

V. SUMMARY AND CONCLUSION

A human being should be moderate not only because of concern about his health in the future, but also because of the well- being in the present

Immanuel Kant

Health and well – being have pervaded the minds and hearts of human beings as inextricable entities. Unfortunately the thrust on maintaining them remains backstage. A scan across the globe lays before one a big picture – burgeoning population with spotlights of those who are sick, aged and vulnerable. Amidst them is there a mounting category of those individuals remaining immobilized due to various circumstances. Cause of their plight is shouldered by the diseases they had fallen prey to or the accidents that had left them so. Either way the statistic on amputees’ sequel to those reasons keep surmounting day by day. India is an active participant in increasing the number. Curiosity to locate the truth behind led to some blinding facts. A *micro level investigatory study* was taken up by collecting data on amputees registered in four hospitals and three prosthetic centers in Coimbatore City enclosing a total area of 4850 km². The number recorded for a period of five years from 2009 – 2013 (beginning), showed the presence of **3726 amputees**, among whom 85 per cent were men. Further analysis showed **2313** among the total group as **lower limb amputees**, again displaying predominance of men. These facts kindled an interest in the investigator, a research scholar in Resource Management to do an in – depth study on amputees, cause of amputation, management strategies and on their decision to adapt to a living style on an artificial limb (prosthesis). With this backdrop a socially relevant study on “ **Accessibility and Adaptability of Limb Prosthesis –An Ergonomic Concern**” was launched. The locale of the study was Coimbatore City chosen adopting convenience sampling. The broad objectives framed for conduct of the study included:

- ☞ *Investigating the causes of amputation.*
- ☞ *Examining the compromises made by the amputees to lead normal living and to manage stress*
- ☞ *Knowing the functional capability of the prosthesis users citing access and adaptability*
- ☞ *Understanding the rehabilitative practices adopted by Prosthetic Teams*
- ☞ *Comprehending the role of Ergonomics in fabrication and use of Prosthetics.*

The schedule drafted for the study was channelized enabling conduct of the five concrete stages in their proper sequence. The findings are summarized as under:

Follow up study

- Same locale and sample (4 hospitals and 3 centers) selected adopting convenience sampling sufficed for this part of the study
- By March 2015 (in a two years gap), the City had enlisted 928 additional amputees with 819 male and 109 female victims. For the small geographical area studied this statistic was quite flabbergasting.
- The second phase of the study recorded 669 amputees, over and above the recorded 2313 to have joined the lower limb amputee cohort among whom 571 were men and the rest women.
- Within a span of seven years (2009 -2015), Coimbatore was found to shoulder 4654 amputees with 65 per cent (2982) belonging to the lower limb amputee category – a really alarming statistic (data from chosen sources alone).
- From among the 2982, almost **27 percent** (800) had ***refused to go in for prosthetic*** – living examples - people who neither thought of access or of adaptability to the human – machine device.
- Among the amputees 41 – 60 years group (45%) predominated followed by the 21 – 40 age range (30%). Those above 61 also were present (18%). A majority of them were male (86%).
- Among the gainfully employed category, 949 and 475 represented the unorganized sector and the salaried class indicating their plight to access and afford prosthesis. Among those unemployed, students and home makers featured more.
- Causes recorded for amputation pointed to three major etiological reasons, namely, medical (6 causes), surgical (8 causes) and others (2). Among surgical reasons RTA and Crush injuries ranked high (924 and 364 respectively). Amputation due to medical reasons recorded patients with Diabetes (552) and gangrene (119) as toppers. Though represented in lesser number the data received was agonizing since it entailed victims under all major categories.
- Data recorded for site of amputation showcased 49, 47 and four percent respectively to have undergone ***transtibial (below knee), transfemoral (above knee)*** and ***bilateral (both the limbs)*** amputation, among whom 1197 had lost their right limb, 898 their left limb and 87 both the limbs.
- Statistical analysis showed a strong association between cause and age group, level, occupation and side.

