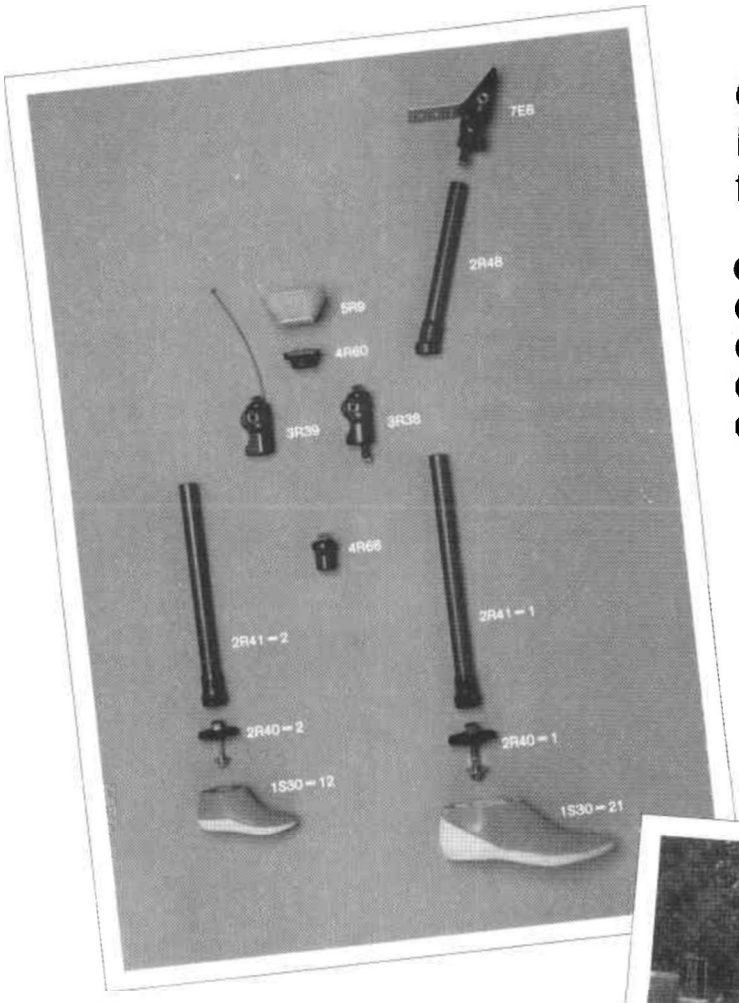
The Journal of the International Society for Prosthetics and Orthotics

Prosthetics and Orthotics International

August 1990, Vol. 14, No. 2

Orthopaedic Technique for Children



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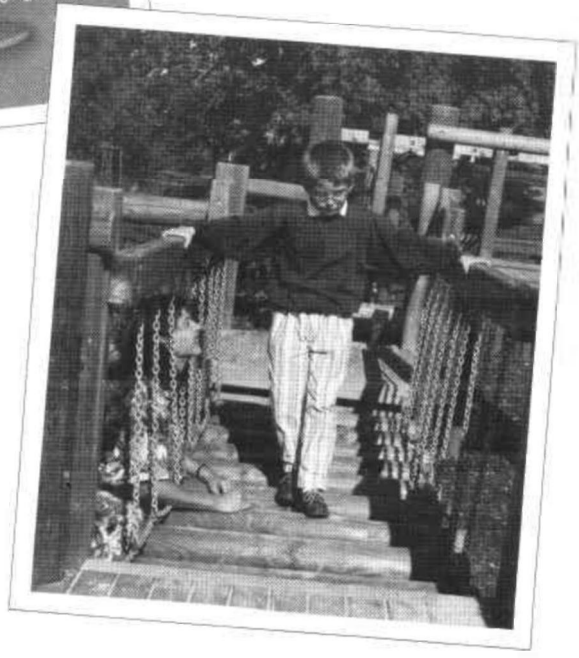

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J. Hughes (1986-1989)	UK
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Aase Larsson	Denmark

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Editorial

Statistics on the disabled in the developing world and the services which they receive are notoriously unreliable. They are difficult to obtain, inevitably inaccurate and sometimes even intentionally misleading. Moreover, in the field of prosthetics and orthotics we know there are large variations from nation to nation – how far has the polio immunisation programme progressed; how many traffic accidents are there; how much industry; what hostilities have there been? So far as the services are concerned, are there any prosthetist/orthotists; is there said to be a training programme; is it real?

Although we cannot know the exact truth of the global picture, report after report makes two things crystal clear. The problem is massive and the provision of service does not even scratch the surface. ISPO has just taken part in a Consultation organised by the World Health Organisation (WHO) on Prosthetic and Orthotic Services in the Developing World and yet again the deliberations re-emphasise the scale of the problem.

WHO considers that at a conservative estimate, 0.5% of the population needs a prosthesis or an orthosis. By the year 2000 it is estimated that the combined population of Africa, Asia and Latin America will be about 4 billion. Consequently, there will be about 20 million people in need of prosthetic/orthotic services there. It should be remembered that the fight against polio is far from over. It is suggested that between now and the year 2000, as immunisation is steadily expanded, a staggering 2 million children may still contract the disease. To provide service to 20 million people also requires a staggering number of prosthetist/orthotists. Even if only one professional is available to treat 1000 patients, the requirement is for 20,000 trained individuals, not to mention the technicians and back-up staff required to service them. Against this requirement it is estimated that in this area of the world, there are at present less than 2,000, more or less, adequately trained individuals – 10% of the requirement! Even more disturbing is the prospect of meeting the shortfall. There are at present only about 180 training places available in the developing world. Probably about 50 of these places are required simply to maintain the available work-force at its existing level. It is not difficult to see that a radical change must take place if there is to be any possibility of satisfying the unfulfilled needs of literally millions of disabled people.

Of course, there is nothing new in this. ISPO came to similar conclusions in 1974 and published them in a Monograph entitled "Needs in Prosthetics and Orthotics Worldwide". What is disturbing is that sixteen years later no significant progress has been made in the provision of even a respectable fraction of the training places required and, of course, training is the key to the solution of this massive problem.

The World Health Organisation Consultation represents an important milestone. Not surprisingly the outcome of deliberations were entirely compatible with ISPO's views on the training and service needs in this field and the priorities which must be addressed. However, for the first time in more than twenty years an authoritative report from one of the major intergovernmental agencies will encourage nations to address this problem and provide rational guidelines for its solution. WHO are to be congratulated on this initiative. They must have the wholehearted support of ISPO and every other responsible agency in this field.

Professor John Hughes
Past President

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Executive Board Meeting

27 and 28 April, 1990

The following paragraphs summarise the major discussions and conclusions of the Executive Board Meeting held in Rome in April. They are based on the draft Minute of that Meeting which have yet to be approved by the Executive Board.

Standing Committee Chairmen and Task Officer Reports

Jorgen Kjølbye had agreed to continue as Chairman of the Finance Committee for the coming Triennium. He reported on the accounting for 1989 (published in the April edition of *Prosthetics and Orthotics International*) which had resulted in a deficit mainly due to the high costs related to the World Congress. The Executive Board discussed the International membership fee for 1991 and agreed that it should remain at 450 Danish Crowns (175 Danish Crowns for Developing Countries). Subscription to *Prosthetics and Orthotics International* was raised to £55.00 for 1991 and the advertising costs would be raised pro rata.

Alvin L. Muilenburg and Seishi Sawamura agreed to serve on the Protocol and Nominations Committee as Fellows at large.

The Executive Board discussed the need to increase the number of National Member Societies and the membership of the Society. Individual Executive Board Members were given responsibilities for developing National Member Societies in different regions of the world. Interest in establishing National Member Societies was being shown in Spain, Taiwan and Indonesia, and the formation of a Regional Society of ISPO in South America was being pursued.

The ISPO/INTERBOR Joint European Education Committee is continuing its work in order to ensure standards of education and training within the prosthetics and orthotics profession in the European Community.

John Hughes would be representing the Society at a World Health Organisation (WHO) sponsored consultative meeting of Schools and Agencies interested in education and training in Developing Countries to be held in Alexandria, Egypt, 17-22 June. The subject of the meeting will be "Training of Personnel for Orthopaedic Technology in Developing Countries".

The Executive Board agreed there should be a free exchange of advertising between *Prosthetics and Orthotics International* and the *Journal of Prosthetics and Orthotics*. A special edition of *Prosthetics and Orthotics International* on the Limb Deficient Child was presently being prepared by H. J. B. Day, as Guest Editor.

Arrangements to hold the Consensus Conference on Amputation Surgery, 1-5 October, 1990, at the University of Strathclyde in Scotland, were well underway. The outcome of this Conference would be to provide information on the development of instructional material to train surgeons in amputation techniques which provide optimal results. Based on this Consensus Conference, plans were underway to develop courses on Amputation Surgery and Prosthetics in several venues throughout the world. Courses will be held as follows: Tunisia in April, 1991; Thailand in Autumn, 1991; North America in Winter, 1991 or Spring 1992; Yugoslavia at a date to be arranged.

H. J. B. Day had agreed to become Task Officer for the Limb Deficient Child for the coming Triennium. He is pursuing the possibility of establishing a Register of Limb Deficient Children and it is intended that a pilot scheme be introduced in the UK to estimate the likely costs of its implementation.

H. C. Thyregod had agreed to continue as the Task Officer for the Professional Register. The database programme was now functioning well and there had been a response of 800 to the first mailing of the questionnaire and to date the information from 500 questionnaires had been fed into the database. A second mailing of the questionnaire to those who had not responded will be mailed shortly.

Joan Edelstein had agreed to continue as Editor of the International Newsletter. In addition, she had agreed to accept the position of Task Officer for Journal Promotion for the coming Triennium.

International Consultants

The following members had agreed to become International Consultants to the Society:

Paul Kapuma	Africa
Seishi Sawamura	Asia
John Craig	Central America
A. P. Kuzhekin	Russia

Secretary's Note: Since the Executive Board Meeting Crt Marincek had agreed to become International Consultant for the Eastern Block and Balkan countries.

The President reported on his recent visit to Russia where he had been invited to attend a Soviet/ American Seminar "Invaltech '90", 16-20 April 1990, in Moscow. He had discussed the possibility of the Society becoming involved in developments in prosthetics and orthotics in Russia and had signed a Protocol of Intent together with the President of AAOP, T. Supan, the President of the US National Member Society, M. LeBlanc, the Minister of the Social Security of the USSR, V. A. Kaznacheev and the Director of the Central Research Institute of Prosthetics, A. P. Kuzhekin.

