

Quadrimebral Amputee Prosthetic Management- A Challenge vis-à-vis Physical, Psychological and Social Rehabilitation- Case Study

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ABSTRACT:- Traumatic quadrimebral amputations are very rare and make a tumult to manage them with appropriate medical Rehabilitation and maintaining their psycho social status at stretch. This requires a thorough deliberation among the members of clinical team starting from accident site to a healthy life in the society. The role of surgeon is as major for saving of life and limb salvage as the prosthetist to bring back the patient to the main stream of society.

Prosthetic rehabilitation of these amputees starts with the decision making about the sequence of prosthetic fitment and the choice of prosthetic component according to the need of the patient. We had a 58 year old quadrimebral amputee with Bilateral below knee amputation and right trans- humeral and left trans radial amputation. As quadrimebral amputation are rare, there is a dearth of literature relating to prosthetic management of this level. Therefore, this case study provides a through description of the sequence of events that lead to the successful fitment and rehabilitation of this complex category of amputation.

Key words: Traumatic quadrimebral, amputation, Prosthetics, rehabilitation, case study.

I. BACKGROUND

On 18th march 2016 Anil Sen, a 58 year old male was run over by a train when he was crossing the railway track beneath the stationary train in laying position, and the train started running, and his both arms and legs were severed and he was lying on the railway track in a serious condition. This accident happened at Sarairohila (New Delhi) Railway station at around 7.30 pm when he was going to join his evening duty as a constable of RPF(Railway Protection Force) in 2016. As it was evening and the place of accident was a non familiar railway track, so he was unnoticed for about one and half hours. At about 9.00 pm he was noticed by the Railway staff and he was immediately shifted to the nearby Northern Railway central hospital. By then he had lost lot of blood and his wounds were in an unhygienic condition, his body was infected and doctors were hesitant and doubtful to take him to for operation. At about 11 pm, four surgeons were engaged to stabilize him and did amputated of all his four extremities and after amputation he became a quadrimebral amputee.

Quadrimebral amputees by definition, are those who have lost all or part of both their upper and lower extremities (Foroohar & Levin; 2011). After amputation he was a quadrimebral amputee with right trans-humeral amputation, left trans-radial amputation and bilateral trans-tibial amputation as shown in the Fig 1.1. Anil Sen regained his sense the next morning after amputation and was very disturbed and anxious about his amputation and the value of his life thereafter. He even had thoughts of ending his life. A decision was taken to counsel the patient and the sr. Prosthetist of the hospital was called to counsel the patient and evaluate him for prosthesis and rehabilitation. As Quadruple amputations are rare with an incidence of just 0.02% (Chin & Sawamura; 2008), there is a dearth of literature addressing these amputees and their possible treatment options (Foroohar & Levin; 2011); it was a challenge for us as a prosthetist to rehabilitate this client. Moreover, the prosthetic rehabilitation becomes even more difficult as the amputee does not has any of his limbs and encounters difficulties for every daily life task almost equivalent to that of a cervical spinal cord lesion (Davidson et.al; 2002)

Quadrimebral amputees face appended challenges in comparison to those who have lost one or even two limbs. In case of bilateral transfemoral amputations, the individual may suffer from a loss of balance in sitting and rolling as well as lack the propulsive and proprioceptive support used in ambulation. Whereas, in case of Bilateral upper extremity amputation the individual face difficulties in performing activities of daily living as they lose the ability to interact with their surroundings and to maneuver objects in their environments.

Another noteworthy issue which quadruple amputation is that the significant loss of body surface area causes increased sweating in these individuals, which may interfere with prosthetic fitting and utilization. Moreover, augmenting to the above concern, the energy expenditure needed for mobilization and ambulation with prosthesis may be substantially increased for these amputees. Therefore, during the prosthetic rehabilitation of a quadrimebral amputee we have to understand the combination of these impairments and its detrimental impact on the patient, the patient's disability and eventually rehabilitative potential of the individual (Allport et al., 2008; Celikoz et al., 1997; Kitowski & Leavitt; 1968; Kitowski & Pelosof; 1973).