Prosthetics – The Common Platform for Amputees and Prosthetists

There were two groups who emerged as active players in the field of prosthetics. One was the user, the amputee and the other, the team which prescribed and fabricated the prosthesis, the **prosthetists**. Before embarking on finding out how the users benefited from the device, it was felt necessary to gain knowledge on the process adopted to fit the samples with the prosthesis. The findings on this aspect are summarized under the following:

Panorama of Prosthetic Prescription

Three popular prosthetic Centers were approached by the selected sample for their prosthesis needs based on the recommendations of the surgeons and personnel from the hospitals where they had undergone amputation and pre - prosthetic training. Hence those three Centers were chosen for finding out the prosthetic prescription protocols. The first center was run by a freelancer, while the other two were run by high tech entrepreneurs.

- **Biomechanics** and **Bio-mechatronics** were found to play a major role in the fabrication process.
- All the limbs prescribed were *custom made*.
- Two basic types of prosthesis were prescribed, namely Exoskeletal offered by Centre 1 and the Endoskeletal design offered by the other two Centres. The former is the conventional model, while the other was the much sophisticated *modular* model, which was quite expensive.
- Fifty one per cent among transtibial and 28 per cent among transfemoral were fitted with exoskeletal limbs. Total contact (least expensive) or open ended sockets were used in fabrication of below – knee prosthesis along with a Jaipur foot. For transfemorals, ischial bearing and ischial containment sockets were used. Materials used were polypropylene sheet or HDPE. The modular ones used polypropylene and resin.
- Various additional components –bio mechatronics accompanied the modular versions, complying with the specific needs of the samples (amputees).
- Cosmesis (the aesthetic outer covering of the limb) was found to be simple in the exoskeletal model, while it mimicked a natural limb in the modular, sophisticated endoskeletal model

Biomechanics of the Prescribed Prosthesis

During the phase of this study (from 2013 -14) there were 142 samples who had approached the three selected Centers for prosthetic fit. Actually there were 151, but nine had declined to go in for an artificial limb (live examples for reluctance to adaptability).

- Among the sample selected adopting purposive sampling, 89 and 30 per cent were transtibial and transfemoral respectively, while the others were bilateral.

Prosthesis for transtibial (TT)s: Among this group a majority belonging to the second and third centers (90% each), had opted for a silicone suction socket (SSS) or suction socket (SS), while the first centre offered only total contact socket. Both the types belong to Patellar Tendon Bearing Socket. Socket is the part of prosthesis that encloses the stump (the part of the residual limb that goes into the socket) and forms union between stump and artificial limb.

- The suspension offered for them was the cuff suspension (recommended by all three centers) followed by thigh corset. The etiology of amputation was an important deciding factor for the choice.

Prosthesis for Transfemoral (TF): Ischial containment socket was the one recommended by all the Centers (75 – 100 per cent), though the first and third Centers also suggested quadrilateral socket for 25 and 23 per cent respectively.

- Total elastic suspension was preferred to pelvicband / belt by more than 80 per cent of the samples from all the Centers.
- Crustacean or conventional knee was prescribed by the first Centre, while the others fitted a modular knee.

Prosthesis for Bilateral: This Cohort suffered a different kind of problem, as they had both the limbs severed. The severed limb showcased in four versions of left/ right pairs – TF/TF; TT/ TT; TF/ TT and TT/ TF. Evidently for the last two each limb had a different type of prescribed prosthesis.

- An important finding was that the ***bilateral had approached only the third centre*** for their prosthetic fix.
- The transtibial preferred SSS socket while the transfemoral opted for ischial containment.

- Cuff suspension/ waist belt and total elastic were the suspensions preferred by both the groups respectively.
- For all the group of amputees the first Centre recommended a Jaipur foot (for those who approached them) while the others gave a modular foot

Alignment technique practiced

- All the three Centers practiced Bench alignment for which the first Centre depended on plumb line method while the others used L.A.S.E.R. assembly method.
- The other two Centers tested their clients for static and dynamic alignment too.

Thus the three Centers were found to exhibit differences in the way they approached their clients and in the recommendations they put forth for prosthetic prescription. Their endeavors were found to be truly socially relevant exuding an earnest desire to help the samples ambulate independently.

