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Elevated Vacuum Suspension Amputee Patient Outcomes: Suggested Initial Transtibial Elevated Vacuum Pressure Setting

Purpose

The purpose of this study is to describe a technique to help predict an initial optimal elevated vacuum pressure level for transtibial amputees.

Study

Eight transtibial LimbLogic Vacuum System (LLVS) patients.
Average duration on the LLVS: 10 months (max: 2.5 yrs, min: 1 month).
Activity level: K3.

Method

Two limb dimension measurements:

- (1) Limb circumference at 1.5 inches above the distal end
- (2) Limb length from the distal end to the patella tendon

Patients are required to walk for one minute at three different vacuum pressure levels: 8 inHg, 12 inHg, and 16 inHg. Pressure fluctuations in the pump are collected for each level (see Figure 1). The limb dimensions and pressure fluctuations are used to calculate the *optimal pressure level*.

Since each patient is slightly different, a range of ± 1 inHg from the *optimal pressure level* is outputted. This provides the prosthetist with the choice of three starting vacuum pressure levels compared to approximately sixteen different levels.

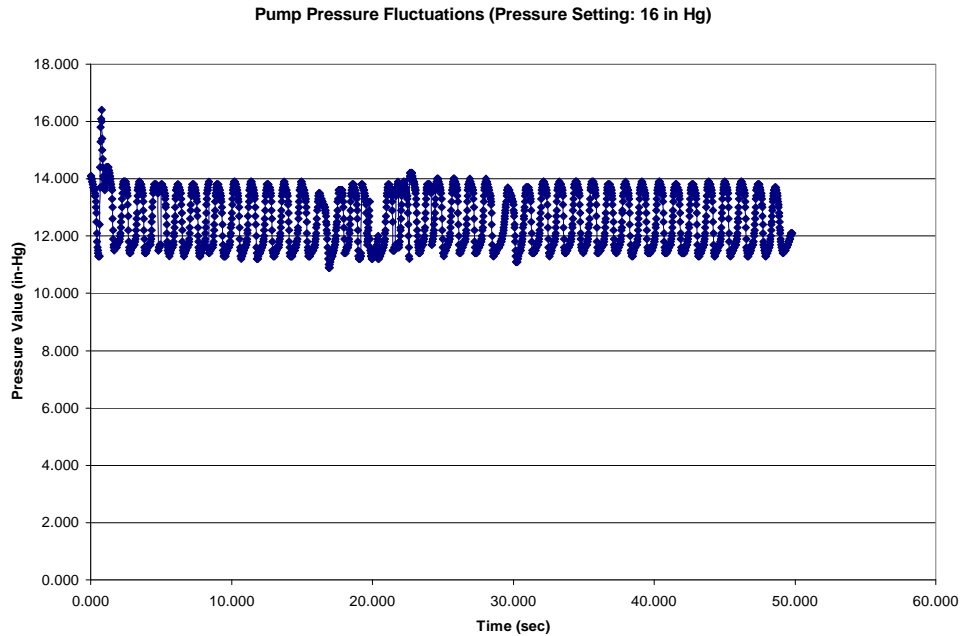


Figure 1: Pressure data from the USB communicator at a vacuum pressure setting of 16 inHg.

Results

The *range of optimal pressure levels* is compared to the patient’s personal vacuum pressure preference after at least one month of usage.

The results are presented in Table 1.

- (1) Highlighted blocks indicate the *range of optimal pressure levels* (calculated from the given method)
- (2) ‘P’ indicates the patient’s personally preferred vacuum pressure setting

Table 1: Transtibial Evaluation Results: Highlighted blocks indicate the optimal pressure range calculated from the given method. The letter ‘P’ indicates the patient’s personally preferred vacuum pressure.

		Patients							
		1	2	3	4	5	6	7	8
Vacuum Pressure Settings (inHg)	8								
	9								
	10								
	11								
	12	<i>P</i>						<i>P</i>	
	13			<i>P</i>					
	14				<i>P</i>	<i>P</i>	<i>P</i>		
	15		<i>P</i>						
	16								<i>P</i>
	17								
	18								
19									
20									

Conclusion

From the patients analyzed:

- 6 out of 8 patients prefer a pressure setting within the *optimal pressure levels* (highlighted section)
- 7 out of 8 patients prefer a pressure setting within 1 inHg from the *optimal pressure levels* (highlighted section)
- One patient (patient 7) does not correspond well with the *optimal pressure levels* (highlighted section).
 - This patient does not intend to use the elevated vacuum suspension on a daily basis and for normal (walking) activities.

Summary

This study provides a method for determining the optimal starting vacuum pressure settings for an initial transtibial elevated vacuum patient

- Only requires initial limb dimension measurements (length and circumference) and 3-5 minutes of patient test walking.
- Provides three vacuum pressure levels with the strongest potential for the greatest patient comfort
- Reduces time and energy required by both prosthetist and patient to determine a comfortable operational vacuum pressure setting
- Eliminates trial and error techniques