The Executive Board agreed that the Society should continue this dialogue and encourage membership of ISPO in Russia.

Cliff Chadderton had agreed to continue as Consumer Consultant to the Executive Board for the coming Triennium.

International Organisations

The World Health Organisation (WHO) is interested in having further discussions with ISPO regarding the outcome of the Alexandria meeting. It is hoped that such discussions would also explore the development of working relations between the Society and WHO.

The Society has organised a session on prosthetics and orthotics at the 5th European Conference of Rehabilitation International (RI) which was to be held in Dublin, Ireland from 20-25 May, 1990. In addition, the President had been invited to address a Plenary Session at this Conference. The Society are also organising a session on prosthetics and orthotics at the 9th Asia and Pacific Regional Conference of RI to be held in Beijing, China from 26-30 October, 1990.

Margaret Ellis had agreed to continue as one of ISPO's representatives to the International Committee for Technical Aids (ICTA).

The Society has sent letters to the Foreign Ministers of influential countries to express its concern with regard to the two International Committee of the Red Cross (ICRC) orthopaedic technicians taken hostage in Beirut. It agreed that the Society should stay in close contact with ICRC to offer the Society's assistance in this matter.

Congresses

Seishi Sawamura presented the Final Report on the Kobe Congress. There being a total of 1759 attendees at the Congress which included 961 full registrations, 263 one-day registrations, 36 student registrations, 183 accompanying persons, 96 exhibitors and 220 staff. The Scientific programme was very well supported with 475 individual presentations. Seishi Sawamura reported that in view of the generous sponsorship and contributions to the Congress, made by individuals and agencies in Japan, and the success of the exhibition and instructional courses, the Congress had realised a profit of more than 4 million yen. The President, on behalf of the Executive Board and the Society, thanked Seishi Sawamura and his colleagues for organising such a successful scientific and social Congress.

Arrangements for the 7th World Congress which is to be held in Chicago, USA, 28 June-3 July, 1992 are well underway. A local Congress Committee has been established and the International Congress Committee has had initial discussions with regard the programme. Further information is displayed elsewhere in this issue of the Journal.

Two countries have indicated interest in hosting the 1995 Congress, namely, Australia and Netherlands. The closing date for invitations to host this Congress is 3 May, 1990 and all bids will be considered at the first meeting of the Executive Board after that date.

Conferences and Meetings

The President reported on the arrangements for the European Conference on Rehabilitation Technology to be held in the Netherlands from 5-8 November, 1990. He reminded the Board tat there were no financial implications to the Society in this meeting. A number of ISPO members had been invited to speak at the Conference. However, it was left to individual members to decide whether or not they wished to offer papers.

Acke Jernberger informed the Board of the progress which had been made in organising the meeting on the Foot and Shoe which is to be held in Jonkoping, Sweden from 10-13 June, 1991. He was presently developing the programme and would report to the next Executive Board Meeting.

The organisers of Dundee '91 – Orthotics, an international conference and instructional course to be held in Dundee, Scotland from 16-20 September, 1991, had requested a formal association with the Society for this Conference. The Executive Board agreed to this formal association.

International Committee Meeting

The Executive Board discussed the unapproved Minute of the last International Committee Meeting. A number of issues raised at the meeting were considered.

The Executive Board discussed the desirability of establishing special interest groups within the Society and were of the opinion that at present such groups should not be introduced, however, should the need arise to establish a particular special interest group this would be examined on its own merit.

The Honorary Secretary reported that office procedures with regard membership and payment of fees had been reviewed in response to suggestions made by a number of National Member Societies. It was hoped that the task falling on National Member Societies would be made easier by this review.

The International Committee had discussed the differentiation in status between ordinary members and Fellows in the Society as a number of National Member Societies had suggested that there should be no such differentiation in the Society's membership. It was agreed that National Member Society representatives should go back to their members and seek their views on this matter, sending them in turn to the Executive Board who would take action as required. However, few communications had been received from National Members Societies and the Executive Board decided to defer taking any action until it was clear that no further communications would be received.

The International Committee/Executive Board Working Group had met prior to the Executive Board Meeting and there had been long and thoughtful discussion at that meeting. The Working Group will report on its proposals to the Executive Board and the International Committee by the Summer of 1991.

Fellowships

Fellowships of the Society have been awarded to:

J. Halcrow	Australia
M. LeBlanc	USA
B. P. McClellan	USA
D. Childress	USA
R. W. Speirs	USA
D. J. Atkins	USA

Norman A. Jacobs
Honorary Secretary

Obituary

Henry Lymark

9th March, 1924 – 20th January, 1990

Henry Lymark, a leading research engineer in the field of the disabled died aged 65 on 20th January this year after a short illness.

Henry was born in Karlskrona, Sweden and educated at Vasteras. On completion of his engineering degree he spent a short period in the army and in 1950 he joined the Swedish Defence Research Unit where he remained until 1969. At that time he started his career working for the disabled at the Swedish Institute for the Handicapped. Apart from a short break from 1970-1972 working for the Board for Technical Development he remained there until his retirement in 1989. During his time at the Handicap Institute he devoted all his energies to develop devices to aid the disabled. His main work was in upper extremity prosthetics and during this time he attained a worldwide reputation as one of the foremost research engineers in this field. His brilliance as an engineer was matched by deeply held feelings for the disabled with whom he demonstrated a very special empathy. He demanded much of his colleagues but always more of himself. He felt strongly that projects should always be driven through to the final objective of providing an aid to the disabled and one step further – evaluation of the result.

Latterly, he was concerned about the lot of the surviving victims of the Thalidomide tragedy, recognizing their dwindling numbers, their increasing handicaps and sadly the reducing number of specialist units capable of caring for them. He was campaigning in his own quiet but insistent way to try and evolve some kind of international solution. He was pursuing two other projects of perhaps higher profile following his retirement. The first was to develop a robot for the multi-disabled and the second to compile a document embracing the significant research and experiences worldwide in upper limb prosthetics. My understanding is that he managed to complete the major part of this task – it would be a most fitting moment if one or two of his colleagues from the present and the past were to edit and publish the work. What a tribute that would be!

His work was recognized in 1974 by the award of the prize of the Swedish Society for Doctors and his appointment in 1977 as an honorary member of the Swedish Society for Orthopaedic Engineers. His friends and colleagues will remember him for the enthusiasm he imparted, his high intelligence, and straightforward honest approach. He had a special capacity for friendship always strongly cemented and cherished by each one of us privileged to be his friend. He had a highly developed sense of humour but at the same time was a very serious man with a clear sense of purpose. I will remember him especially for the times when he would tease with that special twinkle in his eyes. He would make an apparently outrageous statement which I learnt never to dismiss out of hand – there was always a nugget of important truth to be found.

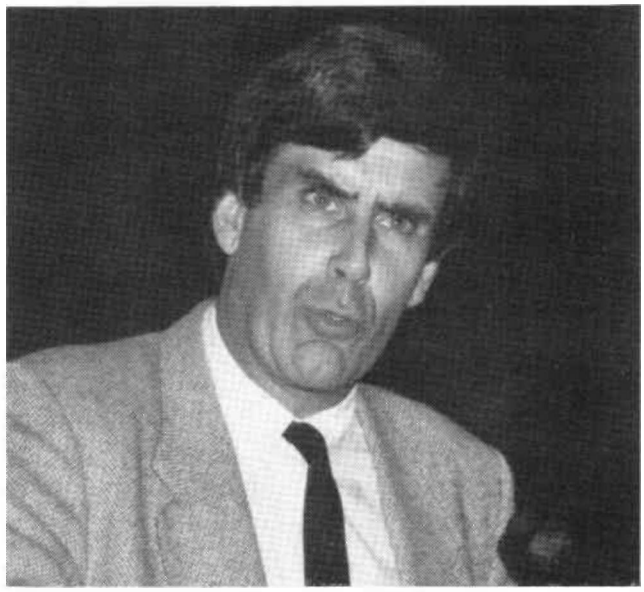
He will be sorely missed by all of us, but most by his wife Mona, their children and family.

G. Murdoch
Past President, ISPO

Obituary

Peter Prakke

13th September, 1939 – 9th May, 1990



On Wednesday 9th May, Peter Prakke died. Perplexity, shock and disbelief dominated the first hours of this news.

One week before the fatal attack Peter was admitted to the hospital with an intracerebral haemorrhage. In full knowledge and with his typical optimism he was prepared for the necessary surgery. It turned out differently.

Next to his large practice as an orthopaedic surgeon he lived intensively with family and friends and found the time to be active in corporate life. Peter happened to be an inspiring counsellor, a strategist and a born leader. He acted as a chairman for three societies.

One of those societies was ISPO (Netherlands). For more than 10 years Peter Prakke was a committee member and since 1986 our Chairman. Over these years the Dutch National Member Society experienced an unprecedented prosperity and attracted a large membership. Undoubtedly his driving force generated many national and international activities. Fluently and humorously he directed with an acute awareness of the important contributions that could be made by the various disciplines within ISPO. His personality and expert judgement will be missed very much.

Vice-chairman Daniel Wijkmans died only two years ago and in a short period of time ISPO (Netherlands) lost its heart and head. The National Committee together with the Membership will have great difficulty in living up to the high standards of the deceased.

The impressive farewell to Peter Prakke was held on May 17 in the Chapel of Saint Elisabeth Hospital, Arnhem. The many hundreds of mourners were addressed, among others, by his daughter Petra who portrayed her father in an inimitable way. We can only agree and honour our dear friend with her final words: "Peter, you are a hero".

Hans Arendzen,
Hon. Secretary
Netherlands National Member Society

Prosthetics and Orthotics International, 1990, 14, 59–62

Long term comparison of some shock attentuating insoles

D. J. PRATT

Orthotics and Disability Research Unit, Derbyshire Royal Infirmary, UK

Abstract

The effect of one years general use on the performance of four shock attentuating insoles is reported. Testing was carried out using the JP Biomechanics Shock Meter on twelve volunteers on a timed oval course at eight intervals during the year. The results show that two of the insoles perform well (Viscolas and PPT) although deterioration does occur after 6–9 months use; the other two insoles (Plastazote and Gait Aid) perform poorly. It is suggested that manufacturers provide some information to the user or supplier regarding the effective life of their products.