Perspectives on User's Perception

➤ **Profile of the Sample**

- Those in productive age (43%) followed by young adults (37%) were found to be the most affected group. A good 84 per cent were men. Among 73 per cent who were married only 51 per cent lived with spouse. Almost one quarter (23%) were single. Thirty six per cent each reported to be graduates and high School pass along with 11 per cent who were illiterates.
- Only 58 per cent among the samples were employed comprising those in business, salaried class and professionals (43, 33 and 24 per cent respectively)
- Almost 26 per cent among those who were not gainfully employed were jobless
- Except a minority of 22 per cent all others were found to be financially sound.
- Their profile gave a bleak picture in that a considerable proportion of the samples were not enjoying or were supported by family members as is evident from the 27 + 22 per cent (single + widow/ widower/ separated) and the non earning category of 42 per cent who stand testimony to it.

➤ **Aspects on Amputation**

- Male domination was seen in all the three types of impairment (transfemoral, transtibial and bilateral)

- Age wise below knee and bilateral groups outwitted the other. Increase in age was found to be directly proportional to incidence of amputation – *a very pathetic situation*.
- From among the samples studied 40 per cent had lost their limb due to medical grounds (Diabetes and TAO), as against almost 60 per cent who were amputated for surgical reasons, especially crush and avulsion injuries caused by accidents. – *another cause for concern*
- Among the types above knee was mainly due to medical and a majority of the other two due to surgical reasons- *a significant finding*
- The samples agreed to having been enduring the trauma for a minimum of five years (40%), followed by 26 per cent who had borne the brunt for almost a decade. Age wise those in the 21 – 60 years had been the maximum sufferers. Similarly bilateral group was forced into suffering for long by virtue of losing both the limbs.
- *Obviously, it is very clear that all the samples had faced a stressful event and had overcome the stressor considerably well*

Managing Strategies Adopted

Responses by the samples to their lifestyle changes in lieu of their status on prosthesis were analyzed for the four components paradigm of human resource input. The responses received are summarized below.

Responses for Affective components - reflected their attitudes, preferences and dislikes

- Personal preference to approach the Centers was evident in that 39, 26 and 35 per cent had come for the fitting to Centers 1, 2 and 3 respectively.
- More than being comfortable, the samples perceived the device to be as good as their healthy limb.
- Age or level of amputation did not have an influence.
- Evidently over and above comfort and function (the ergonomic parameters), their preferences vested more on appearance and cosmesis.
- Inquiry of their personality styles revealed mainly their negative traits/ qualities as being narcissistically invested, dependent, depressed, pessimistic and the like –

which in no way helped to know their true identity. It was only an emotional outburst at the current state of affairs. They had not taken to the predicament easily. Evidently it would have *affected their family's balance* too. This is a streak showing their *reluctance to adapt to the living style*.

Responses for cognitive components - reflected their decision making behavior to meet stressors

- By insistence, a majority of transtibial amputees had accepted SSS sockets, while their counterparts, the ischial containment socket. The samples had accepted the suspension provided by the Centres too – *a pointer reflecting their nature to accept a device offered to them on good intentions and another, the faith and trust they had in the prosthetist team*.
- A good 47 and 48 per cent among men and women showed an interest to change the prosthesis now and then, while 40 per cent among both the groups went in for modifications.
- The tendency was higher among senior citizens
- These factors show the extent to which they were sensitive to issues of discomfort and or incompatibility felt with the device
- Similarly, experience in use, need, occupation held and the extent of mobility desired guided in their decision to be on the prosthesis for more than six hours, and for some beyond nine hours.
- Transfemoral and bilateral amputees used it only for lesser duration, while employed category donned it for a longer time.
- Expectations for longer time of service of prosthesis were found to be greater for the senior citizen group and transtibials, citing physiological reasons. Employed class expected it to be functional only for lesser duration.
- Comprehension of the concepts of growth phase, stump adjustments needed and cosmesis expected in the device had forced them to think rationally.
- User – specific reasons like outgrowing socket size (20 years) and age related bone degenerative changes (60 years) – inherent problems – forced them to go for change in prosthesis within 6 -12 months. For all samples, obesity, shrunken stump, damage in cosmesis - all posed as problems that accounted for their decisions to change.
- Having imbibed the *self – care concept probably had motivated them to take such informed choices*.

