

# Advantages of Ischial Weight Bearing Immediate Post Operative Prosthesis

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## Abstract

This study was conducted to clinically assess a new prefabricated immediate post operative prosthetic design patented in the U.S. The prosthesis has ischial weight bearing proximal contact socket which reduces the pressure and shear over the stump, thus avoiding the stump complications. It has the added advantages of being adjustable to anthropometry and can be used for transtibial, through knee and transfemoral amputations. It is easy to adjust and fit, patient can don and doff as and when required and is reusable. Twelve patients, who were fitted with the prosthesis reported decreased complaints of pain, phantom sensation etc. None developed wound dehiscence or other stump complications. It was used as early as post operative day one and all of them walked on the same day of prosthetic fitment. Its use was limited to hospital premises and the design was acceptable to the patients.

## Introduction

Early ambulation after amputation has enormous benefits on the functional & psychological outcome in lower limb amputees. They include reducing risks of immobility such as aerobic deconditioning and contractures and avoiding complications like pain, oedema, muscle atrophy etc. It thus accelerates wound healing. Postural reflexes are maintained and the patient does not 'forget' walking until definitive prosthetic fitment, with added psychological benefits. Immediate post operative prosthesis thus hastens overall rehabilitation<sup>1</sup>.

There have been many attempts to achieve early post amputation ambulation, the first of which was rigid plaster of paris casting of the stump on the operating table with pylon attachment, proposed by Berlemont<sup>2-4</sup>. Some of the other models were;

- early walking aid for geriatric amputees with polythene, padded leather or metal sockets (Devas, Thomson)<sup>5-7</sup>,
- pneumatic post amputation mobility aid (PPAM)<sup>8-11</sup>,
- simple pylon of copper tubing and tripod base (Harrington et al)<sup>12</sup> and
- prefabricated plastic limbs<sup>13</sup>, to mention a few.

All these models had total contact, end weight bearing sockets which produced shearing and stress forces on the amputated residual limb, leading on to complications like delayed healing and wound dehiscence and hence fell into oblivion.

At the Deptt. of PMR, AIIMS, New Delhi, we conducted a prospective study to clinically assess a new prefabricated immediate prosthetic design, patented as Durga prosthesis in the U.S.A. which is adjustable to patient's build and height and is easy to apply<sup>14-16</sup>.

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## Material and Methods

Device studied: The prefabricated immediate lower limb prosthesis has a polypropylene, quadrilateral ischial weight bearing socket, which is open distally. The socket is adjustable in anteroposterior and mediolateral dimensions. It has a modified silesian band suspension. There are adjustable metal uprights extending from side walls of the socket to SACH foot. There is an automatic locking and manual unlocking knee joint allowing sitting on a chair with bent knee. Patients can don and doff their prostheses themselves (Fig. 1,2).

### Inclusion Criteria

- Transtibial, through knee and transfemoral amputees
- Above 12 years of age
- Within ten days of amputation
- Any cause and type of amputation
- Sound mental status
- Informed consent

### Exclusion Criteria

- Short transfemoral (less than 7 inches) stump
- Long transtibial stump
- Associated medical conditions detrimental

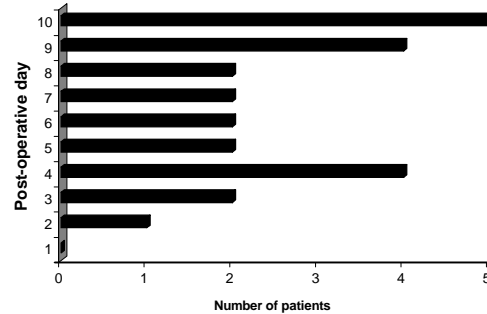
to patient's early ambulation

- Associated upper extremity conditions affecting use of a standard walker
- Sensory deficit in gluteal or perineal region of amputated extremity
- Unwillingness to take part in study.

## Procedure

After bandaging the amputated residual limb, a foam dressing was applied to it. The prosthesis was adjusted to patient's measurements and then fitted. Patient was made to stand and after final adjustments, the fit of the ischial seat was confirmed. Patient was then taught weight shifting on alternate lower limbs and then walking with assistance of a standard walker (Fig. 3).

Fig. 3. Time of Prosthetic Fitment



## IMMEDIATE POSTOPERATIVE ISCHIAL WEIGHT BEARING LOWER LIMB PROSTHESIS



Fig. 1: Front View



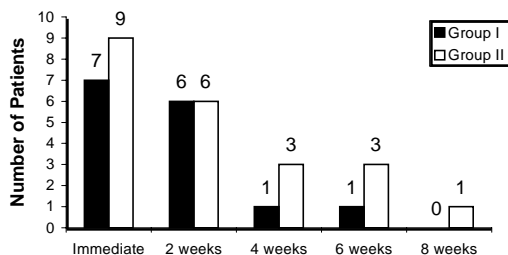
Fig. 2: Lateral View

## Observations and Results

Out of the twenty four consecutive lower limb amputees studied, twelve successfully ambulated with immediate prosthesis and we considered them as group I. The procedure had to be abandoned in the other twelve (group II).

