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THE KNUD JANSEN LECTURE

Amputee rehabilitation – finding the niche

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Introduction

I am very grateful to be given this opportunity to show my appreciation of Knud Jansen, who believed that the rehabilitation of the amputee was best organised by a clinic team. As one of the founders and the first president of ISPO he promoted the multi-disciplinary interest and membership of this society. The theme of this World Congress of technology and services in the field of prosthetics and orthotics for the different age groups reflects this wide interest. I shall be talking more about service than the details of technology, as I want to consider the nature of our rehabilitation goals and now these may be achieved.

Another great orthopaedic surgeon, Sir Harry Platt, disliked the term rehabilitation, which he thought was a "mischievous word", and he was extremely dismissive of rehabilitation medicine. I quote from a lecture, in which he said, "Rehabilitation medicine, so called, is a form of managerial medicine," spoken with a downward inflection of the voice. Despite this condemnation, he was right in his choice of words, because rehabilitation of the amputee is the active management of his problems and disability. Let us consider the situation. The locomotor and manipulation capability of the human increases until maturity and falls off in old age. For an infant or child we should try to restore any abilities which have been lost and encourage normal increase in capability as the child's mental and physical skills develop. The rehabilitation process for the adult should aim to restore an ability which matches the normal, even though it may be at a lower level, whereas the process for the elderly person has to recognise that their pre-amputation ability may have been reduced by the disease which led to the amputation, and so the final outcome may be adversely affected.

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If we use the old World Health Organisation (WHO) terminology, we cannot affect the **Impairment**, part of a human limb is missing; we hope that we can reduce the **Disability** by our rehabilitation process, so that ability and/or activity is improved, but we must also try to reduce the **Handicap**, the disadvantage or unmet needs of the patient consequent upon the impairment and disability. What do these words ABILITY, ACTIVITY and NEED mean?

ABILITY is the individual's potential. It is what he can do and is related to his age and condition. For the unimpaired it can be improved by physical training, whilst for the amputee it can be improved by the whole rehabilitation process, including for many the supply of a suitable prosthesis. Ability may be measured by physiological monitoring in lower limb amputees, and by tests of dexterity in those with upper limb loss. The patient's overall condition, including the level of loss, sets the limit on the maximum ability.

ACTIVITY is what the individual ACHIEVES, being set by his needs, and is related to age, condition and the rehabilitation process, and may be estimated in various ways. However it can never exceed the individual's ABILITY. In short, ABILITY is the individual's potential and ACTIVITY is his ACHIEVEMENT.

NEED changes in response to many factors and so is unlikely to be constant. It may be related to the physical condition, and indeed may be affected by achievement, and it is difficult to measure.

The main NEEDS can be placed in three groups: IDIOPATHIC NEEDS include the desire to overcome mentally the loss or bereavement, and to have the body image

restored. However there is a need to avoid sympathy and dependence, and the loss of manliness or femininity.

SPECIFIC NEEDS are those related to the activities of daily living, employment and leisure.

SOCIOECONOMIC NEEDS vary depending on the person's age, and include equal opportunities during education; the ability to achieve and maintain full earning potential, and to be able to enjoy a full retirement.

The rehabilitation plan

Before we are able to plan a rehabilitation programme for a patient we must assess a number of factors:

- firstly, the physical state, that is the attributes of the stump and of the rest of the patient;
- secondly, his present and future physical requirements in terms of the activities of daily living (ADL), education or employment, social and recreational activities;
- thirdly, his present and future psychological needs in terms of the loss, its concealment, and its relation to function;
- lastly, his capabilities must be assessed regarding understanding, motivation and ability to manage the hardware and training.

Moreover as many patients have unrealistic ambitions and know little of rehabilitation, we need to explore the expectations both of the individual and his family.

Our rehabilitation process must encourage the subject to become a participating member of the clinic team, and to develop a positive attitude of self help. In the case of the infant born with a congenital limb deficiency, the immediate needs of the child are secondary to those of the parents and family. The birth of a limb deficient child is a devastating blow and they want to know what has gone wrong, why it has happened to them and what can be done. They require adequate, knowledgeable counselling as soon as possible and at the first consultation we must explain both the normal development process and, what has gone wrong with it this time, the reason if we know it, and in the vast majority of cases they must be reassured that it is not their fault. One then has to discuss the immediate treatment and any future alternatives; I always give an audio cassette recording of this consultation as an aide memoire. On this and subsequent occasions I help them to agree the objective "to help their child to see him(her)self as having the smallest possible handicap both in childhood and later as an adult."

