



# Comparing the Difficulty of Maintaining Rhythm on Bass Drum and Hi-Hat Pedals Using Prostheses and Drum Set Adjustments

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## INTRODUCTION

Challenges arise for lower limb amputees when playing the bass drum and hi-hat pedals on drum sets. Each individual with a lower limb amputation must develop a method that works best when playing drum set: building an extension<sub>1</sub> or using only one pedal<sub>2</sub>. This study compared different such strategies to find the easiest method of playing drum set for prosthesis-users. It was hypothesized that a rearrangement of the drum set to allow one foot to control both pedals (Toe-heel model: Figure 1) would provide a consistency of rhythm closer to the consistency of playing with two able bodied feet than the rhythm produced using pseudo-prostheses.

## METHOD

**Subjects:** Subjects were recruited that were non-prostheses users, able to wear a pseudo-prosthesis, and had no severe hearing loss/ cognitive impairment.

**Apparatus:** A bass drum pedal (P930, Pearl Corporation, Nashville, TN) and a bass drum (VBL925P/C232, Pearl Corporation, Nashville, TN) were used with a hi-hat stand and pedal (9607DL, Kmc Music Inc). Koss Ear Buds were used to listen to the Mobile Metronome Application (Gabriel Simoes). Audacity 2.1.0 (open source) was used to record each trial and to see the time that each beat occurred. Two different pseudo-prostheses were used in certain interventions to test different methods.

**Procedures:** Four setups were used at both 100 beats per minute (bpm) and 200bpm to create eight interventions: Standard (A), Below-Knee (BK) pseudo-prosthesis (B), Above-Knee (AK) pseudo-prosthesis (C), and the Toe-heel model (Figure 1) (D). Each intervention was put in a randomized order for each subject and tested by playing a 24 beat pattern.

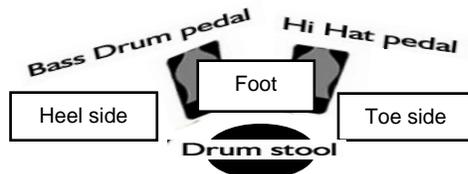


Figure 1: Toe-heel model (D) setup

**Data Analysis:** The average deviation between the metronome and played beats was calculated for all trials. The resulting values represent the accuracy of the rhythm compared to the metronome. Post-hoc comparisons were undertaken as appropriate. A critical alpha of 0.05 seconds was defined prior to data collection. The comparison was done by 2-way (condition x bpm) repeated measures analysis of variance (ANOVA) in SPSS (IBM, version 22).

## RESULTS

Seven subjects completed the protocol. Condition, the main effect, was found to be significant ( $p=0.006$ ), but neither the main effect of bpm ( $p=0.119$ ) nor the interaction effect of condition and bpm ( $p=0.350$ ) were significant at the 0.05s level. Post-hoc comparisons showed that only condition C (AK pseudo-prosthesis) significantly varied from the other conditions (Figure 1). The mean difference in the steadiness of rhythm against the metronome was +0.069s when compared to condition A, +0.039s when compared to condition B, and +0.061s when compared to condition D (Figure 2). Other differences between conditions were not significant at the 0.05s level.

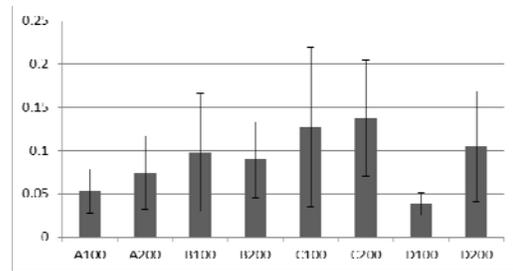


Figure 2. Mean and Standard Deviation in Seconds for each Testing Condition

## DISCUSSION

The hypothesis was confirmed for the AK pseudo-prosthetic attachment because it was less consistent than the accuracy of the toe-heel model. The rhythm maintained with the toe-heel model was not significantly different than the standard of playing with two typical feet. The hypothesis could not be confirmed for the BK pseudo-prosthesis.

Among the limitations of this study was the small sample size and the use of able-bodied subjects. It is recommended to confirm our findings with a follow-up study that addresses those limitations.

## CONCLUSION

The toe-heel model on the drum set seems to be recommendable for individuals who use an AK prosthesis because the toe-heel model would maintain better rhythm than the prosthesis.

## CLINICAL APPLICATIONS

Adapting to activities of daily life after limb loss is important for the successful rehabilitation and the attainment of a normal quality of life. Our findings provide evidence on the most appropriate adaptation strategy for people who play the drum set.

## REFERENCES

1. FUZATO, TULLIO, AMPUTEE DRUMMER, 2014.
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