

# THE EFFECT OF MOLDED FOOTBEDS ON COMFORT AND INJURY RATE IN MILITARY COMBAT BOOTS

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## INTRODUCTION

Initial results from previous studies were positive suggesting that military personnel will be more comfortable and suffer fewer injuries if they use a footbed that is appropriate for their characteristics (Liu et al, 1998; Mundermann et al., 2002). The initial studies were performed primarily by varying the material properties of the shoe inserts. The question still remained, however, whether or not inserts that are individually moldable or adjustable to a particular subject are even more beneficial. One type of individually moldable inserts is made of thermoplastic materials that can be heated and formed to the foot shape of the individual. It was speculated that individually molded inserts could result in even greater improvements in comfort and reductions in injuries and reduce the time required to select the appropriate insert in the military population. Thus, the purpose of this study was to determine the influence of individually moldable inserts on comfort and injury rates in a military population.

## METHODS

Subjects were gathered from a group of Canadian Army military personnel. A total of 163 subjects participated in the study. Participants were randomly assigned to either a control group or a molded insert group. The subjects in the molded insert group received thermoplastic, heat moldable footwear inserts that they were to use in their footwear. The control group continued using their current footwear insert. At the initial fitting, all subjects assessed insole comfort. Injury data were then collected over a period of nine months while the subjects continued to participate in their daily activities while wearing the different inserts. Average comfort was analyzed using paired t-tests within the molded group and unpaired t-tests across the two groups. Injury rates were analyzed using a Chi-square test. In all situations, the level of significance was chosen as  $\alpha=0.05$ .

## COMFORT

Insert comfort was assessed at the initial fitting. Subjects were required to walk in their footwear and then provide a comfort rating for the insert using a 15cm Visual Analog Scale (VAS) (Mundermann et al., 2002). The VAS was anchored on the left side with the statement “not comfortable at all” and on the right side with the statement “most comfortable condition imaginable”. Subjects were asked to place a vertical mark along the scale line representing their opinion of relative foot comfort for the particular condition they were assessing. The subjects in the molded insert group provided performed repeat comfort ratings using the standard issue insert as a baseline control. The final comfort measure was used as the stable/repeatable comfort assessment of the insert condition (Mundermann et al., 2002).

## INJURIES

All subjects were asked to record injury or pain in a standardized personal logbook, which was provided by the investigators. Epidemiological data pertaining to injuries of the lower limbs was also gathered using an exit questionnaire (see appendix A) and by accessing military medical records. An injury was defined to be any type of pain, or damage occurring in the lower limbs or lower back during the nine month testing period. The head surgeon of the military Medical Center arranged to tally injury frequency and type for both the insert condition groups, in order to sanitize subject identities from the injury data and ensure patient confidentiality. Injuries were compared on a per subject basis for each group. Injury frequency was compared for specific injury modalities and total injuries.

## RESULTS AND DISCUSSION

The use of a heat moldable insert significantly increased the comfort of military personnel by over 4 comfort points. Figure 1 illustrates the difference in comfort rating between the molded and control insert condition for subjects within the molded group. Injury data has to be interpreted with caution as exact compliance rates are unknown. There was a significant reduction in the overall injuries for the group with the molded inserts. Almost 100% of subjects in the control group incurred an injury while only 88% of subjects with the molded inserts experienced an injury. The greatest reduction occurred in lower extremity soft tissue damage. There was a significant increase in the number of blisters with the molded inserts, which may be due to the surface characteristics of the insole or the reduced space in the boot. Table 1 summarizes injury data for the control and molded insert groups.

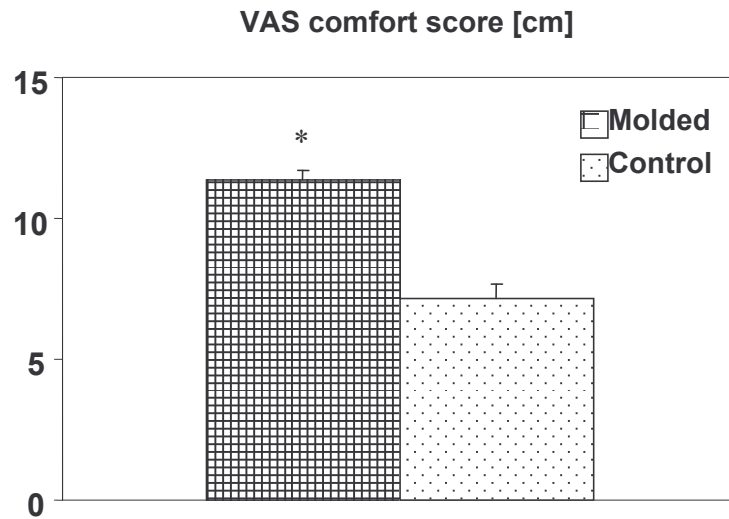


Figure 1. Average comfort results for the molded and control inserts within the molded group. \* indicates a significant difference from the control group.

Table 1. Injury frequency and modality for both the control and molded insert groups.

Injury Modality	Control N=69		Molded n=94	
	#	%	#	%
<b>Total Injuries *</b>	<b>68</b>	<b>98.6</b>	<b>83</b>	<b>88.3</b>
Blisters *	6	8.7	19	20.2
soft tissue damage *	25	36.2	16	17.0
back pain	10	14.5	8	8.5
lower limb pain	18	26.1	31	33.0

\* indicates a significant difference between the two groups.

### SUMMARY

Individually moldable footbeds were found to be significantly more comfortable than the control inserts when used in military footwear. Use of molded footbeds was found to alter injury modality and significantly decrease injury rate in military application.

### REFERENCES

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