Introduction

The orthotics profession in the UK has had a somewhat mixed reaction to the introduction of shock attentuating insole materials, an interest which was initiated in many by the development of Sorbothane. The materials now purported to be of value in shock attentuation are many and yet the generalised use of them has been slow to develop. The author has carried out a number of assessments of many of the materials in a variety of ways to try to establish some guidelines for their use (Pratt et al., 1986; Pratt and Sanghera, 1987; Oakley and Pratt, 1988). Many other reports exist but all of the papers failed to appreciate the long term effects of use on the properties of the insoles (Voloshin and Wosk, 1982; Lees and McCullagh, 1984; Light et al., 1980; McLellan, 1984) despite the fact that evidence exists, both experimental and practical (Campbell et al., 1984), that some of these materials do suffer after use. The author thus decided to measure the shock attentuating effectiveness of some insoles over a protracted period using a new technique (Johnson, 1986) based upon lower limb accelerometry, the Shock Meter. This is a popular technique and one which offers much information but often involving expensive equipment for signal processing and limiting the subject to short walks or treadmill activities. The introduction of the JP Biomechanics Shock Meter offers a substantial benefit for this type of work. The meter analyses the frequency content of the signal using Fast Fourier Transform (FFT) techniques to produce a single number between 1 and 10 to indicate the proportion of the accelerometer signal due to impact; the higher the number the greater the shock. The author thus used this meter to assess four insoles over a period on one month (Pratt, 1988) and this study was extended to cover one years use and it is this study that is reported below.

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Materials and Methods

Four insoles were tested (Viscolas, PPT, Plastazote (45kg/m^3), Gait Aid) selected for the following reasons. Viscolas has been shown to have particularly good shock attentuating properties (Pratt and Sanghera, 1987) but is comparatively heavy when compared with foam materials, the best of which seems to be PPT. Both of these insoles are effective at shock attentuation, although very different in appearance they are both based upon polyurethane chemistry. Plastazote was included in the study because, although experience shows that it suffers considerable compression set with a corresponding reduction in its "cushioning" ability, it is still used by some people to act as a shock attentuating insole. Gait Aid was included because it claims to provide "maximum support" and "shock absorption" by "placing the foot in its correct mechanical position". The insole itself is firm and contoured in such a way as to try to effect the function of the first metatarsal shaft although this was found to be uncomfortable for all of those who used it.

Viscolas and Gait Aid were used in the form of proprietary insoles whereas PPT and Plastazote were cut from sheets, 3.5mm for PPT and 3mm for Plastazote.

Twelve volunteers were recruited for this study, 8 male and 4 female; their ages ranged from 19 to

36 (average 27.8 years) and were selected because they were pain free during gait and had not suffered any recent injury. Each insole was worn by three volunteers and measurements were carried out after 2 days, 7 days, 1, 2, 6, 9 and 12 months in the following manner.

An oval circuit 9.5m × 3.5m on a concrete floor was used and each volunteer, before recruitment, had walked around the track at a comfortable pace and their average circuit time recorded. On subsequent occasions, each volunteer had to walk around the circuit at within ± 10% of their average time whilst wearing the shock meter. Five recordings were made at each visit with the subject wearing socks and then five more wearing socks and insole. The shock meter, consisting of a belt worn pack with readout, an ankle worn accelerometer and an inter-connecting cable, was easy to use, each volunteer calling out the displayed shock factor every two minutes.

The shock meter calculates the shock factor by carrying out an FFT of the accelerometer signal in the frequency range 10–150Hz. This range was found to provide a reliable output, getting over the usual problems associated with the attachment of the accelerometer. By expressing the area under the FFT between 10 and 50Hz as a fraction of the whole area between 10 and 150Hz a number between 0 and 1 is obtained which is subsequently scaled to between 0 and 10 for ease of handling.

The data for each insole were expressed as a percentage of the sock-footed reading and compared with the others.

Results

It is clear from Figure 1 that, for all practical purposes, the shock attentuating properties of Plastazote and Gait Aid are constant (except for less than 2 days use of Plastazote) and poor; ranging from 98.0% to 98.5% for Gait Aid during the year and 97.2% to 99.0% for Plastazote over the same period (the differences between the start and end values are not statistically significant).

The picture is different with Viscolas and PPT, both of which show deterioration during the twelve months. Viscolas changed from 82.2 ± 2.2% to 89.4 ± 3.1% whilst PPT changed from 83.5 ± 1.0% to 93.5 ± 3.2% during the same period. The results show, however, that even after

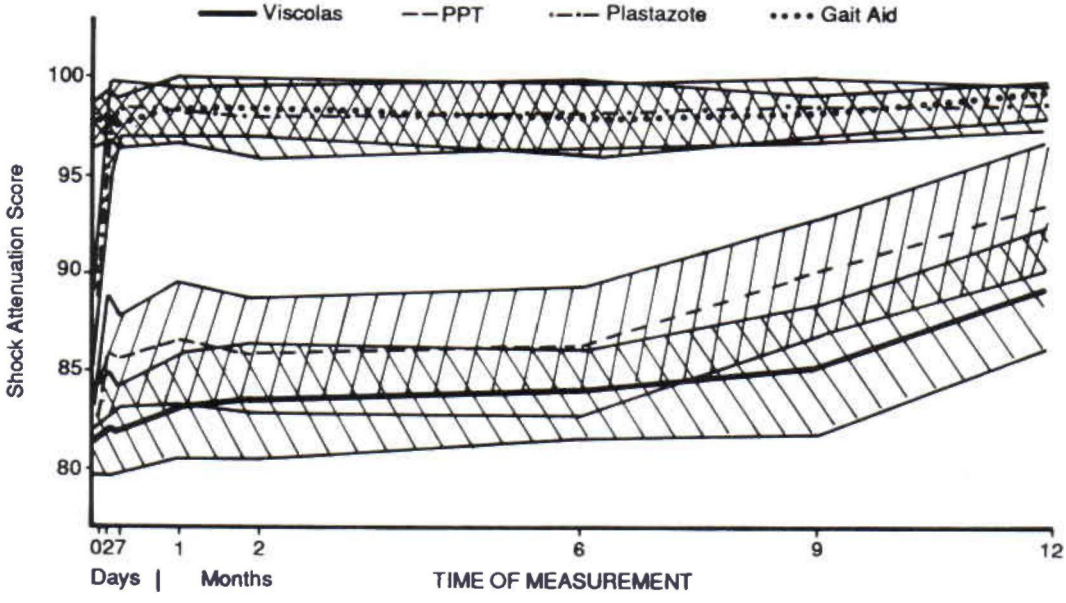

Fig. 1. Shock Meter results for the four insoles tested. the shaded areas either side of each line represent the limits of ± one standard deviation. The numbers on the ordinate indicate the time of the measurement and the numbers on the abscissa are calculated from

$$\frac{\text{(shock factor with insole)}}{\text{(shock factor without insole)}} \times 100$$

Smaller values thus indicate a superior shock attentuating performance.

12 months these two materials perform better than the other two after just two days use.

The reasons for the deterioration were different in the two cases. PPT seemed to pass through a stage of no apparent damage or significant change in properties (up to about 6 months). There was marking of the surface and scuffing in the forefoot region developing after this but this appeared to be a surface effect rather than one of the bulk material. After this the main insole material began to break off mainly in fine particles, but occasionally in larger pieces. At this stage the shock attentuating properties began to deteriorate and at the end of the twelve months much of the bulk of the insole had disintegrated. With Viscolas the pattern of mechanical breakdown was quite different. Whilst the top surface layer of Cambrelle on the insole rapidly showed some signs of wear this did not seem to progress to any significant amount. The main changes took place within the insole with the polyurethane developing transverse splits. Although this damage, again, was seen at quite an early stage, as soon as 2 months in some cases, it did not initially seem to affect the shock attentuating properties of the insole. Up to 9 months the insole was still performing well (80.0 $\pm$ 2.2% to 85.3 $\pm$ 3.3%) but after this, increased splitting and breakdown of the structure of the insole occurred and the shock attentuation began to suffer, rising to 89.4 $\pm$ 3.1%.

Discussion

There is a growing body of evidence of a causative relationship between repetitive impulsive loading and the aetiology and development of some pathologies. Foremost among these is joint degeneration (Radin, et al., 1980; Broom, 1986; Radin, 1987) but many other complaints are also included such as headaches, plantar fasciitis, Achilles tendinitis, osteoarthritis, lower back pain and prosthetic joint loosening (Light et al, 1980; McLellan and Vyvyan, 1981; Voloshin and Wosk, 1982). These points are noted and discussed in the paper by Collins and Whittle (1989) where they make the very valid observation that the visco-elastic components (passive) play only a small part in protecting the body from harmful shock loading. They note, as do others (Pratt, 1989) that active mechanisms play a significant part in the moderation of shock loading and this can be clearly demonstrated. Despite this the augmentation of the shock attentuating mechanisms in the body, both passive and active, by the use of insoles can be of value to certain categories of patients who can be considered to be 'at risk'. Eccentric contraction of muscles to act as controllers of motions used to attentuate shock has been a commonly held belief. However, this view is challenged (Simon et al., 1981; Nigg et al., 1984) and is based upon the view that the reaction time of muscles is too long to actively absorb an appreciable amount of energy, this view being supported by McMahon and Green (1984). It is felt that active shock attentuation by reflex control would be too slow particularly for the early stages of the stance phase. Light et al. (1980) hypothesise that perhaps the muscles are controlled by higher centres and when we are fatigued these controls become less efficient. It is at this stage that artificial shock attentuators would be of value.

The results of this study clearly show that the shock attentuating performance of these insoles can be greatly affected by wear and use. The performance of the insole material depends not only upon the chemistry of the material but also upon mechanical factors such as compression set. Tests by Campbell et al (1984) have shown that Poron (PPT) suffers typically less than 5% set compared with about 70% for Plastazote. It is felt that these results cast in doubt the figures quoted by manufacturers for the performance of their insoles as these all relate to the "as new" behaviour. Some idea of life-time for the material should also be quoted, being based upon some standardised laboratory testing procedures which would be used by all the manufacturers. Until then, small tests such as this, can show the long term performance of these materials and aid prescribers in making the most appropriate material selection for their patients.

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Addresses

Viscolas	Chattanooga UK, Goods Road, Belper, Derby DE5 1UU, UK.
PPT	Langer Biomechanics, Brookhouse Way, 1 The Green, Cheadle, Stoke on Trent, Staffs, UK.
Plastazote	BXL Plastics Ltd, ERP Division, Mitcham Road, Croydon, Surrey CR9 3AL, UK.
Gait Aid	Gait Aid Inc., 4195 Dundas Street West, Suite 303, Toronto, Ontario, M8X 1Y4, Canada.