The average time of prosthetic fitting was 6.7 days after amputation (Fig.4).

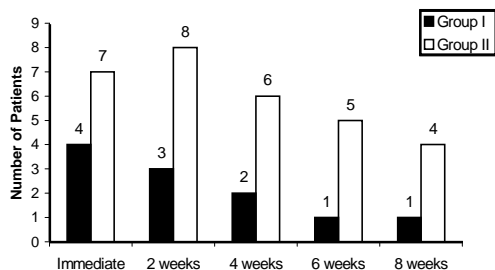
Fig. 4 : Pain



The total distance walked varied according to individual patient and at the end of the study those who completed the programme could walk for time periods varying 30 minutes to 120 minutes at a stretch without any complaints. All of them walked on plain surface without any difficulty and seven out of twelve patients (58.3%) could walk on uneven surface as well. A young male negotiated up and down stairs with his transfemoral immediate prosthesis.

We noticed that patients in group I had decreased incidence of pain as compared to those in group II who did not ambulate with immediate prosthesis (Fig. 5).

Fig. 5: Phantom Sensations



A reduced incidence of paraesthesiae, phantom sensations, phantom pain and discolouration and oedema of the stump were also noticed (Fig. 6, 7, 8).

Fig. 6. Phantom Pain

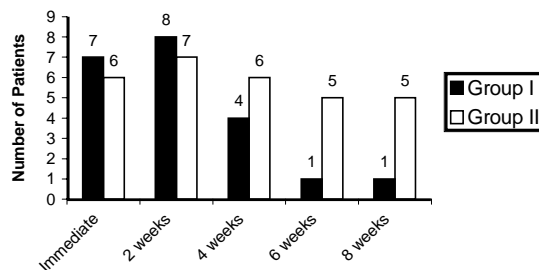


Fig. : 7 Paraesthesiae

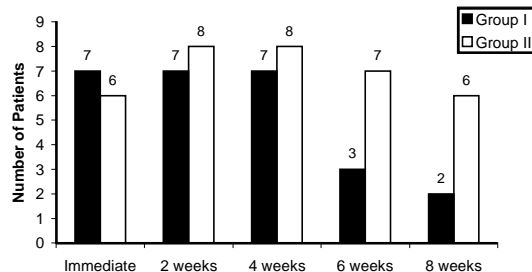
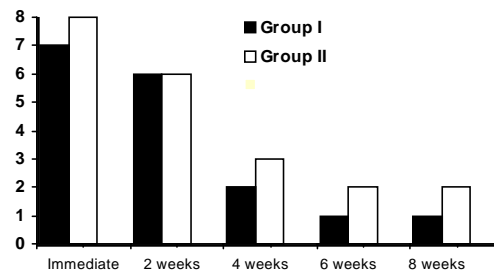


Fig. : 8 Odema And Discolouration



A statistical significance could not be arrived at due to the small population studied. None of the patients had wound dehiscence or excessive stump soakage in either groups. Only one transtibial amputee in group II who was amputated for vascular disease and had an ulcer on the anterior

aspect of the knee, developed a knee flexion contracture.

The prosthetic design was made to western standards and many of our patients could not use it because the socket was too loose. This was the reason for abandoning the trial in 9 patients of group II. We did not alter the adjustability in socket which could have been done. Two patients had excessive pain in the limb and were unable to cooperate and one patient had a conversion reaction during the procedure.

## Discussion

The present study was conducted in 24 consecutive lower limb amputees in immediate post amputation period. Knutsson and Stahl<sup>4</sup> were of the opinion that only those patients who were walking before the amputation, at least with stick could ambulate postoperatively as well. However, in our study, all the patients who had successful trial walked on the same day of prosthetic fitment irrespective of their pre-amputation ambulation status.

The classical technique of immediate post surgical prosthetic fitting necessitated meticulous care in application of the rigid dressing, alignment of the pylon and foot and in prosthetic gait training, requiring a skilled and dedicated prosthetic team to achieve optimum results and to minimize complications<sup>13,17</sup>. It also needed frequent changes of temporary sockets which placed an extra burden on an already over burdened workshop<sup>4</sup>. The new prefabricated design is in stark contrast to this, being easy and simple to apply with adjustability provided in itself.

Immediate postoperative prosthesis once applied was static, caused variable and unpredictable pressure on the wounds and the surgeon could not observe or palpate the wound instantly. Though the pneumatic devices allowed wound inspection, all of them provided total contact equal pressure throughout the stump with

intimate fit<sup>5-7</sup>. There also was the potential risk of inflation pressure causing tissue necrosis<sup>18-20</sup>. The study design bypassed weight through the amputation stump and thus removed any pressure or shear on it, allowing wound inspection as and when necessary.