For all patients, we have to plan how to measure, control and improve the level of rehabilitation which has been achieved. Merely replacing the old phrase "looking at our results" by the modern version "Outcome Measures", does little unless it is part of an "Audit" in which the outcome, of each stage, is compared with a previously set standard, so that the stage, whole treatment process or even that standard can be modified, as part of a continuing drive to improve quality.

It is frequently assumed that the end result should be satisfactory, providing the surgeon performed the amputation properly, and the client, having no other significant disabilities, is provided with a well-made, correctly fitting prosthesis, and has been trained in its use.

Satisfactory often refers to our standards, but does it match the client's expectations?

Suppose the outcome is, in our view, unsatisfactory – have the professionals, hardware or system of supply failed? Sometimes yes, but perhaps the subject has lower aspirations and is actually satisfied with the outcome. It is not my intention to comment on the many individual methods of outcome measurement which have been devised, often to suit particular situations, but some confuse ability with activity and many observe them as an absolute, whereas the subject observes their ability relative to their needs. These may not remain constant and so whenever the subject attends after an interval, we should discuss whether the prescription or rehabilitation process is still the optimum, in the light of any improvement or deterioration in the person's general condition, alteration of his needs and capabilities and changes in available prosthetic techniques and components.

Lower limb loss

The basic physical need of the lower limb amputee is to regain his mobility and the first option is to achieve this in a wheelchair. There are environmental and other circumstances in which the amputee, particularly if bilateral, may be better served by a wheelchair. Secondly he can hop or use crutches regularly or occasionally, for example, in the bathroom or when walking over particularly difficult terrain.

A prosthesis, however, will enable him to stand, walk, and possibly run, jump and climb. There is no doubt that a prosthesis is the right choice for a fit young adult who has an uncomplicated trans-tibial amputation; but it is not always so easy to decide whether to fit a prosthesis to someone who is older or more disabled.

I believe there are five types of patient to whom we should not supply a functional prosthesis:

1. those who don't want one;
2. those who are technically impossible to fit, e.g. a gross uncorrectable flexion contracture;
3. the medically impossible, e.g. the presence of dense contralateral hemiplegia making locomotion impossible;
4. the medically unsuitable, e.g. the presence of severe cardiac disease;
5. the socially unsuitable, e.g. those in care where a prosthesis is not going to help and indeed may never be used.

You will note that I stressed the word functional. Even if locomotion is unlikely, we should consider whether a simple prosthesis will aid transfers between bed and chair, and there are those who although chairbound, value cosmetic devices which improve their self respect.

How do we recognise those who are unsuitable? Are we certain? Should we re-assess? Some who may appear unlikely to benefit when seen soon after surgery, may present quite a different picture later. How are we to categorise those we think suitable for prosthetic supply when third party funding authorities insist that certain categories of patients are limited to particular prosthetic hardware? We have to guess what will be the outcome before starting the rehabilitation process and one way to make this guess more intelligent might be to study a number of patients and correlate the activity achieved with their clinical features.

Survey of clinical conditions influencing activity

Twenty years ago I undertook such a research project (Day, 1978). First we had to find a method of expressing the activity achieved as an absolute, unrelated to age, or any other factor. After trials involving over 1,500 patients we established a method of describing activity numerically from the subject's answers to a formal questionnaire. This included questions about the ability to don and doff the prosthesis, the number of hours worn, the type of housing and the composition of the household, together with a detailed account of the nature of employment, daily living and recreational activities. Details of stair climbing and walking both inside and outside the home and the aids used were required. These answers produced positive and negative scores which were added to produce an overall Activity Score (Day, 1981). This score ranged from -70 to + 50 with the idea that the "average" activity would be around zero. The multiplicity of questions ensured that many aspects of the individual's lifestyle, and not merely the distance they could walk, contributed to the final score. As part of the validation process some clients wore step counters on their prostheses for 10-14 days. At the end of that time the individual was questioned about his activity during the test period, and a score derived. This was then compared with the number of steps actually taken. We identified five named categories of activity and suggested a step rate which was appropriate to each (Table 1).