- *Majority of 55 per cent never practiced use of assistive mobility devices.* Single cane, mono crutches and walkers were the assistive devices used by those who needed assistance for ambulation.
- Similarly *69 per cent were not found to use wheel chairs*, the mechanical maneuvering device. Preferred more for office use, outdoors or during travel shows their prudence in taking advantage of the assistance.
- The samples were found to depend on self help in performing daily personal activities. Bathing was tactfully done by adopting a comfortable posture – sitting on floor, standing (TT alone) or using a stool.
- Donning and doffing the prosthesis was a personal affair as far as 49 per cent of the samples were concerned. The TF and bilateral group (among those who needed assistance) depended entirely on their partners (assistants), while a negligible proportion was satisfied with partial assistance.
- Only 49 per cent among overall samples stated that the prosthesis donned was cost effective. More than the initial investment, maintenance and replacements were found to be very expensive.

Responses for Temporal components - reflects their time management behavior

Lag period is the time delay in limb fitting after amputation and duration of pre-prosthetic and prosthetic training. Compulsorily all the samples had undergone such a phase. The duration is decided by the surgeon and the consulting orthopedic doctor.

- The average time interval between amputation and fitting is 145 days – a prescribed lag period.
- Fifty three and 29 per cent of men and women respectively had complied with the prescribed period. Women were found to have preferred lesser duration while those in the younger age group also had felt so. Age and level of amputation sincerely influenced adherence to the period and even more (> 181 days) if the circumstances demanded.

While lag period took care of the healing aspect of the amputated site, **gait training** decided the ease with which the samples could regain their lost gait even when using an artificial limb. Hence the time spent on gait training gains significance

- Choice of the female candidates to go in for less than 120 days gait training was quite evident.
- Unfortunately 25 and five per cent among male and female underwent no gait training.
- The decision by the 41 and above age group for longer duration can either be attributed to their behavioral concept to adhere to prescribed time norms or to fight against dependence (positive behavior) or as an expression of their adamant behavior complaining that the training is not perfect (negative).
- Bilateral were sincere in following gait training.
- ***Self care concept was not found to guide the samples on this score, because the time they spent religiously on this training decided their ability for ambulation and post prosthesis quality of living.***
- All the samples agreed to be spending quality time on leisure. Unfortunately the activities taken up tended more towards sedentary activities, which can affect their prosthesis use adversely as they may lead to the samples' gaining extra weight, obesity and limited ambulation.

Responses to physical components - reflect their notions on dependence and job reintegration

- Except nine amputees who had rejected prosthesis prima facie, all others from the 142 samples recorded dependence status to various assistive modes
- Only 58 per cent from among the total sample had resumed job after reintegration, among them, again only 52 per cent continued in the same job they held before amputation. The others had to seek new jobs.
- Age, wearing comfort of prosthesis, educational level and the like had a say in the sample resuming to job.
- The decision of 67 per cent to change their job to suit their demands for lowering physical workload is justifiable.
- Lack of incentives and promotion prospects were cited as reasons for not taking up a job.
- These are ample proof to highlight the sample's sentiments to lead a normal life as was prior to amputation.
- ***Claiming their rights to normal living styles is thus made very evident.***

The findings on their perception on post – prosthetic life exposes the coping strategies adopted by them to tackle stressful events which would otherwise have led to a crisis for the family – a dependent amputee.

- They were found to have taken informed decisions (physical component), cognitive decisions (cognitive component) and conscious decisions and seasoned approach in the ergonomic component – ***a good display of their adaptive behavior leading to resiliency.***

Projected symptoms of resiliency - ideation of managing stress in day to day living

- A good 44 per cent avoided sitting on the floor. Among those who sat more than 65 per cent even among the bilateral shunned assistance both to sit and rise up.
- Thirty nine per cent of the samples demanded chairs with arms for sitting, which facilitated them in getting up on their own
- While 91 per cent were mobile, nine per cent stated not to be walking at all. Among those mobile, 13 per cent each were home level walkers and restricted outside walkers. This speaks of the seriousness of the issue.
- Age factor coupled with co morbidities and stump status determined the extent of walk permitted by their doctors.
- ***Instead of being a dependent member the prosthetic prescription at least had rendered them enough mobility to take care of their personal pursuits.*** TF and bilateral were the most affected lot.
- The same 91 per cent who were mobile tried tackling curbs/ obstacles too in their path. More than one half (TT and bilateral) walked without assistance.
- Going up adopting forward method was the best technique practiced.
- For use of ramps, 89 per cent needed assistance, especially the TT demanded absolute help as they couldn't manage them, rather balance with a cane or crutch. Similarly preference for use of a wheel chair was expressed by TF and bilateral – evidently all of them knew to tackle the problem well.
- Ironically a good 62 per cent, who were successful self drivers, had to give up driving due to the predicament. Private taxis, train and buses (54, 40 and 40 per cent respectively) were the most sought after mode of conveyance after amputation. Among the three groups only the TT amputees were found to be using these modes more. It was surprising to record 65 per cent among them using all the modes. When

