ACUTE BLOOD FLOW RESPONSE ASSOCIATED WITH ELEVATED VACUUM
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INTRODUCTION
The popularity of elevated vacuum continues to increase in the prosthetic field. Some of the primary reasons are associated with the numerous clinical benefits, including healthier residual limb skin. Published research studies have concluded that with vacuum skin issues are less predominant (Ferraro, 2011), the overall skin tissue appeared healthier (Arndt, 2011) and wound healing improved (Burnelli, 2009; Traballesi, 2009). The purpose of this preliminary research was to observe the acute blood flow response associated with elevated vacuum using a Laser Doppler flowmeter.

METHOD
Subject: An active 65 year old male transtibial amputee participated in the study. Amputation was a result of trauma 12 years prior. The amputee had no previous experience with elevated vacuum and is a non-smoker, has normal blood pressure, and has no previous history of vascular disease or renal failure.

Apparatus: Residual limb microvascular blood flow (ml/min/100 g of tissue) was continuously recorded in real time using the Laserflo® BPM2 (Vasamedics, St. Paul, MN).

 Procedures: Blood flow was measured in response to three different treatment levels: baseline (0 inHg), vacuum at 10 inHg and vacuum at 20 inHg. The sensor was position anterior-medial on the residual limb away from any bone, scar tissue and major blood vessels. The amputee was instructed to remain in a supine position while data was collected continuously for five minutes. A rest period of 10 minutes was implemented between treatment levels.

Data Analysis: Known artifacts due to patient movement were noted during data collection. To reduce visual presence of noise, the residual limb blood flow response was post processed using a moving average. The average blood flow was calculated for each treatment level.

RESULTS
Figure 1 contains the blood flow response for the three treatment levels. The average blood flow for the first two minutes is reported in Table 1. Both vacuum treatment levels demonstrated an increase in blood flow beyond the baseline treatment level. The percent increase from baseline was 65% for vacuum at 10 inHg and 91% for vacuum at 20 inHg.

DISCUSSION
Elevated vacuum demonstrated higher acute blood flow measurements for the subject. Normal blood flow for non-amputated subjects at the calf location is 1.4 (±0.5) ml/min/100g of tissue (Schabauer, 1994). For the vacuum treatment levels, the subject exhibited blood flow values near this level. The preliminary data offers knowledge useful in formulating future studies.

CONCLUSION
The study results indicate that elevated vacuum used by a non-vascular amputee has the potential to increase the patient’s acute blood flow response.

CLINICAL APPLICATIONS
Increased blood flow, as demonstrated acutely by elevated vacuum, has the potential to facilitate wound healing, reduce ischemia, provide better skin coloration, and improve overall skin health.

REFERENCES

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