At the same time as this system was being validated clinical details of all new lower limb adult amputee patients were collected. On their first visit data concerning their clinical condition were noted. In order that adequate information would be gained about those who only achieved low activity, the survey protocol demanded that all patients (who agreed) would be fitted with, at the least, a simple prosthesis unless there was a very strong contraindication to prosthetic supply. All went through a period of gait re-education after prosthetic fitting and when it was considered that the subject had reached a plateau in their rehabilitation they were assessed by the clinicians (doctor, prosthetist and therapist) separately and allocated to one of the five grades mentioned. They were questioned, the questionnaire completed, and an activity score

Table 1. Categories of activity

Description	Activity score	Steps per annum
VERY HIGH	more than +30	more than 2.5 million
HIGH	+10 to +30	1.25 to 2.5 million
AVERAGE	-10 to +10	500,000 to 1.25 million
RESTRICTED	-40 to -10	100,000 to 500,000
INACTIVE	less than -40	less than 100,000

Table 2. Numbers of patients in survey.

Number of patients seen on first visit	854
Number not fitted	35 (4.1%)
Died before rehabilitation completed	193 (22.6%)
Maximum number available for survey	626

Table 3. Gender, age and level of amputation.

	Male	Female	Total
Age:			
Under 65	122	33	161
Over 65	162	81	243
Level:			
Proximal	199	77	276 (69.3%)
Distal	85	37	122 (30.6%)
Total	284	114	389

ascribed without reference to their clinical notes. Only later was the score compared with the pre-rehabilitation clinical findings.

The survey included all new adult lower limb amputee patients referred to the Manchester Centre between March 1976 and February 1978 (Table 2).

By the time the project ended in November 1978, 404 patients had been assessed (64.5% of those available). The 222 remaining were not considered to have reached a plateau in their rehabilitation by the end of the project.

Of the 404, 6 with hip disarticulations or trans-pelvic amputations were excluded from further analysis. Of the 398 remaining 284 were male and 114 female (Table 3). Some 57% of the males were over 65, as were 71% of the females. Approximately 70% of the males, and 67% of the females had a "proximal" amputation level in which the knee joint was lost (i.e. knee disarticulation or trans-femoral).

Table 4. Cause and level of amputation by gender.

	Male	Female	Total
Cause:			
Trauma	24	4	28
Neoplasm	7	8	15
Infection	14	3	17
Other	6	1	7
Non-vascular	51	16	67
Vascular	233	98	331
Total	284	114	398
Vascular as percentage	82%	86%	83%
Non-vascular level:			
Proximal	20	11	31
Distal	31	5	36
Vascular level:			
Proximal	179	66	245
Distal	54	32	86

Dyvascularity was the cause of amputation in 82% of males, and 86% of females (Table 4). Trauma accounted for the amputation in 7% of all cases, neoplasia and infection each accounting for about 4% of the total. In view of the small number involved, amputations for trauma, neoplasm, infection and those labelled as 'other' are amalgamated and referred to in the results as "non-vascular". These latter resulted in proximal amputations in only 46% of cases, compared with 74% of those whose amputations were for dysvascularity.

When considering the results it is important to remember that:

1. this survey was carried out twenty years ago when 70% of amputations were at of above the level of the knee joint;

Table 5. Activity by age, level of amputation and gender – percentages of group surveyed.

	Inactive	Restricted	Average	Very high and high
All in survey	25	47	21	7
Over 65	37	50	12	1
Under 65	9	45	30	15
Proximal	40	48	11	1
Distal	16	47	24	13
Male	21	47	22	9
Female	39	45	11	4

Table 6. Activity by three factors – age, gender and level – percentages of group surveyed.