The amputees who satisfied the inclusion criteria were fitted with the ischial weight bearing proximal contact immediate postoperative prosthesis after applying foam dressing over the bandages. It was ensured that no pressure or excessive pain was felt at the stump end or suture line and that the ischial seat was conforming to the ischial tuberosity. Initially, patients were taught to shift weight on alternate limbs and then bear weight on the affected limb. After making sure that no pressure was felt at the residual limb with total weight bearing, patients were allowed to walk as much as they could, with assistance of a standard walker. This differed from the classical teaching of IPOP which graduated from touch down weight bearing in the first few days to 25 to 50% of body weight, measured by bath room scales<sup>21</sup>, where the enthusiastic often ended up with complication. Some authors advocated weight bearing only after suture removal<sup>19,22-24</sup>. Such a problem did not occur with this design as the stump end was free and secure within the prosthesis. A standard walker was used always to prevent any imbalance, incoordination, fear of vertical position or trauma or fall should they occur.

In the group where trial was abandoned, nine out of twelve were due to an ill fitting socket despite maximum adjustments. No attempt was made to increase the slot provided in the socket which could solve the problem.

In our series, patients who amputated with immediate post operative prosthesis had lesser incidence of pain, paraesthesiae, phantom sensation and phantom pain, as compared to those without. The values were statistically non significant due to the small sample size studied.

Many authors<sup>5,23-25</sup> have described reduction in phantom pain and other complications with early ambulation which was also observed in our study.

No patient had wound dehiscence or excessive stump soakage. Warren and Moseley<sup>26</sup>, Golbranson et al<sup>22</sup>, Cohen et al<sup>17</sup> and Kane et al<sup>27</sup> reported incidence of stump complications and wound dehiscence in vascular amputees who practiced immediate ambulation with rigid dressing.

Mark<sup>28</sup> objected to the tendency of joint-less limbs to produce an awkward gait and Slocum<sup>29</sup> expressed his concern about immediate post operative prosthesis with a stiff knee producing faulty gait patterns at a later date. This was found not to be true in this series. All amputees, whether transfemoral, through knee or transtibial, walked with a stiff knee in the immediate prostheses. Their definitive prostheses had knee movement and no gait abnormality was detected in any of them. Thorpe et al<sup>30</sup> could not directly attribute any gait abnormality to the use of a pylon.

All patients in group I accepted the new prefabricated prosthetic design. They did not express too much of concern on walking with a stiff knee and none had any fear of falling. This was in accordance with the opinion of Kay and Pennel who found that some preferred a stiff knee which was more stable and provided no fear of falling<sup>31</sup>.

A peg leg or pylon protruded when the patient sat down, which was cosmetically displeasing<sup>32</sup>. The disadvantage was overcome in the design studied by a manually unlocking knee which provided flexion in the prosthesis when patient wished to sit down. Such a provision with hinges to allow manual control for sitting and standing was found in the "early walking aid for elderly amputees" developed by Devas<sup>5-7</sup>.

A high degree of self esteem was observed in all the patients who were fitted with IPOP.

Though all our patients were apprehensive about their ability to walk again without a part of their leg, the visual feedback in front of a mirror, thus seeing themselves standing and walking again, boosted up their morale. This is in accordance with the opinion that "the best use of immediate prosthesis is the psychological benefit". Golbranson et al felt that the intensity of immediate ambulation programme decreased the incidence of post amputation depression<sup>22</sup>.

## Limitations & Recommendations

Our study, with a total of twenty four amputees was limited in its sample size. This was in view of the limited clinical experience prior to this. Moreover, due to the restricted availability of the design and prior clinical knowledge, the prosthetic use was confined to hospital premises.

We propose a larger clinical trial including use of prosthesis at home. It is also recommended to increase the adjustability in the socket which alone would make the prosthetic application possible in a larger number of patients.

## Summary and Conclusions

A new prefabricated immediate prosthetic design was clinically assessed in 24 lower limb amputees. The prosthesis has ischial weight bearing proximal contact socket which reduces the pressure and shear over the stump, thus avoiding stump complications. It has the added advantage of being adjustable to anthropometry and can be used for transtibial, through knee and transfemoral amputations. It is easy to adjust and fit, patient can don and doff as and when required and is reusable.

Twelve patients had successful trial of the new immediate prosthesis and they walked with assistance of a standard walker on the same day of prosthetic fitment. A decrease in incidence of pain, paraesthesia, phantom sensations and phantom pain were noted in them. Out of the other twelve, the reason for abandoning the procedure was a

large socket in spite of maximum adjustment in ten patients as they were extremely thin. Other two had stump and psychological reasons.

We found that the use of immediate post-operative ischial weight bearing prosthesis was feasible in our setup. Minor adjustments in the modular socket measurements need to be done to enable thin built patients to be accommodated.

The design concept was largely acceptable and no serious complications like wound dehiscence or delayed healing as seen with the other immediate post-operative prostheses were seen with this. Its use improved patients' morale and needed no sophisticated prosthetic techniques. It was simple to use and adjustable to each patient. High level of satisfaction and self esteem were reported in patients who had a successful immediate prosthetic ambulation.

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