Case Report

Evaluation of Gait Performance of a Hemipelvectomy Amputation Walking with a Canadian Prosthesis

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Background. Hemipelvectomy amputation is a surgical procedure in which lower limb and a portion of pelvic are removed. There are a few studies in the literature regarding the performance of subjects with hip disarticulation during walking. However, there is no study on gait analysis of hemipelvectomy subject. Therefore, the aim of this paper was to evaluate the gait and stability of subject with hemipelvectomy amputation.

Case Description and Methods. A subject with hemipelvectomy amputation at right side was involved in this study. He used a Canadian prosthesis with single axis ankle joint, 3R21 knee joint, and 7E7 hip joint for more than 10 years. The kinetic and kinematic parameters were collected by a motion analysis system and a Kistler force platform.

Findings and Outcomes. There was a significant difference between knee, hip, and ankle range of motions and their moments in the sound and prosthesis sides. In the other side, the stability of the subject in the anteroposterior direction seems to be better than that in the mediolateral direction.

Conclusions. There was a significant asymmetry between the kinetic and kinematic performance of the sound and prosthesis sides, which may be due to lack of muscular power and alignment of prosthesis components.

1. Introduction

Lower limb amputations have been done as a result of trauma, vascular disease, cancer, and so forth. The incidence of amputation varies between 2.8 and 43.9 per 100000, in which 0.5% and 3% have been done as disarticulation through the hip joint or above [1, 2]. The main reasons for amputation at this level are vascular impairment, malignancy, and tumor [1, 3]. Those with hip disarticulation miss their abilities to stand and walk efficiently (without use of crutch or walker) and have to use special prosthesis [2, 4]. Various types of components have been designed for hip disarticulation and hip pelvectomy to enable the subject to stand and walk [4, 5]; however, they have several problems including high energy consumption during walking, slow walking speed, style of walking which is not cosmetically appealing, and limitation in range of motion of leg joints [6–10]. As a result of small number of prosthetics users there is limited number of research on this topic. Furthermore, there are a few studies on kinetic and kinematic parameters of Canadian prosthesis users [6, 7, 9]. In one research study the loads applied on prosthesis were evaluated during walking of a subject with hip disarticulation amputation [8].

The mean walking speed of hip disarticulation (HD) subject (walking with prosthesis) varies between 0.83 and 1.31 m/s [7]. Moreover, their step length differed between 0.65 and 0.96 m, which is significantly less than that of normal subjects [7, 11]. The energy consumption of these amputees is also more than 2 times than that of normal subjects [11].

In contrast to hip disarticulation, hemipelvectomy amputation is a surgical procedure in which the lower limb is removed including a portion of the pelvic. Therefore, it seems that the performance of these subjects differs from those with HD, due to higher level of amputation. Based on author’s knowledge, no research study evaluated the ability of subjects with amputation at this level. Therefore, the aim of this paper was to evaluate the performance of subject with this amputation.