CASE REPORT

Prosthetic restoration in patient with incomplete spinal cord injury

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We describe a case of 55-years-old man with a known T11 AIS C since 1985. The muscle strength of his left leg is better than the right leg and he is an active community ambulator. He walks using his right knee ankle foot orthosis without a knee lock. However, on April 2012 he had undergone a left transtibial amputation secondary to infected diabetic foot ulcer. He only had his first contact with rehabilitation team 2 months after the amputation and started on gait retraining since. Given the fact that he is a K3 level as he used to climb Batu Caves which is known to have 272 steps and he plans to continue this activity for his religious purposes, we prescribed him with prosthesis – patella tendon bearing socket, pin and lock suspension, silicone liner and energy storing foot. In conclusion, a community ambulator in dual disabilities, that is, spinal cord injury and amputee is hardly encountered due to multiple confounding factors. However, the right prosthetic prescription in patient with good prognosticating factors to ambulate will determine successful rehabilitation.

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A 55 year-old-man who is a known case of diabetes mellitus type II and traumatic spinal cord injury (SCI) since 1985 presented to rehabilitation clinic 2 months post left transtibial amputation. Premorbidly he was an independent community ambulator. He was walking with a single-point cane and used a right knee ankle foot orthosis (KAFO). He was driving an unmodified automatic car and climbed up Batu Caves which has 272 stairs for prayer during Thaipusam every year.

One month before the amputation, he had an ulcer at his left foot. The ulcer worsened despite regular dressing and eventually he had to have a left transtibial amputation. He was discharged home, had dressing regularly at the nearest clinic and referred to us after the wound had completely healed that was 2 months after the amputation. At home he was ambulating with standard non-detachable arm and footrest wheelchair, independent in all personal activity of daily living and transfer using standing pivot with the right lower limb with KAFO.

Upon our assessment, his amputation stump was slightly bulbous (as patient was never taught about stump care), there was no pain but phantom sensation was present. Neurological assessment revealed T11 AIS C. There is no ISNCSCI documentation before amputation as he never had any follow-up with us before. His KAFO upright bars were loose, had no lock and the ankle hinge allow dorsiflexion but restrict plantarflexion (Figure 1).

He was then referred to a physiotherapist for a balance, strengthening and gait retraining, and an occupational therapist for stump care. Prosthesis prescription was also given based on expected K3 level (ability to walk with variable cadence) and dual disabilities. Therefore a patella tendon bearing socket, a silicone pin and lock suspension as well as energy storing foot were prescribed. A new KAFO was also prescribed to improve his stability during walking with the prosthesis.

After 3 months of therapy, he finally had his prosthesis ready but still waiting for a new KAFO. A month later, he was already independently donning and doffing the prosthesis, walking steadily at the parallel bar and has started driving again. On assessment with Amputee Mobility Predictor Assessment Tool - with prosthesis (AMP PRO) he scored 30 out of 47 that equals to K2 level (ambulate with the ability to traverse low-level environment barriers such as curbs, stairs, or uneven surfaces) according to Medicare K-level.¹

'Doctor, am I able to walk again?' is one of the most frequent questions to be asked after disability. In the study by Anderson,² walking is identified to be of importance to SCI patients after sexual, bowel and bladder function in paraplegia. This research output is also in agreement with another study led by Pell,³ which demonstrates that the quality of life after lower limb amputation had shown to be significantly associated with mobility. The ability to walk in motor incomplete paraplegia AIS C was reported ranging from 76 to 87%.⁴ On the other hand, the ability to walk in amputee (without paraplegia) was reported to be 78% for unilateral transtibial and 50% for unilateral transfemoral.⁵ The study further reported that 20% of patients walked indoor, 16% walked outdoor and 20% climbed stairs. Therefore with dual disabilities of SCI and amputation, the walking ability rate could be lower.

Positive predictors of walking ability after lower limbs amputation can be divided into four. (1) General factors: younger age, participation in sport before amputation and employment status at time of prosthetic fitting, (2) medical: unilateral and distal amputation, longer stump and fewer stump problems, (3) physical: walking status before amputation, ability to stand in one leg and good physical fitness and (4) psychosocial: good social support, cognition and motivation, shorter time interval referral for rehabilitation.⁶

For SCI AIS C, the positive predictors of walking are (1) age younger than 65-year-old during injury,⁷ (2) muscle strength of

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Figure 1. KAFO with loose upright bars without lock and ankle hinge.

grade 3–5 at L2 on one side and grade 3–5 at L3 on another side, (3) sensory; van Middendorp and colleagues⁷ identified light touch at L3 and S1 as the predictor, whereas Scivoletto and Di Donna⁴ in their review mentioned sacral light touch-pin prick discrimination and (4) timing of motor recovery.⁴

In this case, the patient has a few good prognosticating factors to ambulate as SCI and amputee. As SCI patient, he had injury at 28-year-old and he has adequate muscle strength as have been mentioned above. Being an amputee, he had unilateral transtibial with a good length and stump that healed well without issue. Thus we had proceeded with prosthesis prescription.

Prosthetic fitting is a challenge in SCI patients due to impaired sensation thus predisposing patient to pressure ulcer. Herman *et al.*⁸ suggested prosthetic prescription in paraplegia should have these criteria; well fitted socket for stability and control, protective and comfortable liner, allows independent donning and doffing, and lightweight. Other factors that we consider in this case are gait abnormality secondary to paraplegia, which increases energy consumption on top of diabetes mellitus and aging that reduce physical ability.⁹ Therefore we prescribed energy storing foot to help with energy conservation due to its lighter weight feature in comparison to the other articulated prosthetic feet, silicone liner with pin and lock for better control and suspension in swing phase.

In conclusion, successful rehabilitation in patient with dual disabilities of SCI and amputation are determined by ability to identify prognosticating factors to ambulate and prescribing the right prosthetic components.

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COMPETING INTERESTS

The authors declare no conflict of interest.

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