commutation by bilateral was found to be negligible, the TF group showed a sparse response. Definitely this poses a great handicap to the samples. Many of them (surgical case) were found to relive those stressful/ dreadful moments.

- *Among the three groups in the amputee cohort, the TT group was found to be more accommodative and adaptable to the rehabilitative phase than TF. The hypothesis set for the study is accepted*

All these statements stand testimony to the commitment, integrity and veracity displayed by the samples to cope with the situatizon and show to the society the fight they put up for adaptation.

Psycho – social support – pep to return to normal living

- A point of agony and sympathy was the 35 per cent who were denied support from family members (23 and 12 % living alone and left in Homes respectively). Representations from all the three type of amputees were witnessed.
- More than 60 per cent of TT and TF respectively and 47 per cent among bilateral enjoyed the support of family and lived with them. This is ample proof to say why many were self – directed in facing life situations.
- Being accepted as an ‘amputee’ in the public and being accepted by society on this status was definitely felt as a prick on their self esteem and self respect.
- Donning prosthesis as a hindrance to social living, feeling its presence as an embarrassment by both the wearer and the onlooker restricted their desire for public appearance and in social gatherings.
- A self inflicted notion that they are not welcomed by society in public places is yet another psychological factor that needs special address.

These factors siphon out the finer sentiments the samples cherished as being not gratified on the pretext that they are amputees. Advocacy on the truth that they are an inextricable part of the society needs to be done, though it is being done by the Prosthetists team about whom the next unit of the findings elaborates on.

Prosthetists – the “crisis interveners” and their role in a nutshell

Three prosthetist Centers approached by the sample for prosthesis fit warrant a special mention

Center 1: Established in 1995 as a service organization enlists in its core reinforcing rehabilitation facilities for needy amputees. Challenging its path through a financial crisis till 1998 had picked up momentum with its foundation – now an International organization. Covers amputee requirements across the entire State and stretches mobile prosthetic providing facilities too. Is headed by a freelancer, though is currently run under a project granted by the Organization a philanthropist at the global level. The center caters to the needs of clientele from international locales too. They fabricate the conventional, cost effective model of prosthesis especially for those attending the regular camps organized by the Organization and delivering them either free of cost or on a nominal cost.

Center 2: Established in 1995, it is an ISO: 2008 Certified Company, the brain child of two high tech groups, one a manufacturer and exporter of high tech prosthetic and orthotic products and providing low cost products and solutions to NGOs across the world as a part of the social initiatives of the group and the second a global supplier of such products and services, and offering lower limb prosthetic component manufacture and distribution worldwide. The company's branded range of lower extremity prosthetic products cover all levels of amputation of the lower limbs including microprocessor controlled prosthetic knee and a variety of dynamic yet stable foot pieces and dynamic responses foot etc.

Center 3: It is a 90 year old Company founded in 1919 by a prosthetist with footings in Germany. They are global leaders in provision of innovative services and products for people with limited mobility. They have centers in 46 locations spread across 100 Countries. They believe in modular fittings for the components comprising the prosthesis. They cater to the needs of the clients by offering cutting edge technology and custom made fabrication using modular bio mechatronics.

The diligent services of the centers in the lending a helping arm to the requirements of a needy group for restored ambulation and rehabilitative services is therefore acknowledged with utmost humility and appreciation.

Success behind rehabilitation – the sequential process

The basic method followed in fabricating prosthesis remained the same for all the Centers though they catered for individual anthropometric variations.