	Inactive	Restricted	Average	Very high and high
Male: Distal: 65-	4	37	31	28
Female; Distal: 65-	17	42	33	8
Male: Proximal: 65-	6	52	30	12
Male: Distal: 65+	19	52	29	–
Female: Proximal: 65-	27	50	23	–
Male: Proximal 65+	37	47	14	2
Female: Distal: 65+	36	64	–	–
Female: Proximal: 65+	45	49	5	–

2. the modular prostheses fitted to 70% of all the cases were not of the modern lightweight design.

Therefore we should not take the actual figures as being applicable to the situation today but the trends shown are probably still valid.

In all the following tables, the Very High and High activity groups have been combined.

Some 25% of all the patients surveyed were Inactive, 47% Restricted, 21% Average and only 7% of High activity (Table 5). What factors can be associated with activity?

As might be expected the elderly do not do as well as the young, 87% of those aged more than 65 years are in the Restricted or Inactive categories, whereas 45% of the younger group exhibit Average or High activity. Those with higher level amputations do rather less well than those with more distal levels. Only 12% of proximal compared with 37% of distal level patients have Average or High activity. About 45% of both genders have Restricted activity, but there is an appreciable "shift to the left" towards Inactivity in females.

Table 6 displays the activity achieved against all three factors, and this table has been arranged in descending order of activity, led by young males with distal amputations of whom 59% have Average or High activity, down to the older female with proximal amputations of whom only 5% achieve Average activity.

However there are three other factors: the most important is the cause of amputation. Those whose amputation was for vascular disease do measurably worse (Table 7). Additional disabilities are also of considerable significance. For the purpose of this survey they are divided into two groups:

1. the presence of symptoms and/or signs of vascular dysfunction in the contralateral leg (PVD);
2. the presence of any other concurrent disabilities (CD) which are considered to be likely to affect the patient's activity with prosthesis.

Table 7. Activity by cause of amputation and other disabilities – percentages of those surveyed.

	Inactive	Restricted	Average	Very high and high
Non-vascular (NVASC):				
No added disability (NCD)	–	12	38	50
Added disability (CD)	10	26	37	26
Vascular (VASC) no PVD other leg (NPVD):				
No added disability (NCD)	–	33	58	8
Added disability	39	30	30	–
VASC + PVD other leg (VASC-PVD):				
No added disability (NCD)	25	55	20	–
Added disability (CD)	32	55	13	–

In the case of non-vascular (NVASC) amputees the presence of a concurrent disability (CD) reduces the percentage of those achieving High activity from 50% to 26% and increases the number in the Restricted and Inactive groups by the same amount, while the percentage who are of Average Activity remains the same.

Some 58% of vascular amputees, without any designs of vascular dysfunction in the other leg, and without other disabilities (VASC - NPVD - NCD) are of average activity (Table 7), but the presence of a concurrent disability (VASC - NPVD - CD) reduces this to 30% whilst the percentage who are Inactive increases from nil to 39%.

The presence of signs or symptoms of vascular insufficiency in the contralateral leg is also very damaging to the activity level achieved by those who have had the amputation for vascular disease (VASC - PVD - NCD) raising the percentage of those who are Inactive or of Restricted activity from 33% to 80%. The addition of a concurrent disability (VASC - PVD - CD) raises this percentage slightly further to 87%.

This survey indicates some tendencies but could not accurately correlate the level of activity with specific clinical factors. Although 50% of uncomplicated amputations performed for non-vascular causes (NVASC - NCD) exhibited High activity, the fact the 12% of cases came into the Restricted category confirms my view that the activity achieved is concerned with trying to satisfy their needs within the upper limit set by their clinical condition. So, although the survey cannot provide an accurate forecast of the activity, it may provide help in guessing.

Having decided that a prosthesis is appropriate we must now consider the prescription details in the light of the patient's condition, ability, and expectations, and our knowledge and experience. The advance in prosthetic technology over the last 25 years, and the enormous increase in choice of systems and components has made it easier to meet the needs of active adults, but does not always help in dealing with the elderly, for whom it may be more appropriate to fit first a prosthesis containing simple functional components, upgrading this later is so indicated, rather than prescribing one which proves to be too sophisticated and therefore leads to disappointment. Increasing publicity and the media-led concept that all problems can be solved by the application of high technology does to help elderly patients to understand and accept the limitations set for them by their age and clinical condition. I remember well the veteran whose trans-femoral amputation was performed in 1917 when he was 19 years old, bitterly complaining to me when aged 86, that his new prosthesis was no good – "not like the one they made in 1919, I could run on that one."