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Accelerations due to impact at heel strike using below-knee prosthesis

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Abstract
The acceleration in the sagittal plane of the prosthetic tube at heel strike in normal walking was measured in five healthy amputees with their definitive below-knee prosthesis, every subject using six different prosthetic feet, wearing sport shoes as well as leather shoes. The experiments were carried out in the rehabilitation centre "Het Roessingh", Enschede, The Netherlands.

Maximum accelerations were extracted from the acceleration-time-signal. Mean acceleration maxima of all subjects were calculated for each foot-shoe combination to eliminate the individual influence of the subjects. In the axial direction the maximal accelerations demonstrate a clear difference among the prosthetic feet and the shoes, while in dorsoventral (tangential) direction the inter-individual variation in the acceleration extremes dominates the difference between the types of footwear. In comparison with non-amputees the magnitude of the maximal axial acceleration at heel strike does not differ significantly.

Introduction

One of the important aspects in the design and selection of prosthetic feet is the comfort they offer the user in walking.

An item of comfort is certainly the absorption of high level accelerations (in fact negative acceleration, but further referred to as just acceleration), induced by the impact between (shoe) heel and ground at the end of the swing phase. Without sufficient damping these high accelerations can easily lead to an overload of the biological tissues of the stump and the skeletal joints. To evaluate the differences in absorption of high level accelerations among commercially available prosthetic feet and the influence of the shoe type on these differences, an experiment was designed in which these accelerations at heel strike were measured.

In a similar experiment as reported here, but with non-amputees Van Leeuwen et al. (1988) found in the tibia a peak acceleration at heel strike of $40m \cdot s^{-2}$ in the axial direction of the tibia and of $80m \cdot s^{-2}$ in the direction perpendicular to the tibia, while in the shoe sole these peak accelerations were $600m \cdot s^{-2}$ and $150m \cdot s^{-2}$ respectively. From these figures it is clear that for healthy subjects there is a great amount of shock absorption in the foot-ankle complex, expecially in the axial direction of the leg. The knee, hip and other skeletal joints take care of peak acceleration absorption as well. Mizrahi and Susak (1982) found that at impact with one straight leg, after fall from 50 mm, there only remains a maximum acceleration of $46m \cdot s^{-2}$ at the level of the greater trochanter.

Johnson (1988) investigated the influence of shoe insoles on peak acceleration absorption. He defines a shock factor as the integral of the amplitude spectrum from 50 to 150Hz divided by the integral from 10 to 150Hz. Due to the use of an insole this shock reduction between 8% and 39% can be achieved with respect to a shock factor.

Method

Five male subjects with an unilateral below-knee amputation, of good physical condition and experienced in prosthetic walking, were each provided alternately with six different prosthetic feet. Information on the subjects and feet is presented in Tables 1 and 2. After a weekly period of habituation to each new prosthetic foot, the volunteers were invited to the gait laboratory where accelerometers were fixed to the prosthetic tube just above the foot-tube connection. Gait parameters as well as the axial and tangential acceleration were registered while walking a distance of 2 times 10m at a comfortable speed. The experiments were performed with two types

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Table 1. Information on the below-knee amputees who co-operated with the experiment.

subject	age (Yrs)	body weight (kg)	initial foot	amputated since (Yrs)	walking speed (m/s)
1	59	102	Bock Dynamic	21	1.33
2	52	75	„ Lager	44	1.78
3	23	—	„ „	—	1.44
4	32	92	„ „	10	1.32
5	30	88	„ „	10	1.26

of shoes: a pair of normal leather shoes and a pair of flexible sports shoes.

The accelerations were registered with Bruël & Kjoer accelerometers Type 4375 for the axial acceleration and Type 4393 for the acceleration perpendicular to the tube axes in the sagittal plane. Both accelerometers had a sensititivy of $0.3pC/m \cdot s^{-2}$. The signal was amplified to $0.1V/m \cdot s^{-2}$ and with the aid of an analogue/digital-converter and an IBM-XT compatible computer sampled with a frequency of 2000Hz.

Each walking track of 10m included approximately 6 prosthetic heel strikes. Due to occasional wire fractures, resulting in a constant measuring-signal, some measurements had to be rejected afterwards as being incorrect.

Data analysis

In the experiment no use was made of foot-ground contact detectors to eliminate any disturbance from these devices. The moment of heel strike was accurately extracted from the registered acceleration signal. A reliable way of automatic detection of this moment was to determine the point where the absolute value of the first time derivative of this signal exceeded the value $1 \cdot 10^4 m \cdot s^{-3}$ (Fig. 1).

The first extreme acceleration after heel strike was determined. For each experiment the mean

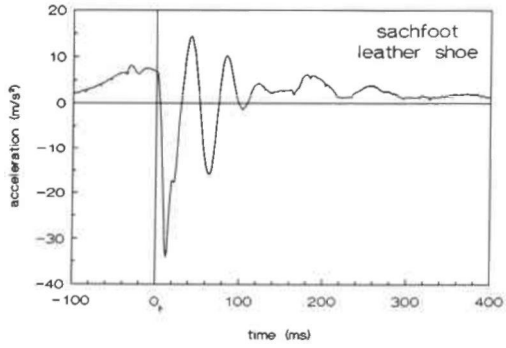

Fig. 1. Axial acceleration around heel strike (0 msec.) of subject 1 wearing a SACH foot and leather sole.

Table 2. Information on the prosthetic feet.

1. Otto Bock SACH foot
2. Otto Bock dynamic foot
3. Otto Bock uniaxial foot
4. Rax foot
5. Seattle foot
6. Blatchford Endolite Multiflex foot (medium stiffness)

and variation of these peak accelerations were calculated. Due to the inter-individual differences in the gait patterns the peak accelerations per subject were normalised before calculating the mean of all five test subjects. This normalization was achieved by dividing for each subject the axial and tangential peak accelerations by the axial peak acceleration of walking with an Endolite foot with sports shoe and the tangential peak

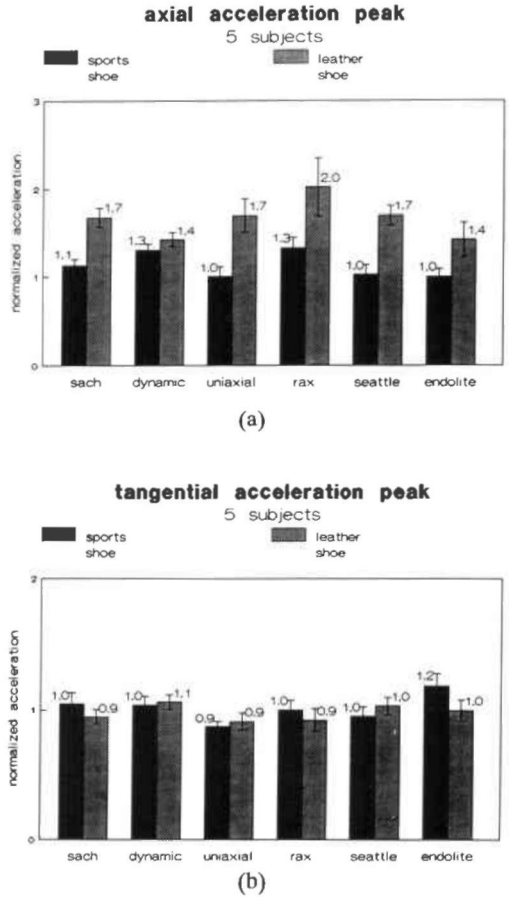

Fig. 2. Mean normalized acceleration maxima in axial (a) and dorso-ventral (b) direction ± 90% confidence interval.

acceleration of walking with an Endolite foot with leather shoe respectively.

Results

Figures 2a and 2b show the mean maximum axial and tangential accelerations, with a 90% confidence interval according to the Student-t-test, of all five subjects per foot design, wearing leather and sports shoes respectively.

It can be seen in Figure 2b that the influence of foot design and shoe stiffness on the peak tangential acceleration is not significant. The influence of these factors on the peak axial acceleration is larger (Figure 2a), although the differences between the mean accelerations are moderate. For the axial acceleration the added flexibility of the sports shoe leads in all cases to a reduction of the peak acceleration, a reduction which is most pronounced with the stiffer feet like the Rax.

The inter-individual differences were very large as can be seen in Figure 3, the mean maximal axial and tangential accelerations are depicted for each subject, foot design and shoe. These large differences are caused by variation in weight, length, muscle strength and other physical properties.

The assumption is made that the walking patterns of the subject are constant in all experiments so differences for one subject are only caused by the variations in foot type. Small variations in gait throughout the experiments will occur due to physical and mental coincidences, but these influences can be largely eliminated by taking the mean of a reasonably large sample.

Discussion

The declination of peak accelerations at heel strike is an important aspect of the foot-ankle performance. The choice of the foot type influences the magnitude of the accelerations in the axial direction of the prosthetic tube at heel strike, leaving the tangential accelerations