- Stages in fabrication comprised of putting a negative wrap cast, measuring remaining leg, modifying for errors, extension of mold and pre heating, processing, removing, trimming and finishing, assembling of the foot with socket and pasting the suspension. The high tech centers further refined and introduced sophistication based on user needs including embedding microprocessors – an embedded prosthesis.
- The fundamental components for lower limb were the socket and the foot. For the TT group a shank and knee were added components (bio – mechatronics) and for TF group it was thigh and hip joint as the case may be.
- These points highlight the *magic hands which work with high precision to bring about ambulation in an otherwise disappointed category of the society on the one hand* and on the other *acts as a beacon light for those gifted in search of an opportunity to start an enterprise - a very feasible and a lucrative avenue.*

Proactive participants in the rehabilitative process

A group of **109** samples visiting the three centers during the last phase of the study were chosen for this part adopting purposive sampling. After preliminary visits **nine** of them dropped out. The rest **100** of them were included as samples for this *participatory approach in ergonomics*. This sample visited the centers to get fitted with prosthesis. The findings of the study are summarized below:

- Male members predominated (82%), with a maximum belonging to the 41 -60 age range (47%) followed suit by the 21 – 40 years (35%).
- Surgical victims from accidents (66%) along with 28 and four per cent categorically diabetics and vascular patients had joined stating medical reasons.
- It was quite a relief in that except a few (7%) the others were of long standing amputation and had come *for a refit – an encouraging finding speaking about the sample’s awareness level and their practices on self – care.*

Ergonomic concerns in prosthetic fabrication

- Total length and foot length were recorded for the TT group, while for the TF group stump length also was measured in addition to the other two. *These made active participation by the affected group imperative.*

- The samples were found to come in varied dimensions ascertaining that the principle of “one size fits all” or the common mean values for men/ women does not suit here, *buttressing the fact that prosthesis has to be customized.*
- Correlation matrix showed strong relationships with a few variables. Age was found to influence lower limb anthropometry in prosthesis designs. *Hence the null hypothesis set for the study is rejected*
- Regression analysis (r^2 - 0.50) for TF group also highlighted the strong association existing between duration of amputation and the total length of limb. *The hypothesis set for the study is accepted.*
- Regression analysis (r^2 – 0.63) for below knee amputees showed total length to be significant with gender and foot length.
- *These data forced to reject the null hypothesis stated as prosthetic prescription is based on individual anthropometry.*
- These factors hold good to conclude that empirical data on individual anthropometry is highly significant in prosthesis designing – a *human – machine interface.*
- *Evidently the rehabilitative process is indeed a good participatory ergonomic process.*

One can state that prosthesis is definitely *a symbol of amputee empowerment*, as they are fabricated after repeated dialogues between the prosthetist team and the amputee. The surgeons and hospital personnel who had rendered referral services to the prosthetic Centers and they in turn had laid in roads for a successful rehabilitative process; of course *an exercise of mutual benefit – a win – win situation for both.*

These truths may be unbelievable unless and until the beneficiaries state about the device in their own versions.

Perceptive analysis of the prescribed prosthesis

Success of the prosthesis in terms of bringing back at least a part of their lost normal living style was already found and discussed. This part of the findings focuses on their perception about their body condition as active participants in the endeavor deduced by administering an opinionnaire. The findings are summarized under:

Phantom sensations

- Phantom sensation was expressed as present by 81 per cent of male members and 67 per cent of women amputees.
- It was perceived as painful requiring medicines by almost all irrespective of the age range and by TF, TT and bilateral (76, 84 and 100 %) respectively. Though it is more of a psychological feeling, its impact on normal living can never be ignored.

Condition of stump

- Second aspect was condition of stump which has a long bearing on their “life with prosthesis”.
- More than 50 per cent of the men felt it when walking, while the proportion was higher in women.
- Surgical scar, adhering of bone to the scar, fluid drain from stump and painful stump were but a few problems stated as being endured by the sample irrespective of age or level of amputation.

Condition of contra - lateral limb

- Another important aspect was the condition of the contra lateral limb (the healthy limb).
- As the samples were positioning their posture/ gait many at times over the healthy limb by which they ran a greater risk of inflicting damage to that limb which may even lead to amputation it was considered with great caution. Co morbidity problems further aggravated the issue.
- Almost 30 per cent irrespective of other factors had expressed feeling cramps, having ulcers and or sustained pain in their healthy limb, which is not a good sign of well being.
- These facts warrant that good intervention programme to enlighten them on after effects of prosthesis fitting and to teach them maintenance of good carriage may help reap appreciable dividends.

