P005 - DESIGN AND DEVELOPMENT OF SIX-POSITION FEET TEMPLATE FOR PERIPHERAL NEUROPATHY DIABETES TESTING

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INTRODUCTION

On November 2016, World health organization (WHO) show that around 422 million adults in the world are diabetes. Half of diabetes patients develop peripheral neuropathy requiring intervention resulting in hospitalization and subsequently this may lead to amputations. However, diabetic patients with peripheral neuropathy can survive and live as normal people if they are treated in right way and on time. To classify risk the level of a patient, normally sensory and motor function of the peripheral nervous system is evaluated by technicians with monofilament device. The monofilament device produces a sensational response by touching and pressing on patient's skin. According to this method, we are interested in developing a robotic system for peripheral neuropathy diabetes testing following previous work [1]. The new version of robotic system is being developing.

Six test positions are focused on here and are added to the template of the robotic system. The six test positions consist of three positions at the middle area of the feet (metatarsals bone), one position at the heel area (Calcaneus bone), one position at the big toe area (First phalange bone) and one position at the little toe area (Fifth phalange bone) as shown in figure 1(a). To develop an optimal robotic system with compact dimension, a universal template for various size of foot and also both left and right feet is the challenged.

METHODS

The template was designed and developed on 50 volunteers, with feet in between 35-45 of European size. The suitable areas of all test positions are determined for each foot of volunteers, especially the two test positions of big toe and little toe. These two positions provide a long range of adjustment between left and right side. The hypothesis of the experiment is that the three test positions at middle area of foot are stable position and the rest are the area that we need to find an adjustment area. Different templates were developed for the experiment with purpose of 'study on adjustment area of feet between 35-45 Euro with both left and right side'. 10 templates were designed and implemented for experiment.

In the experiment, volunteers were asked to put their foot on the templates, then fit the posture of the foot on all six test positions and ask them for comfortability of their foot. Rating are no point for template that cannot fit their foot on six test positions, one point for template that can fit their foot on but uncomfortable feel and two point for template that can fit their foot on with comfortable feel.

Scores and comments were recorded for researchers. To define the solution of the template, statistical methods were applied to give a preliminary analysis. Then specific cases were customized for the template to cover as many cases as possible.

RESULTS AND DISCUSSION

Result from the experiments show that the three test positions at the middle area of feet can be fixed positions, including with the heel position. Big toe and little toe test positions require a long range for adjustment with some angle slope for left and right side to be changeable. However, there are a few cases that do not fit the template, so specifically modifications are applied to the template to make it fit as many cases as possible. The modified template was test on volunteers again and the results show that the template had more than 85% accuracy. The final solution of template consist of three test positions at middle area of feet and heel test position as fixed positions on the template and two test positions of big toe and little toe as adjustable positions to fit with each person's feet. The adjustable positions of big toe and little toe are 60 mm long range with +10 degree and -10 degree slope from the center line as show in figure1(b).

(a) (b)

Figure 1: a) Six test positions, b) Template of six-position feet template for peripheral neuropathy diabetes testing.

CONCLUSIONS

This work is a study on a feet template for peripheral neuropathy diabetes testing. The template consist of six test positions; three fixed positions at the middle area of feet, one fixed position at the heel area, one adjustable position at the big toe area and one adjustable position at the little toe area. The template is designed to fit both left and right feet at 35-45 Euro foot size. The result show that the template has more than 85% accuracy.

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