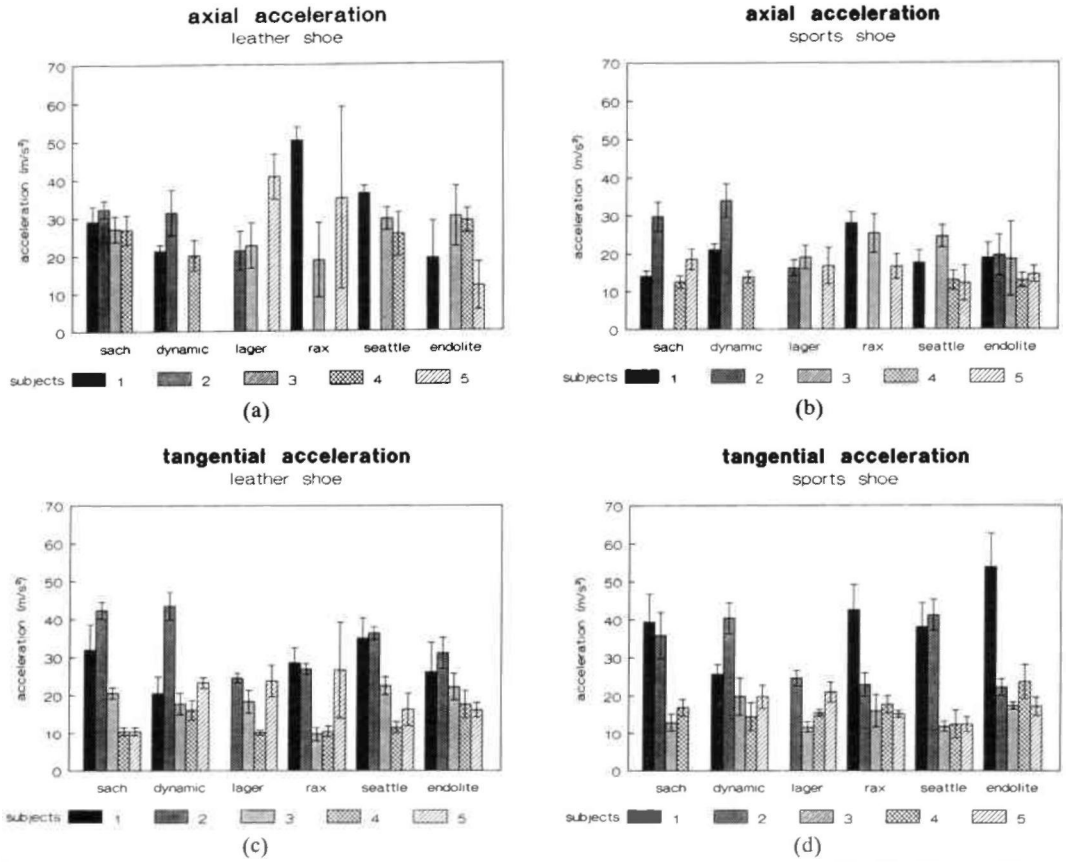

Fig. 3. Individual acceleration maxima in axial (a & b) and dorso-ventral direction (c & d) of all subjects wearing leather (a & c) and sports (b & d) shoes ± 90% confidence interval.

practically unaffected. A significant reduction of the maximal axial acceleration can be achieved by wearing sports shoes instead of normal rigid leather shoes.

The registered axial accelerations of the prosthetic tube of the unilateral below-knee amputees ranges from 20 to 50m · s^{-2} which is comparable with the 40m · s^{-2} for healthy subjects, as measured by Van Leeuwen et al. (1988). In tangential direction, however, the accelerations were lower in prosthetic walking (10–40m · s^{-2}) than in normal walking (about 80m · s^{-2}).

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An audit of amputation levels in patients referred for prosthetic rehabilitation

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Abstract

Most lower limb amputations in the United Kingdom (UK) are carried out within general surgical, orthopaedic and plastic surgical units of district hospitals. This study of patients referred for rehabilitation was undertaken to determine the number and specialty interests of surgeons referring amputees, the numbers referred by each and, as one of several possible measures of appropriateness for rehabilitation, the amputation levels in patients referred for the first time to one sub-regional Disablement Services (limb fitting) Centre (DSC) over a 14 month period. Thirty nine surgeons, referred 263 amputees. The majority (61%) of surgeons referred 5 or fewer: a nucleus of 11 vascular surgeons (28%) referred 64% of the patients. The underlying pathology, speciality interest of the surgeon or numbers referred by individual surgeons had no relation to final healed level which was below the knee in 55% of cases compared to national figures for all other DSC's ranging between 39% and 48% below-knee between 1981 and 1988.

Since current practice in the UK is to refer all but the frailest patients for consideration of prosthetic rehabilitation, this study suggests that, nationally, more patients could be suited for the functionally superior below-knee level of amputation than are currently benefiting from it.

Introduction

In the aftermath of the McColl report (Department of Health and Social Security, 1986) and in the light of plans for the assumption of responsibility for amputee rehabilitation by the UK Regional Health Authorities in 1991, there has been increased interest in amputation surgery generally and increased need for information on which to base future plans. This small study of amputations carried out within the catchment area of the Newcastle Disablement Services Centre (DSC) is aimed at determining the number of consultant surgeons referring amputees for rehabilitation, the numbers referred by each, the specialty interests of those surgeons and relating these to the final healed level of amputation – the latter being one of the most important determinants of rehabilitation outcome. The catchment area covers 8 health districts containing a population of 1.9 million. The study involves all amputees who were referred for *consideration* of prosthetic rehabilitation. Post-operative deaths or those who were considered too frail for referral for a prosthesis were excluded. The final decision in whether to proceed with prosthetic fitting was taken by the DSC rehabilitation team.

Methods

The names of all patients first referred to the Newcastle DSC during the 14 month period up to July 1988 were retrieved from the centre's database. The case notes were perused noting name of surgeon, "cause" of amputation and level of final healing. Thus, a profile could be constructed giving numbers and levels for each surgeon over the period. The major specialty interest (Orthopaedic, General, etc) of each surgeon was noted and, for general surgeons, those with a declared sub-specialty interest in vascular surgery were identified.

Results

Amputees were referred by 39 surgeons – 7 orthopaedic, 1 plastic and 31 general. Of the

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Table 1. Number of amputations referred by individual surgeons.

No. of amputations	No. of Surgeons	Total amputations
1–5	24	55
6–10	5	50
11–15	6	78
16–20	3	52
21–25	0	0
26–30	1	28
Total	39	263

general surgeons, 12 were identified as having a special interest in arterial surgery.

A total of 263 amputees were referred by surgeons of the following specialty distribution:— Orthopaedic 13, plastic 1, general 249. Some 87% of all amputations were for vascular disease (including diabetics). The numbers of amputees referred by individual surgeons are shown in Table 1. The majority (61%) referred five or fewer amputees during the study period. A group of 11 surgeons (28%) referred 10 or more each (one referred 28). Between them, these 11, all noted as having a vascular interest, referred 168 amputees (64% of the total).

The amputation levels achieved are given in Table 2. Some 242 (93%) were either above or below-knee amputations, the remainder around the knee (6%) or ankle/partial foot (2%). Since the critical factor for the success of prosthetic rehabilitation is the presence of the knee joint, the term "above-knee" (AK) in the remainder of this report will include through knee and Gritti Stokes amputations and "below-knee" (BK) will include Symes and partial foot amputations. The surgeons referring 10 or fewer amputees per year achieved 43 (45%) AK and 52 (55%) BK levels. The corresponding results for the 11 (vascular) surgeons who referred 10 or more amputees per year were 75 (44%) AK and 93 (56%) BK.

Discussion

Although surgical factors such as quality of the myoplasty and character of the scar are important influences on the stump/prosthetic socket interface, it is the level of amputation which is the most important surgical determinant of rehabilitation outcome (Waters et al., 1976) and which has therefore been considered alone in this study. The overall BK rate of 56% in-patients referred by surgeons in the 8 health districts studied compares favourably with a reported national average among attenders at all DSC's of 41% between 1981 and 1985 (Ham et al., 1989) and 48% in 1988 (Department of Health, 1989). Whilst the study population was heterogeneous in terms of the nature, extent and location of pathology leading to the amputation, the uniformity of amputation levels across the whole group of surgeons was striking, no differences being observed in the BK rates of occasional amputators, frequent amputators or vascular surgeons. Surgical policies towards amputations resulted in a 55% BK rate for all amputees considered to be candidates for prosthetic rehabilitation regardless of the indication for the amputation, or whether or not performed by a surgeon with a specialist vascular interest.

It was not possible to access the impact of any prior vascular surgical management on level of amputations since the details of arterial reconstruction procedures were often incomplete at referral to the DSC. It has been suggested that a failed attempt at limb salvage by arterial reconstruction can lead to an amputation at a higher level than could otherwise have been achieved by primary amputation. (Szilagyi et al., 1979; Kazmers et al., 1980; Gregg, 1985; Sethia et al., 1986.) The author's results do not point to any such effect since the BK rate is the same in the "vascular surgical" group as in the remainder.

The annual referral rate of amputees in the Newcastle area as revealed by these results is 13.1 patients per 100,000 population compared with the national average of 8.9 per 100,000 (Department of Health, 1989). This difference probably reflects the known high incidence of smoking and of arterial disease in general in the North East. However a prospective study of amputees is now underway aimed at investigating the incidence of prior vascular

Table 2. Final levels of healing in 263 amputations.

Above-Knee	Below-Knee	Through Knee	Gritti Stokes	Symes	Forefoot
100 (38%)	142 (54%)	3 (1%)	14 (5%)	1 (1%)	3 (1%)

assessment and reconstruction and to access its relationship to the amputation rate in the area (McCollum, 1988).

There were 17 amputations through or close to the knee. Although there is some enthusiasm for "perigenicular" amputations amongst surgeons (Houghton et al., 1989), there is less so amongst rehabilitationists. In a group of patients referred specifically for prosthetic rehabilitation one would hope to see very few such amputations since they inevitably result in a protuberant uncosmetic knee joint even with modern modular prostheses. They are best avoided on patients who are likely to be candidates for prosthetic rehabilitation, but in patients who are destined for a wheelchair existence, the longer stump may be an advantage. These considerations underline the importance of a careful, combined surgical-prosthetic assessment preoperatively.

The case for the establishment of specialised amputation units (Department of Health and Social Security, 1986) is not proven by these results. The fact that a BK rate in patients referred for prosthetic rehabilitation well above the national average is achievable in one geographical area must be a reflection of surgical attitudes, and points up the potential for improvement in BK rates nationally simply by changing surgical policies. If amputation surgery units were to be established, any improvement in BK rates could be mis-attributed to the existence of such units in view of the increasing national trend towards more BK amputations which has already been observed during the present decade (Ham et al., 1989; Department of Health, 1989) and which would be accelerated by the more general adoption of updated amputation practices. Whether some authors' declared objective of a BK : AK ratio of 2.5:1 (Dormandy and Thomas, 1988) is realistic is likely to depend more on the use of special tests for level selection (Burgess et al., 1982; Yamanaka and Kwong, 1983; Dowd, 1986), than on the existence of amputation units. There are however undoubted benefits from the establishment of local, sub-regional, in-patient units for intensive *rehabilitation* of amputees (Jamieson, 1982; Ham, 1988). More amputee rehabilitation units should be set up — preferably in association with local vascular surgical units, in which increasing interest in and refinement of amputation surgical objectives would naturally follow.

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A survey of amputations at Dodoma Regional Hospital, Tanzania

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Abstract

A survey of 143 amputations performed at Dodoma Regional Hospital, Tanzania between 1983 and 1988 is presented. Consideration is given to indications for amputation, amputation levels, stump revision and supply of prostheses.