As quadrimebral amputation are uncommon and rare, there is a paucity of literature regarding quadruple amputees. Resources related to the recovery and rehabilitation following four-limb amputation are even more limited. In spite of all the hurdle in the case of Anil Sen he was motivated and after stump maturation successfully fitted with prosthesis. The complete prosthetic rehabilitation of the amputee have been documented in this case report. This case report aims to offer a guide to the sequence of events that lead to the successful prosthesis management of Anil Sen, a quadruple amputee who was successfully rehabilitated and returned to his job.1,4-7 (Allport et al., 2008; Celikoz et al., 1997; Foroohar & Levin; 2011; Kitowski & Leavitt; 1968)

Case description and methods

After maturation of stump, Anil Sen reported to the department of Prosthetics and Orthotics Northern railway Central hospital. The most challenging issue in this case for the Prosthetic and orthotic professional was the sequence of prosthesis fitment as literature were ambiguous about it. Most of the literature (Cooke et al; 2016; Foroohar, & Levin; 2011) provide the different types of prosthesis used for the patient but none of them actually mentioned the sequences of fitment and rehabilitation. After a lot of brain steering and constructive debate among the prosthetic professionals it was decided that the lower of this quadruple amputee should be fitted first.

Fitment of Lower Limb Prosthesis

The trans-tibial lower limb prosthesis were fabricated. The prosthetic system was equipped with higher end components and well fitted light weight carbon composite total contact socket. His system was initially fitted with K2- 3 foot with light weight pylon system. Before amputation the height of the patient was 6'2". To achieve better balance we reduces the height of the prosthesis by 2 inches to lower his CG and after fitment of lower limb prosthesis the patients height was 6 ft.

Another major problem was faced during the trail, standing balance and gait training of the patient when he experienced major balancing issues as both his upper extremity were amputated. After a lot of brainstorming and conceptualization a novel design concept was adopted. A pair of axillary crutches made of good quality Ply wood made were taken and cross link mechanism was applied over the back and chest of the patient to keep the two crutches intact with the axilla of the patient. This maneuver was finally successful with the patient and he was able to stand and walk with the help of the crutches.

The patient was very dynamic and had a powerful spirit, as almost after one hour of his initial trial, he insisted to remove the crutches and he started walking without crutches but with safeguard and precaution of two of his sons on both sides as emergency supporter. To the surprise of everyone on the 2 day of the gait training Anil Sen started walking freely without any support (Fig 2.1, 2.2). On the same day he was fitted with the upper extremity prosthesis which tremendously helped him in walking independently.

Fitment of upper extremity Prosthesis

On the second day of the training both myo electric upper extremity prostheses were fitted him. For both upper extremity prostheses, the first line choice was myo electric hand and push button elbow for above elbow amputation. Myobouy response for both stumps were good and after fitment it worked as desired. He was able to hold the object. His training sessions now involved gait training as well as ADL (Activity of daily living) training (Fig 3.1).

Training with the four Prosthesis

On day four of his training Anil Sen started practicing with all the 4 prosthesis together. He adopted very fast to all the 4 limb together and it was observed that after the successful fitment of upper extremity prosthetic system, his walking pattern improved tremendously as a consequence his gait became quite normal (Fig 3.2).

During trial and training on the eighth days with all the four limbs, alignment of lower limb prostheses were changed at regular interval to make the patient achieve the most stable position. At the end of eighth day, finally he was able to walk freely without any support and simultaneously he started doing activities with his upper extremity prostheses.

To reduce the energy consumption, his lower limb prosthetic foot were replaced with another energy storing foot i.e K3-4 (velocity foot). The patient was very comfortable with the new prosthetic foot and immediately became acquainted with it (Fig 4). On the day ten of the training he was ready to go home with his prosthesis and was discharged from the artificial limb centre, Northern Railways, New Delhi.

Returning back to Job

At the time of accident, Anil Sen was 58 years old. After the fitment of the prosthesis he returned to his service to the Railway Department but not as a constable but in an alternate job and retired at the age of 60. Since his initial fitting in the latter half of the year 2016, his prosthetic system has been replaced two times. Now he is living in a healthy and peaceful life in the society with his family members and relatives.