So we have decided the prescription details, when should we start? We are told to fit as soon as possible, but amputation is a bereavement and the subject goes through similar stages of denial, anger and depression. One elderly lady asked me, "What did they do with my leg? I wish I had been able to say goodbye to it like I did to my husband at his funeral." Perhaps sometimes it may be better to give the person a short time to grieve before prosthetic fitting.

Assuming that we have prescribed and carried out the prosthetic fitting and gait re-education let us go forward to that time when we have to determine not only the activity achieved but also whether or not this satisfies the user's needs. When I was validating the activity score method I fitted step counters to two users with trans-tibial amputations on the same day. One was a retired policeman aged 69 whose amputation had been performed for vascular disease. He spent most of his days walking, within the limits of claudication in the other leg, in his local shopping mall. The step counter showed he was walking 1.25 million steps per annum. The other, a 27-year-old accountant whose amputation was for trauma, had no other disability. He spent most of the day sitting, and played squash once a week. he was walking 950,000 steps per annum. The policeman's activity was driven by his need to meet people, and was near to the maximum ability set by his condition and age, but his needs were not satisfied because he wanted to be able to walk more, whereas the young man was pleased with his performance.

Unfortunately I know of no scientific method of measuring satisfaction, one can only question the patient and family, look for tell-tale signs and use one's experience. Good communication between all members of the clinic team, including the user, is vital to gain the necessary information. Sometimes a person may claim to be satisfied because they fear upsetting members

of the team if they admit their needs are not met by their performance. For most users the prosthesis is a tool which helps them to meet their needs. At one end of the spectrum are those who wish to climb mountains or indulge in other extreme activities, perhaps sometimes to demonstrate that, "I'm as good as they are." Their high level of need provides the motivation to raise their achievement towards their maximum ability. At the other end of the scale some, like the policeman, with vascular dysfunction and limitation of walking ability prior to amputation may be dissatisfied because they expected to return to the ability which they had before the disease process started. And unfortunately for a few the prosthesis is something to be blamed whether as a symbol and reminder of their loss, or as an excuse for lack of their perceived success, such as "If it wasn't for this leg I would be chief executive by now."

Appearance is important to many – some want excellent static cosmesis and practise hard to achieve a near normal gait, partly for self esteem, but also to gain employment of their choice. Others demand a high level of static matching but are unconcerned about the visual effect of a poor gait. Appearance is also important for many whose activity is very limited. A young woman with a complete paraplegia from spina bifida had never walked. Following a high trans-femoral amputation she would not leave the house because she felt that people considered her to be a lazy amputee. A cosmetic prosthesis which could be attached to her chair enabled her to return to work and a full social life. However not everyone wants to conceal their loss, increasingly we see among the more active a need to omit the cosmetic cover on endoskeletal prostheses, and indeed to have pictures on the sockets. Some want unusual function, like the young man with a knee disarticulation who demanded a socket fit which was loose enough for him to rotate the prosthesis on his stump so that he could earn a living appearing on the stage in night clubs.

Upper limb loss

I must now consider those fewer cases who present with upper limb loss, of whom about one third have congenital limb deficiency, while perhaps 70% of the remainder have had amputations for trauma. Fortunately the human has some spare upper limb functional capacity, in that many tasks can be performed with one arm and hand. I say fortunately, because no prosthesis available can match the immense capability of the human hand and arm. Those with unilateral loss may be so competent using their normal arm as the dominant limb, that many prefer to manage for some of the time without a truly functional prosthesis, but may require some cosmetic restoration because of the vital role played by the hand in our relationships with others. However the bilateral arm amputee is likely to need prostheses in order to function independently.

So there are again three basic treatment options, first to advise and train the individual to

Table 8. Details of patients in Manchester Myoelectric Trial 1978-1988.

	Children	Adult	Total
Assessed	311	107	418
Accepted and fitted	266	93	359
1990 survey	258	89	
Gender: male	55%	69%	
female	45%	31%	
Cause: congenital	96%	27% males	
	–	62% females	
trauma	3%	63% male	
	–	24% female	
Level of loss:			
distal to elbow	91%	60%	
proximal to elbow	9%	40%	
Laterality – left	58%		

Table 9. Age of fitting and percentage utilisation.