Introduction

Tanzania, with a population of some 23.5 million people, has only ten orthopaedic surgeons, some 50 physiotherapists, and less than 20 orthopaedic technologists using five orthopaedic workshops. The two orthopaedic technologists in Dodoma Orthopaedic Workshop were trained locally at the TATCOT school in Moshi.

Dodoma Regional Hospital, with 400 beds, covers the main specialities and cares for a population of about 1.2 million people of Dodoma Region of Tanzania. The Orthopaedic Department cares for approximately 3 million people in the central zone of Tanzania, and is one of the three orthopaedic centres in the country.

Most of the patients are drawn from the rural areas, where agriculture and livestock raising are principal activities. Proper health care and health consciousness is not universal. Some "services" are offered by traditional healers and that combined with the lack of reliable and universal transport plays a role in delaying proper treatment in many cases.

Between 1983 and 1988, 1,759 major orthopaedic operations were carried out at the hospital, and of these, 143 were major amputations of the limbs (8%). Table 1 indicates the prevalence of the amputations compared with other surgical conditions. It can be seen that the percentage of amputations has remained static over the period of five years. Table 2 indicates the levels of amputation. The causes of amputation will reveal the reason for the prevalence of amputation at or below-knee level.

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Table 1.
Prevalence of amputations compared to all operations.

Year	Operations	Amputations	%
1983	142	7	4.9
1984	275	23	8.4
1985	246	24	9.8
1986	277	26	9.4
1987	395	34	8.6
1988	424	29	6.8
Total	1759	143	8.1

Dodoma hospital is not able to undertake sophisticated investigations, such as skin perfusion pressures, Laser Doppler velocimetry and radioisotope clearance rates, to investigate blood flow in limbs. The incidence of peripheral vascular disease is so low (only one case of diabetic gangrene in our series) that this does not form a serious obstacle to the determination levels of amputation.

Indications for amputation

Table 3 lists the indications for amputation. Some 38% of amputations were carried out because of tumours. Apart from sarcomas of bone (7) and soft tissues (5), most of the tumours were carcinomas in long standing tropical ulcers combined with infection and destruction of the underlying bone (Fig. 1).

Table 2. Prevalence of amputations by level.

Level of Amputation	Number
Above-knee (AK)	35
Through-knee (TK)	8
Below-knee (BK)	67
Above-elbow (AE)	12
Below-elbow (BE)	7
Other amputations	14
Total	143

Table 3. Prevalence of amputations by indication.

Indications for amputation	Number
Tumour	55
Metabolic	30
Trauma	24
Infection	10
Iatrogenic	10
Burns	8
Miscellaneous	6
Total	143

Metabolic conditions and arteriosclerosis are uncommon causes of gangrene, compared with industrial countries. Only one amputation could be clearly related to diabetic vascular disease in this group; it is also difficult to specify how many amputations were really caused by typical arteriosclerosis, for the history and clinical picture of some patients were not fully convincing. A pathologist is not available at Dodoma, so that the causation can not be confirmed.

There were 24 traumatic amputations. They were caused by criminal acts, usually axes (5), train injuries (4), motor accidents (4), injuries at work (3) and the remainder by casual accidents.

Fig. 1. Tropical gangrene.

Acute infections included four cases of osteomyelitis, which is a common condition in developing countries. There were two cases of gas gangrene, and four severe infections following open trauma of the lower limbs.

Iatrogenic causes included a variety of conditions, ranging from topical herbal treatment to relieve pain in the extremities, to postoperative gangrene and gangrene arising from plasters that were too tight.

Four amputations were carried out for dry gangrene of the foot following the application of a local liquid on razor cuts. The "drug" appeared to cause prolonged vasoconstriction or/and chemical damage of the peripheral vessels, although it could be that gangrene was already established.

Three lower limb amputations were carried out in two poliomyelitis patients after one-stage corrections of severe flexion contractures of hip and knee joints that led to excessive stretching of the popliteal vessels with obliteration of the lumen. Three upper limb amputations were due to unpadded plasters applied by unqualified personnel, with no instructions or warnings to the patient or relatives.

Burns in epileptic patients following falls into fires, resulted in tissue necrosis and severe infection which demanded amputation.

Miscellaneous causes included three amputations for Madura foot. This fungal infection was responsible for destruction of the bony architecture of the foot, the formation of multiple discharge sinuses and subcutaneous abscesses, severe pain and complete loss of function. Three amputations were done for snake bites. The amputations due to snake bites were related to ischaemic limb necrosis partly caused by the venom, and partly because of prolonged ischaemia due to a tourniquet. There was one cause of a congenital cavernous lymphangioma which produced a leg weighing 15kg.

Many of the indications related to conditions associated with a tropical country, with relatively few associated with arteriosclerosis and relatively few due to trauma.

Revision of amputation stumps

Fifteen patients had revision of the amputation stumps. Only two underwent revision because of inadequate blood supply to the amputation stump necessitating amputation at a higher level.

The majority of revisions had chronic infection of the stump. Sinuses were often present, four caused by osteomyelitis, and nine by foreign body in the form of thread in the sinuses. There was some doubt about the method of sterilisation of the thread in some hospitals, and also its use

in the presence of infection. Treatment was by excision of the wound, adequate drainage and any necessary sequestrectomy. In two cases, breakdown of the stump necessitate an amputation at a higher level.

Ten revisions were performed at the request of the Orthopaedic Technologists because of limb fitting problems. Four had stumps that were too long, four had inadequate muscle coverage of the bone, and two had sharp subcutaneous bone edges.

The supply of prostheses

Amputees have to pay for their appliances, and the cost of USD 70 for a below-knee prosthesis is beyond the means of many families. It is the practice for patients to be discharged from hospital soon after the amputation stump is healed and to return later for their prostheses when the stump is mature. Some appear at the Orthopaedic Workshop with artificial limbs they have made themseves (Fig. 2).

The Orthopaedic Workshop in Dodoma was established in 1985, through the financial assistance of an Italian Organisation, CUAMM of Padoma. In an effort to reduce costs, "appropriate" technology has been used, relying heavily on locally available materials. For the last two years, local fir wood has been used. It is durable, light, and easily machined. From the wood, feet and shanks are manufactured, joined to a resin socket (Figs. 3 and 4). Initially 75% of prosthetic components were imported, but now, 75% are manufactured locally.

Fig. 2. Home made artificial limb.

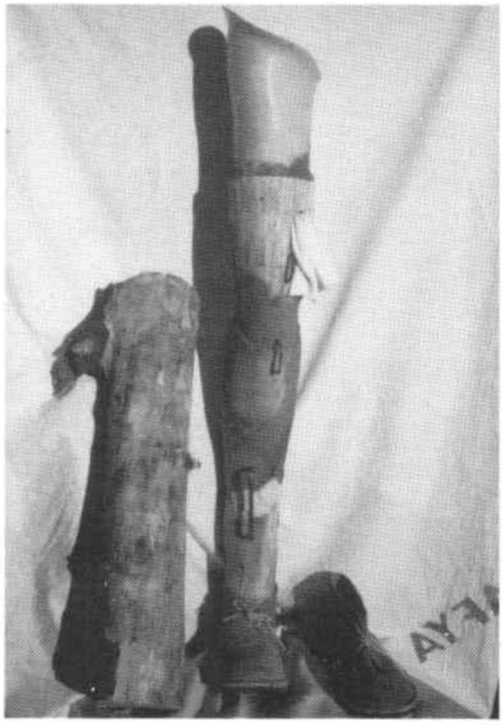

Fig. 3. Above-knee prosthesis using fir wood and resins.

Resins are still widely used for making the socket. Cow-hide does not do well in the environmental conditions of the region and does not last well at village level. For those patients with limited finance, a peg-leg is manufactured with a simple sandal on a foot (Fig. 5). This is quite adequate to allow farming activities.

Discussion

The common causes of amputation in developed countries, such as arteriosclerosis and diabetes, are relatively infrequent. This may be partly explained by a life expectancy of only 53 years, which may also explain the smaller number of patients suffering from coronary insufficiency and stroke. There were some cases of established gangrene affecting one limb for which no cause could be firmly established. Sometimes the application of local drugs accentuated the problem and makes amputation inevitable. Three patients admitted their limbs become gangrenous following application of local drug after razor cuts

Fig. 4. Finished above-knee prosthesis.

that are commonly used as pain relieving procedures. One patient had gangrene affecting both lower limbs and one affecting all four limbs.

Because of the relative infrequency of arteriosclerosis, problems arising from incorrect selection of the amputation level were few, as the proximal limit of the problem area was relatively well defined. Attempts to attain a low level only failed in two amputees, and they needed revision to a higher amputation level.

There has been considerable co-operation between the Department of Orthopaedics and the Orthopaedic Workshop in revising amputation stumps from elsewhere to achieve a proper limb fitting. The workshop has carried out an assessment of its work. Of 107 patients who underwent all types of lower limb amputation in Dodoma until the end of 1988, only 29 attended the orthopaedic workshop for their artificial limbs (27%), presumably inhibited by financial reasons. This indicates that in the first four years the major share of the 88 prostheses made at Dodoma workshop were supplied to patients coming from other hospitals.

The average income of USD 20 per month has presumably made a USD 70 prostheses unachievable by many families. Attempts have been made to keep the costs low by use of low-cost local materials and components; moreover labour costs are not charged to the patients. There is a further factor in that a person who is an amputee and has difficulty in finding employment may use crutches as a source of income. The use of "appropriate technology" is essential to provide a service, and merits considerable further research.

The Orthopaedic Department and the Orthopaedic Workshop have tried to impress on amputees the benefits of limb fitting. Successful amputees have been used as part of the educational programme to demonstrate that a degree of normality can be achieved.

Fig. 5. Below-knee peg-leg.

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Prosthetic use and functional and social outcome following major lower limb amputation

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Abstract
A total of 175 consecutive below and above-knee amputees sent to the prosthetic workshop in Helsinki for prosthetic fitting from 32 hospitals were reviewed to determine their functional ambulation and social adaptation. The average age of the patients was 62.2 years at the time of the prosthetic fitting. The mortality was 11% (19) during the first postoperative year. One-year postoperative information was obtained for 141 of the surviving patients (90%) by personal contact. At the time of the review, 68% of the amputees (96 patients) who had been fitted with a prosthesis made extensive and regular use of it. Half of all the above-knee amputees and 79% of the below-knee amputees used their prosthesis throughout the day or over seven hours a day. A total of 72% of the above-knee amputees (33/46) and 85% of the below-knee amputees (67/79) had useful ambulation, at least indoors. Of the 141 patients contacted, 124 (88%) lived in their own homes. The remaining 16 patients (11%) lived in apartment houses for the aged or old people's homes. A total of 48 amputees (34%) needed a regular home help.