II. DISCUSSION

Quadrimebral amputation are extremely rare (Davidson et al.; 2002) and these are severe injuries with potentially devastating functional as well as psychological sequela (Garrison and Merritt 1997; Celikoz et al., 1997; Kitowski VJ, Leavitt, 1968). Compared to single limb amputees, these subgroup of amputees (quadraple amputees) are more reliant on rehabilitation and prosthetics, although with more modest expectations and outcomes (Foroohar & Levin, 2011). There is a dearth of literature in the field of rehabilitation of these amputees and what so ever is available, illustrate an inconclusive and ambiguous depiction. The most difficult part during the management of our present client Anil Sen was to decide the sequence of fitment of prosthesis. Many pioneers in the field suggested that upper extremity should be fitted first and ADL training should be given first as upper extremity prosthesis will help the patient maintain balance during gait training. But contrary to it we decided to fit the patient with the lower limb prosthesis first because the patient had low self-esteem when he reached the artificial limb fitment center. Both literature as well our person experience suggest that adopting to below knee prosthesis is much easier and faster than above elbow prosthesis. So, in order to boost his self-confidence we decided to make him stand first with the below knee prosthesis and a pair of modified crutches. Our decision worked in the right direction and the patient was able to stand and walk within in two days which significantly boosted his confidence level. This is in accordance with previous studies (Behera & Dash, 2022; 2021) which suggests that standing of their residual limb with the use of Prosthesis for the first time fill them with happiness and self-confidence to the extent that they feel that prosthesis bestowed them with a new life.

Immediately after the patient was stable with the below knee prosthesis we fitted him with myoelectric upper extremity prosthesis which he adopted to very well. He was able to perform his ADL activities and walk confidently at the end of 10th day of training when he was discharged. He then immediately returned to his workplace in an alternate job when helped in rehabilitating him socially and psychologically. As a matter of fact quadrimebral amputation is not only physical but also affects the psychological and social well-being of the individual. Studies (Canavese et al., 2010) suggest that among overall amputee population only 63% of the individuals with amputation return to work and this when the job-return rate was studied among multiple limb amputees only one-third of these patients were able to return to work (Davidson et al. 2002). Therefore in the present case report the patient returning to his job with the prosthesis was a major achievement.

Another noteworthy element perceived during the rehabilitation of this present study was that the patient had full support from his family and two of his sons always accompanied him to the artificial limb center and helped him and motivated him throughout the fitment and training sessions. This illustrates the importance of family and social support in re-imbuing self-esteem as well as self-confidence which helps in speedy rehabilitation of the patient. The significance of family and social support has been highlighted in amputee literatures (Behera & Dash 2022; 2021).

III. CONCLUSION

Quadrimebral amputation is complex and the prosthetic rehabilitation of quadrimebral amputee is a challenge which require an enthusiastic, very strong headed and determined prosthetic team. The prosthetic rehabilitation of this group of amputees not only requires the fitment of prosthesis but requires the prosthetist to listen to the client and motivate the client throughout the processes. The prosthetist should be innovative and creative enough to understand and design the prosthesis as well as the environment in order to facilitate easy as well as early acceptance of the appliances. Another important fact which we would like to put forth is that very individual case of quadrimebral amputation is unique and therefore should be studied and discussed thoroughly before fitment of prosthesis.

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Fig 1. Anil Sen with quadriplegic amputation



Fig 2.1



Fig 2.2.

Fig 2.1 , 2.2 Patient during Gait training with Transstibial Prosthesis

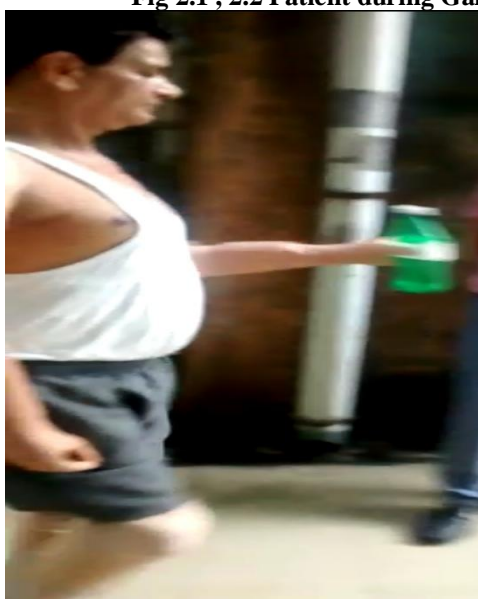


Fig 3.1



Fig 3.2

Fig 3.1. Patient Training for ADL activities.

Fig 3.2. Patient training with the Upper extremity prosthesis and lower extremity Prosthesis



Fig 4. Patient with all the four Prosthesis at the time of discharge