2.6)	81 (13)	25
Able-bodied	133 (17) ^a	100	4 ^b	4 ^b			

^a Waters et al., 1988; ^b Murray et al., 1964; ^c Two subjects decided to use both sockets; P = Prosthetic leg; NP = Nonprosthetic leg; Maximum Vertical Ground Reaction Force [VGRF] ratio

and a Chi square test were used to determine if significant differences existed (p<0.05).

RESULTS AND DISCUSSION

There were no significant differences for any of the variables (Table 1). The present study adds to the body of knowledge in at least two areas. First, there appears to be more than one paradigm for fitting a TTA socket. Despite the two different socket fabrication strategies, the results of the tests for gait, energy expenditure, the quality of life questionnaire (PEQ), and final socket selection were not different.

The second area is related to the simplicity of the alginate method. No shaping is done to the negative mold as it is applied to the residual limb, no modifications are made to the positive mold, and multiple check sockets are not needed. The omission of these steps saves time. The process may not require a prosthetist. The simplicity of the method could be valuable in third world countries where prosthetists and fabrication facilities are scarce or nonexistent. The simplicity of the method might also be beneficial to new amputees, since the effort associated with making a new socket is substantially reduced. Sockets could be fitted more frequently to better account for residual limb volume changes. The simplicity of the method could also save time in a typical prosthetic clinic.

CONCLUSIONS

It is concluded that more than one paradigm exists for shaping prosthetic sockets, and the alginate method is simpler than the traditional method. The alginate method may be helpful in third world countries, permit more frequent socket changes for new amputees, and save time in the typical prosthetic clinic.

REFERENCES

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