The ideology on taking responsibility for the self has to be reinforced.

Perception on the product

Having found their status sequel to donning prosthesis, the beneficiaries' opinion on the device fitted on them was understood by administering a rating scale. This aspect evaluated the product based on the Center from which it was fabricated – an analysis of the product from the selected centers.

Parameters perceived as satisfactory with regard to the product's fabrication, personal experiences on phantom sensation, experiences on pain, miscellaneous factors, features expected in a prosthesis based on own experience etc were put forth and their statements jotted down on a four point scale with ranking from highest score of 4 awarded to rank 1 to a score of 1 to rank 4 in descending order.

Objective ranking of the centers for their products revealed *Center 1 to be ranked first* followed by Centers 3 and 2 respectively. *Consumer satisfaction fortified with ergonomic objectives of comfort, safety and function overtook other aspects like sophistication, embedded systems and expensiveness.* Obviously cost effectiveness would have been an important criterion.

Accessibility is therefore not only related to affordability, but also to the extent to which the amputees find their "comfort zone".

SWOC analysis

- A host of well wishers in the form of family members, friends, doctors, practitioners, prosthetists, technicians, philanthropists, relatives and many others have had a big role in motivating the samples to go in for prosthesis. Instilling in them the required self confidence to go in for prosthesis would have definitely been a herculean task.
- Evidently *interpersonal relationships for exchange of resources*, a theory much appreciated for *social support* was found to be gratified for the selected sample.
- A group of samples (42 in number from among the 100 samples visiting the Centers) who had come for a refit were surveyed. Among them 27 per cent among transfemoral and eight per cent from transtibial belonged to the last quarter of the previous century. Many had been victims of accidents.
- Having come for refit indicates that the system had gained momentum in the real spirit.
- The views of the sample on pointers for accessibility were culled out in five major driving forces like personal needs, personal factors, family support, and service available and financial support. The findings revealed the mixed feelings they had for the factors.
- Among 32 factors listed 18 points each were listed in positive and neutral. But for 17 points it was a negative response. It was clear therefore that a point felt as positive by one emerged as negative for another. Perception on accessibility was delineated in different ways by the sample, proving the heterogeneity of the ample.

- Similarly pointers requested for adaptability witnessed dichotomy to prevail in the way the samples accepted to adaptation, again showcasing factors found positive and negative. The responses showed that the feelings were individualistic, rather user- oriented. Negative expressions were a vent to their pent up feelings on left with a predicament.
- Perception of their body image coupled with the concepts of embodiment on a negative track was found to prevent them from responding in the affirmative to the questions of accessibility.

A *SWOC analysis* was done to find out the potentials of the issue under consideration for accessibility and adaptability. Pointers on strengths vis - a - vis weaknesses were found to vie with each other for a special address. Nevertheless, the multiple window options available for opportunities and challenges stage viable prospects for being in the limelight. A concerted effort from all stakeholders can enable a spectacular take off to the silver line of social responsiveness.

The study thus has emerged as a plethora for the samples to come out with pent up feelings about their physical and emotional status as well as focus on a growing business avenue which is vibrant more with colours of social relevance than the commercial spirit.

The investigator had thus embarked on a research study on a path never treaded before from the perspective of Resource Management. The results have proved that for anything to be accessible and adaptable requires commitment from the self (the beneficiary) and the benefit providers to go on parallel lines. One without the other can take one nowhere. Adaptability should come from the self and accessibility from the providers, because *accessibility* refers to the design of products, devices, services, or environments (especially for people with disabilities). The concept of **accessible** design ensures both “direct access” (i.e. unassisted) and "*indirect access*" meaning compatibility with a person's assistive technology. A glove in hand attitude – resources and management - alone can reap benefits. The combined efforts of all stakeholders are therefore warranted. Hence, the following suggestions are put forth as recommendations to the concerned sectors for perusal and effective action.