Introduction

In Finland, there has been a clear increase in the number of lower limb amputations since the early 1970s (Solonen et al., 1973; Pohjolainen and Alaranta, 1988). The yearly incidence of major amputations has been 25 per 100,000 inhabitants. Amputation is often regarded as the final failure of orthopaedic or vascular treatment. However, amputation can often eliminate a painful limb, bring relief to the patient and also allow rehabilitation of the patient to the status of a functional prosthetic ambulator. The majority of amputations performed in the Western world are due to arterial insufficiency (Department of Health and Social Security, 1986; Helm et al., 1986; Ebskov, 1988).

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In amputation surgery and rehabilitation the most important outcome for the patient and the family is successful ambulation, with return to suitable accommodation and to previous social connections. The amputee frequently makes heavy demands upon the social services and the welfare workers of the hospital and the community. In addition to social adaptation, the rehabilitation process involves training the patient to walk with a prosthesis and to use ancillary aids.

The purpose of this study was to review the functional success of prosthetic ambulation according to different levels of amputation. In addition, a number of variables were analysed to assess their correlation with mobility. The return to society, whether ambulant or in a wheelchair, the living environment and the need for social services were also assessed.

Materials and methods

The patient base consisted of a total of 175 consecutive patients with major lower limb amputations sent to the Prosthetic Factory of Helsinki for prosthetic fitting by the operative units. The patients had been operated on between November 1985 and August 1988. The patients were examined by a physiatrist and a certified prosthetist. The medical records of the patients were also evaluated. Several variables such as cardiovascular, neurological and pulmonary diseases, operations and medication were defined. Out of all the original total of 175 patients, 19 (11%) died during the first postoperative year. The mortality at one year for vascular amputees was 11%, for tumour patients 12% and trauma patients 10%. Follow-up information for 141 (90%) of the surviving patients was obtained by personal contact after one postoperative year, with patients being interviewed and examined by the authors.

Patient sample

The sample consisted of 127 (73%) males and 48 (27%) females. The mean age was 62.2 years

Table 1. Distribution of patients according to diagnosis.

Diagnosis	Number of patients	
Vascular disease	142	(81.2%)
diabetes	88	
arteriosclerosis	52	
embolism	2	
Trauma	17	(9.7%)
Malignant tumour	10	(5.7%)
Frostbite	4	(2.3%)
Other	2	(1.1%)
Total	175	(100.0%)

with a range of 14 to 87 years. The proportion of the total sample in each age group increased progressively up to the 70-79 age group. The latter constituted the largest ten-year cohort, representing 31% of all the 175 amputees. The majority, 103 (59%), were between 60 and 79 years of age.

The distribution of patients according to diagnosis is shown in Table 1. The most prominent diagnosis was disease of vascular origin.

The distribution of patients by sex, type of amputation and age is shown in Table 2. There were 93 (53%) below-knee (BK), 62 (35%) above-knee (AK) and 20 (11%) bilateral amputees, of which 15 were bilateral BK, 3 bilateral AK and 2 BK/AK amputee patients. The mean age was 73.0 for female BK and 62.8 years for AK amputees, while the figures for men were 59.9 and 61.7 years, respectively.

Thirty-nine per cent of all the patients had undergone a previous vascular procedure or amputation. A reconstructive operation was the most common procedure (33%). The other procedures were sympathectomy (24%), amputation of the ipsilateral or contralateral limb (20%), endarterectomy (15%) and embolectomy (8%).

The patients had many additional concurrent disabilities: there was a 22% incidence of symptomatic ischaemic heart disease, while 14% of the 175 patients had experienced myocardial infarction and 49 (28%) had congestive cardiac failure. Eighteen (10%) had experienced a cerebrovascular accident.

Table 2. Distribution of 175 patients by sex, type of amputation performed and age.

Sex	Unilateral		Bilateral			Age (yrs)	
	BK	AK	BK/BK	BK/AK	AK/AK	$\bar{x}$	SD
Women	27	16	4	1	–	67.5	13.2
Men	66	46	11	2	2	60.2	16.2
Total	93	62	15	3	2	62.2	15.8

Classification of functional level

To summarize the information given in this section, the patients were classified into seven categories adapted from Narang et al. (1984):

Class I Ambulating with a prosthesis but without other walking aids.

Class II Independent at home, ambulating with a prosthesis but requiring one walking stick or crutch for outdoor activities.

Class III Independent indoors, ambulating with a prosthesis and one crutch, but requiring two crutches outdoors and occasionally a wheelchair.

Class IV Walking indoors with a prosthesis and two crutches or a walker, but requiring a wheelchair for outdoor activities.

Class V Walking indoors only short distances ambulating mostly with a wheelchair.

Class VI Walking with aids but without a prosthesis.

Class VII Nonambulatory except in a wheelchair.

Results

The average delay between the operation and the first permanent prosthesis was 16.4 weeks in all groups: 16 weeks for BK prostheses, 16.3 weeks for AK prostheses and 19.3 weeks for bilateral prostheses.

Table 3. Location of 141 surviving amputees.

Location	Below-knee	Above-knee	Bilateral	Total
At home				
alone	17 (21.5%)	16 (34.8%)	3 (18.8%)	36 (25.5%)
with spouse	43 (54.4%)	20 (43.5%)	8 (50.0%)	71 (50.3%)
with relatives	7 (8.9%)	7 (15.2%)	3 (18.8%)	17 (12.1%)
Apartment house for the aged	5 (6.3%)	3 (6.5%)	1 (6.2%)	9 (6.4%)
Old people's home	7 (8.9%)	–	–	7 (5.0%)
Hospital	–	–	1 (6.2%)	1 (0.7%)
Total	79 (100.0%)	46 (100.0%)	16 (100.0%)	141 (100.0%)

Table 4. Need for a home help among 141 amputees.

Home help	Below-knee	Above-knee	Bilateral	Total
No home help	53 (67.1%)	29 (63.1%)	11 (68.8%)	93 (66.0%)
1-3 hours/week	16 (20.3%)	7 (15.2%)	5 (31.2%)	28 (19.9%)
4-8 hours/week	10 (12.6%)	10 (21.7%)	–	20 (14.1%)
Total	79 (100.0%)	46 (100.0%)	16 (100.0%)	141 (100.0%)

Accommodation

At the time of the prosthetic fitting, 19 patients (11%) were in hospital. Their accommodation at the time of follow-up is summarized in Table 3. A total of 10 amputees (7%) removed into apartment houses for the aged after amputation. One amputee (1%) was in hospital at the time of the review. Of the 141 patients, 124 (88%) lived in their own homes. The remaining 16 patients (11%) lived in apartment houses for the aged or in old people's homes. Structural modifications to patient's homes such as the installation of ramps and rails, handrails in the toilet and bathroom etc. were required in the homes of 60 amputees (43%).

Home help

At the time of the follow-up, 48 amputees (34%) needed a regular home help (Table 4). Twenty-eight amputees (20%) needed a home help 1-3 hours per week and 20 amputees (14%) needed a home help 4-8 hours per week.

Employment

Of the 81 patients under 65 years of age at the time of amputation, 29 (36%) were in full or part-time employment, 4 (5%) were on sick leave, 2 (2%) were students and 46 (57%) were retired on a pension. Of the 72 patients aged under 65 at the time of the follow-up, 12 (17%) were working, 4 (5%) were on sick leave, 5 (7%) were students and 51 (71%) were retired.

Use of the prosthesis

The prosthesis was used for a mean daily total of 9.3 hours for women and 10.1 hours for men. At the time of the review, 68% of the amputees (96 patients) who had been fitted with a prosthesis made extensive and regular use of it, wearing it either all day (85 patients) or for a major part of the day (11 patients) (Table 5). A further 23 patients used it for about half of the day, while 7 patients used it for only a part of the day or occasionally, and 15 patients never used their prosthesis at all.

Only half (23/46) of the AK amputees used their prosthesis all day or over seven hours a day. The corresponding figure for the BK amputees was 79% (62/79).

Mobility

Table 6 shows the grades of mobility in the 141 patients who were followed up one year after amputation. At the time of the review, 85 amputees (60%) had useful ambulation indoors and outdoors (Classes I-III) and 111 (79%) were able to walk indoors (Classes I-IV). A further 15 amputees (11%) walked only short distances indoors (Class V) and 11 patients (8%) moved only in a wheelchair (Class VI). Of these 15 nonambulators (Classes VI-VII), 80% were over 60 years of age and 73% were AK amputees.

Of the AK amputees, 72% (33/46) were successful ambulators with their prosthesis, at least indoors (Classes I-IV). The corresponding figures for the BK amputees were 85% (67/79). Five per cent (4/79) of the BK amputees and 24% (11/46) of the AK amputees were nonambulators with their prosthesis. Of the bilateral amputees, 69% (11/16) walked with their prosthesis indoors (Classes I-IV) but the majority ambulated with a wheelchair when outdoors.

Table 5. Use of artificial limb by 141 major amputees.

Use of artificial limb	Below-knee	Above-knee	Bilateral	Total
No use	4 (5.1%)	11 (23.9%)	–	15 (10.6%)
1-3 hours/day	5 (6.3%)	2 (4.3%)	–	7 (5.0%)
4-6 hours/day	8 (10.1%)	10 (21.7%)	5 (31.2%)	23 (16.3%)
7-11 hours/day	6 (7.6%)	5 (10.9%)	–	11 (7.8%)
> 12 hours/day	56 (70.9%)	18 (39.1%)	11 (68.8%)	85 (60.3%)
Total	79 (100.0%)	46 (100.0%)	16 (100.0%)	141 (100.0%)

Table 6. Functional outcome of amputation.

Class	Below-knee	Above-knee	Bilateral	Total
Class I	17 (21.5%)	5 (10.9%)	1 (6.3%)	23 (16.3%)
Class II	26 (32.9%)	5 (10.9%)	3 (18.8%)	34 (24.1%)
Class III	13 (16.5%)	14 (30.4%)	1 (6.3%)	28 (19.9%)
Class IV	11 (13.9%)	9 (19.6%)	6 (37.5%)	26 (18.4%)
Class V	8 (10.1%)	2 (4.3%)	5 (31.3%)	15 (10.6%)
Class VI	4 (5.1%)	7 (15.2%)	–	11 (7.8%)
Class VII	–	4 (8.7%)	–	4 (2.8%)
Total	79 (100.0%)	46 (100.0%)	16 (100.0%)	141 (100.0%)

According to patients' reports, the mean walking distance was 360 metres for women and 830 metres for men. Among the follow-up amputees, 21 (15%) felt that they walked as much as non-amputees – for example they could walk outdoors for 2-3 hours – while 33 amputees (23%) could walk over one kilometre.