Age when first fitted with myoelectric hand	Number	Average percentage utilisation
Under 4 years	116 (33.4%)	67.5%
4 - 8 years	43 (12.4%)	66.1%
8 - 12 years	49 (14.1%)	69.2%
12 - 16 years	50 (14.4%)	70.8%
Adult	89 (25.6%)	76.3%

perform necessary tasks with the normal arm, perhaps using the stump to steady the work, or by encouraging the use of the feet by children with high level congenital deficiencies. The second is to provide aids to facilitate specific tasks. The third option is a prosthesis. In the past the subchoice was between a cosmetic but relatively functionless prosthesis or one with a body powered terminal device. The advent of the electrically powered hand has introduced a third alternative which provides both function and a degree of cosmetic restoration. How can we assess the outcome of rehabilitation of the arm amputee? Various tests of dexterity with terminal devices have been used, but some rely on timed performance of tasks which bear little relation to everyday life.

Between 1978 and 1988, 418 children and adults were assessed for the supply of myoelectric prostheses at the Manchester Centre (Table 8).

The sex distribution of the 311 children considered the myoelectric supply (54.7% male, 45.3% female) did not differ significantly from that of the 266 fitted (55.3% male, 44.7% female). Over 96% of the children had a congenital limb deficiency. A total of 107 adults were assessed and 93 (87%) fitted. The sex distribution – 68.8% male, 31.2% female, reflected the cause of limb loss. A formal survey was carried out in 1990, at which time 12 patients could not be traced and so the report is on 258 children and 89 adults (Day, 1992).

All individuals were wearing conventional prostheses before being fitted with electric hands. Almost half the children were under the age of four at the first fitting of a myoelectric and (Table 9) while the remainder were fairly equally spread in three age bands.

The percentage of each age group of children who abandoned the prosthesis during the first year ranged from 14% to 20.7%, with an average of 17.4%, and 20.2% of the adults gave up during the first year.

The numbers who gave up in subsequent years can be tabulated, but these do not reflect the acceptance properly because the follow-up period ranged from 2 to 12 years, and children particularly, tend to alter their attitude to any prosthesis. A more accurate way of showing utilisation is needed and the actual number of patient/years worn can be expressed as a percentage of the total possible. Applying this method looking back from the end of 1989 at all 258 children fitted we find the utilisation ranges from 66.1% to 70.8% with an average of 68.2%. That of the 89 adults is higher at 76.3%.

Having confirmed that 190 patients were still wearing electric arms regularly at the time of the survey, we needed to find out how much they were used, for what and why they were liked, and disliked. Each patient was asked to complete a questionnaire, guaranteeing personal anonymity so that future treatment would in no

Table 10. use of electric hand at school or work.

Age fitted	Less than 1/4	1/2 - 3/4	3/4+	All day Every day	Total more than half-time
Under 4 years	4.5%	13.6%	6.2%	66.6%	86.4%
4 - 8 years	16.6%	8.4 %	33.3%	33.3%	75.0%
8- 12 years	7.1%	6.6%	28.5%	57.0%	92.1%
12 - 16 years	29.4%	17.4%	11.7%	35.0%	64.1%
Adult	20.0%	–	–	80.0%	80.0%

way be prejudiced. Some 131 (69%) replies were detailed enough for analysis, and these reflect the age group distribution. The response rate for each group varies between 60% and 73%. Considering first the usage at work or school, we find that between 33% and 66% of children and 80% of adults wear the arm all day every day: 64% to 92% wear it for more than half the time, but 29% of those fitted between 12 and 16 use it for less than 1/4 of the working week (Table 10).

Of those who do not wear the electric arm all day, 14% wear a split hook, 40% a passive hand and 46% no prosthesis at all for the remainder of the time. Table 11 shows the first choice of prosthesis for wearing at home in the evenings and at weekends, and for social occasions.