Recommendations

➤ The beneficiaries (amputees)

- Develop positive change in attitude
- Learn to strengthen the gifts and limit weaknesses
- Befriend the society
- Widen the horizon for expanding the benefits
- Receive the predicament as a challenge, not as a threat/ disability
- Accept social networking as a routine
- Adopt changes in living styles for personal good (diabetics and vascular patients)
- Become a role model from learnt experiences - disseminate cognitive coping strategies
- Be a provider of information to the needy, designers and ergonomists
- Lend a helping hand to bring out user - friendly designs
- Practice hygiene and sanitation to prevent infection
- Adopt healthy food habits - especially younger generation
- Stop cherishing volatile sentiments

➤ Prosthetists – the Social Entrepreneurs

- Expand networks with hospitals
- Widen scope for user - friendly designs
- Design products enabling affordability
- Rope in media for geo - mapping/ advertisement
- Conduct campaigns to make selves known
- Create database of clients
- Increase accessibility through refined rehabilitation
- Take failures as challenge and improve upon it to deliver better
- Improvise ergonomic designs

➤ Government – the cog wheels of support

- Take responsibility for the specified cohort
- Devise social security schemes for the affected lot
- Create insurance cover for the needy
- Fund projects of social relevance - especially on amputees
- Envisage mass production of prosthesis for enhanced accessibility
- Rope in public - private partnerships for designing prosthesis
- Make sanction of license to younger generation very strict
- Adopt stringent measures to punish traffic rule violators
- Improve PWD activities to prevent accidents

➤ Families – the inevitable link

- Extend a helping hand
- Offer to give the much needed '**family resistance resources**'
- Remove feelings of dependence syndrome from the affected
- Be a co - partner in tackling the stressor event

- Envisage modifications in living styles and arrangements
- Instill confidence in them to regain the lost control over their lives
- Be on their side to lessen grief
- Help them tide over the triple threat -function, sensation and body image
- Insulate them from emotional consequences
- Commit to **bonadjust** and **bonadapt**

➤ **Other stakeholders – the contemporaries**

- Avoid social isolation
- Reduce occupational limitations
- Encourage job reintegration
- Offer reinforcement to the needy
- Reinstate employees
- Expand and extend workforce compensations
- Deliver ESI benefits
- Help remove social myopia towards amputees as dependents
- Corporate / NGOs to take it up as a CSR program
- Help prevent accidents
- Reduce pollution / environmental degradation leading to infections

➤ **Doctors – the lifeline**

- Promote additional training on proprioception
- Network for sound/ affordable physiatry
- Design defined hallmarks for development
- Promote research with prosthetists teams to strengthen possibilities for advanced treatments and prosthetic designs
- Train freelancers
- Consider service as a Corporate Social Responsibility program (CRP)
- Envisage accessible intervention strategies
- Mobilize emergency services

➤ **Educational institutions – creators of a new genre**

- Offer Degree/ Diploma in prosthetics (Rehabilitation and fabrication)
- Train freelancers on the topics through workshops
- Conduct campaigns to create awareness among amputees (on available services)
- Create awareness among public on this aspect of social relevance
- Encourage / fund project proposals on the social/ entrepreneurial relevance of the issue

In commit and contribute to this social endeavour the investigator puts forth the following **suggestions for future research**

- ☞ Chronological age versus adjustments to adaptability
- ☞ Adaptability trends among primary caregivers to amputees
- ☞ Emotional Profile of primary caregivers to amputees
- ☞ QoL status of users and non users of prosthesis - comparative study
- ☞ Workplace adaptation by amputees (users and non users of prosthesis) - ergonomic concerns

Conclusion

In any attempt made at rehabilitation, researchers stress the measurement of ‘outcomes,’ geared obviously by the need for evidence – based practice, in place of giving services that have a traditional ‘sake of service’ note. This field, especially where the beneficiary essentially has to be a proactive participant has seen parallel increase in the use of outcome measures. A judicious mix of their limitations, variations, capabilities with functional requirements, societal demands and gifts from science and technology can have a long term advantage over an adversary. No more does humanity have the privilege to look at this cohort with a socially myopic eye. On their part, (the samples) it is high time they rose up to the occasion and joined the mainstream of personal and national development. Motivation and encouragements in the form of access and strategies for adoption have been on board for them for a safe sail. It is up for the beneficiaries to take them or reject them in their stride.

Remember

Our eyes are in front because it is more important to look ahead than to look back. Don't dwell on things in the past; learn from them and keep moving forward. We are tested not to show our weakness but to discover our strength

- **Anonymous**

Findings of the study show symptoms of a good awakening which is expected to gain momentum and become stronger in the near future.