Comparing the percentage of each age group's usage at work/school, home and in their social life confirms that many wearers value the dynamic cosmesis which hand movement provides. Indeed 60% of both sexes rate its appearance at 8-10 on a ten-point scale, and 72% rate its function at the same level. Some 33% of wearers specifically liked the hand "because it looked real" while 20% disliked its appearance though continued to wear it for its improved function.

The question, "For what activities do you find the electric arm best?" produced many answers, but also some which were surprising. One man said that the electric hand was excellent for his work in pharmaceutical quality assurance but was not suitable "for his more adventurous activities of rock climbing, abseiling, parascending and casualty handling when on his Red Cross duties." One reply to the question, "What do you like about your electric arm?" came from a man with a congenital deficiency, previously wearing a conventional arm who changed to an electric hand three years before, when aged 21. He said, "For the first time in my life I feel part of the human race. Not only do I have a hand that looks and behaves (at a glance) in a natural way but it also operates in a way that makes me feel human. In could not envisage life without the electric hand and I could not leave the house without it." As for the lower limb loss we must always try to match the rehabilitation process and our technology to the needs of the user. Appearance was vitally important to one young lady for whom we made a passive prosthesis with a polypropylene endoskeletal structure so that she could wear in while bathing in the sea. Another young lady having worn a myoelectric hand successfully for some years prefers to use a passive cosmetic prosthesis as a supermarket check-out assistant. She uses it to steady and push goods about, and the majority of her customers did not notice that she is an amputee. A myoelectric hand provides the appearance and function required by a young man who performs conjuring tricks with cards and coins. However sometimes ability is so compromised that the needs cannot be satisfied, and the goals have to be altered to maintain self

Table 11. Type prosthesis chosen to wear at home and socially.

First choice for use at home			
Fitting age	Electric hand	Passive hand	None
Under 4 years	60.5%	4.6%	34.9%
4 - 8 years	23.1%	30.8%	46.1%
8 - 12 years	38.5%	–	61.5%
12 - 16 years	25.0%	12.5%	62.5%
Adult	60.0%	–	40.0%
First choice for use socially			
Fitting age	Electric hand	Passive hand	None
Under 4 years	65.9%	20.5%	13.6%
4 - 8 years	58.3%	33.3%	8.3%
8 - 12 years	78.6%	14.3%	7.1%
12 - 16 years	70.6%	17.6%	11.7%
Adult	80.0%	20.0%	–

esteem, as for an elderly lady who sustained a left shoulder disarticulation, right trans-humeral and right trans-femoral amputations. Some limited independence was achieved with the aids which enabled her to eat, write, paint, control an electric chair and operate environmental controls. Somehow she maintained at least some of her self respect. the following is an extract from a poem which she wrote:

I'm tired of this, I'm tired of that,
Tired of everything in fact.
Tired of eating such a chore,
Tired of drinking through a straw,
Tired of having no hands at all,
Frustration drives me up the wall.
Can't hug a child nor pat a dog,
Just sit here helpless like a log.
Can't shed a tear unless someone knows,
Cos I can't dry it up and can't blow my nose.
Can't scratch an itch or rub my head,
And I can't turn over in my bed.
But this does not mean I'm always blue
What matter the loss of a limb or two?

Every prosthesis has advantages and disadvantages, and how the positive and negative factors balance is personal to the patient and takes into account only their present requirements. one young woman with a transverse deficiency in the hand still uses aids for holding a table tennis ball or a fork but required no aids or prosthesis to win three gold medals, one silver and a bronze for swimming at the Paralympics at Atlanta in 1996. At the same meeting a young man won the silver medal in the high jump whilst wearing a sophisticated trans-tibial prosthesis, only to be beaten for the gold medal position by a trans-femoral amputee who jumped without a prosthesis.

In conclusion, our aim must be to rehabilitate the client to the stage that his achievement satisfies his needs within the limit of his ability. it is now proposed by the WHO that their 1980 classification of Impairment, Disability and Handicap be changed to Impairment, Activity and Participation, a more positive wording which leads me back to the title of this lecture and the word Niche which refers to a quotation from the English novelist John Galsworthy, who said:

> "A niche of usefulness and self respect exists for every man however handicapped, but that niche must be found for him. To carry the process of restoration to a point short of this is to leave the Cathedral without a spire."

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