The main subjective symptom restricting walking in the amputees was ischaemic pain in the contralateral leg. The pain was mild in 19 amputees (14%), quite severe in 21 amputees (15%) and severe in two amputees (1%). Of the 141 amputees, 16 (11%) suffered from pain in the knees or hips and 9 (6%) from low back pain. Four patients (3%) had skin problems in their stump, 4 (3%) had symptomatic ischaemic heart disease and 3 (2%) had hemiplegia resulting in disability. In the complete group of 141 patients, 7 (5%) had some discomfort in the form of stump pain and 75 (53%) suffered from phantom pain. In one of these patients the stump pain was severe enough to limit walking.

Discussion

In most series concerning the rehabilitation of lower limb amputees, the patient base is consisted of the patients of one surgical unit (Helm et al., 1986; Cumming et al., 1987; Moore et al., 1989). The patients in this study came to the prosthetic workshop from 32 different hospitals for the prosthetic fitting. In general, only some of the amputees receive a prescription for a prosthesis at all. In Finland, the percentage of prosthetic fitting has been 62% for BK amputees and 27% for AK amputees (Pohjolainen et al., 1989).

The loss of a leg is a major disaster for patients, limiting both mobility and independence. Most patients with vascular disease are elderly with concomitant chronic illnesses. In this series, only 41% of the 175 patients had no other diseases. There was a considerable proportion of diabetics – 51%, which is similar to the proportion found in some other studies (Mooney et al., 1976; Rush et al., 1981; Tan et al., 1983). Other studies have also found similar high percentages for concurrent disabilities and concomitant chronic illnesses (Weaver and Marshall, 1973; Rush et al., 1981; Cumming et al., 1987). The disabilities resulting from cardiovascular disease, impaired vision and reduced learning capacity frequently impose extra problems in locomotion and in achieving independence.

The higher age at operation among the women is in agreement with previous observations (Mandrup-Poulsen and Jensen, 1982; Helm et al., 1986). It may reflect an earlier onset of arterio-sclerosis in men. In the present series men also had bilateral amputations performed more often than women, which is in accordance with the findings of Helm et al. (1986).

Early and better mobility can be facilitated by conservation of the knee joint with consequent retention of proprioception and a lower energy requirement (Waters et al., 1976; Huang et al., 1979). In the present study, there was evidence that retention of the knee joint influences the final degree of mobility, as 85% (67/79) unilateral BK amputees were mobile indoors with their prosthesis compared with 72% (33/46) where the knee joint was sacrificed. Of the patients in this study, 73% (11/15) of those in whom the prosthesis was unsuccessful were AK amputees. This is in accordance with the findings of Moore et al. (1989).

The use of a prosthesis indicates the state of rehabilitation and the benefit of the prosthetic fitting process in general. Of the 141 follow-up patients, 22 (16%) did not use their prosthesis or used it less than three hours per day, while 85 (60%) could ambulate with the prosthesis indoors and outdoors. Four patients (3%) ambulated only with a wheelchair while 69 (49%) needed the wheelchair occasionally or were able to get outside their home with the wheelchair. Many elderly patients cannot walk safely with crutches or a walker, especially outdoors.

The main symptom which restricted walking was ischaemic leg pain. Stump problems were very common but in only one of the patients was the stump pain severe enough to be a contributory

factor in limiting the use of the prosthesis. In the series of Weaver and Marshall (1973) there was a 23% incidence of stump or phantom pain and in 10% of these patients the discomfort was so severe that it either caused cessation of walking or limited the use of the prosthesis.

Chilvers and Browse (1974) stressed the difficulty of returning patients to their homes and 7 out of 20 of their cases were discharged to institutions. Of the 105 patients reported by Weaver and Marshall (1973), 18 were discharged to institutions. In the present study of 175 patients, 146 (83%) came from their home for prosthetic fitting and were also discharged home. A total of 29 patients (17%) came from institutions but at the time of follow-up only 17 patients (12%) were in institutional care. The successful return of 83% of surviving amputees to their homes would not have been possible without the involvement of medical social workers and home helps, or the structural alterations carried out in the homes of amputees.

The problem is also the time lag of 16.4 weeks between surgery and the fitting of the prosthesis, a delay observed in another Finnish study (Pohjolainen et al., 1989). Yet, although there have been delays in the prosthetic fitting, the percentages with an unsatisfactory outcome for prosthetic use (28% for AK and 15% for BK amputees) are not high compared with those in other reports (Jensen and Mandrup-Poulsen, 1983; Moore et al., 1989). By activating postoperative training, reducing the delay in the prosthetic fitting and organizing the regular follow-up of amputees the chance of a poor functional and social outcome may be minimized. There is also a need to assess several independent variables in order to determine the feasibility of prosthetic use and ambulation following major lower limb amputation, especially in elderly amputees.

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Prosthetics and Orthotics International, 1990, 14, 80–84

Gait recovery pattern of unilateral lower limb amputees during rehabilitation

P. A. BAKER and S. R. HEWISON

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Abstract

The aim of this study was to determine the rate at which gait recovery as measured by temporal distance factors (velocity and symmetry) occurs in unilateral lower limb amputees. A microcomputer footswitch system was used to record the gait patterns of twenty subjects, mean age 65.1 years. The initial measurement was taken when the subject was capable of walking 6 metres with an interim prosthesis within the parallel bars. The patient sample as a whole was analyzed and subjects were further divided into four groups, depending on ambulatory aid required at discharge. Group A, n = 3 used no aid, Group B, n = 5 used a single stick, Group C, n = 6 used 2 single sticks and Group D, n = 5 required frames. A one way analysis of variance ($F = 4.55$, $p = 0.02$) showed a significant difference between the Groups, (A and D, B and D, C and D). The major velocity increase occurs within the first 30 days of the gait training programme. Overall about 55% increase in velocity can be expected within the first fifteen day period followed by an additional 30% between days 15-30. A moderately strong correlation ($r = 0.78$) was found between initial and discharge velocity. The correlation between initial and discharge symmetry was weaker ($r = 0.50$).

Introduction

Clinical experience shows marked variation in the rate at which amputee patients gain proficiency in the use of a prosthesis. The younger nonvascular patient is generally perceived as attaining a better rehabilitation outcome as measured by walking speed, and energy costs than the older vascular patients (Perry and Waters, 1981). The older amputees with peripheral vascular disease represent the largest group within the amputee rehabilitation field and show considerable variation in their ability to master a prosthesis. Many of these patients die either during or soon after rehabilitation. Mortality rates for this group of subjects two years after amputation have been reported as being between 20% and 41.2% (Ebskov and Josephson, 1980; Kihn et al., 1972). The short life expectancy and typical poor health pattern of peripheral vascular disease amputees dictate that time spent in rehabilitation programmes must be carefully monitored.

Gait analysis is a useful objective method of evaluating amputee progress. Skinner and Effeney (1985) observed it should be particularly useful in monitoring the rate of rehabilitation. They went on to say that unfortunately the technique has enjoyed very limited application.

The authors could find no previous studies that examined the rate of gait recovery following amputation or indeed any studies suggesting optimum time periods for prosthetic gait training.

Methods

Subjects

The first twenty unilateral lower limb amputees admitted to Caulfield Hospital for prosthetic gait retraining after 1/9/87 were admitted to the study. Inclusion required that the recent amputation was a new level of amputation for that leg and that a prosthesis was never previously fitted for the purpose of walking at that level of amputation on that leg. There were no exclusions on age, level of amputation or cause of amputation.

Fifteen (75%) of the subjects were male. The mean age of the entire group was 65.1 years with a range of 25-88 years. Most amputations were as a result of peripheral vascular disease (80%), three from road trauma (15%) and one (5%) from cancer. The majority (75%) of the subjects were below-knee amputees, three (15%) above-knee, one (5%) through-knee and one (5%) hip disarticulation.

Procedure

The study was conducted in a 401 bed rehabilitation and extended care hospital with a

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30 bed amputee and diabetic ward. The programme included pre-prosthetic training, fitting of an interim prosthesis by the prosthetic department, gait training by the physiotherapy department, general rehabilitation by a multidisciplinary team and definitive limb prescription. The study was conducted on both an in-patient and out-patient basis. There is a prosthetic by the prosthetic department on-site and once the patient had been fitted with an interim prosthesis and was capable of walking six metres within the parallel bars the first gait recording was taken. The patient's gait was then re-measured approximately twice weekly. Conditions which prevented the patient participating in the gait measurement sessions were recorded. These included skin breakdown, illness, condition of the remaining foot and other. The gait measurement was taken using the patient's current ambulatory aid.

Equipment

A micro-computer footswitch system (Perry et al., 1981) was used to collect the temporal-distance parameters of gait. The system consists of insole footswitches, a photoelectric stop-start device, a recorder and a calculator. Each footswitch contains a cluster of contact closing sensors in the areas of the heel, the fifth and first metatarsal heads and the great toe. The recorder stores the elapsed time of the run and data from the footswitches for up to 20 studies. The calculator accepts the data stored by the recorder and calculates the gait parameters, printing the results on a permanent record.

Results

Subjects were divided into 4 Groups depending on style of ambulation aid required at discharge. Group A, n = 3 used no aid, Group B, n = 5 used a single stick, Group C, n = 6 used two single sticks and Group D, n = 5 required a frame. Subject 20

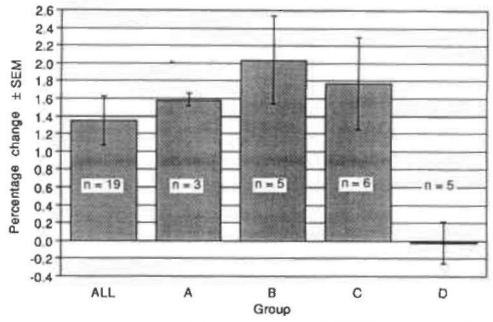

Fig. 1. Mean Percentage Change in Velocity per Day for all Subjects and each Group Over the Mean Period of 63.2 ± 5.9 Days

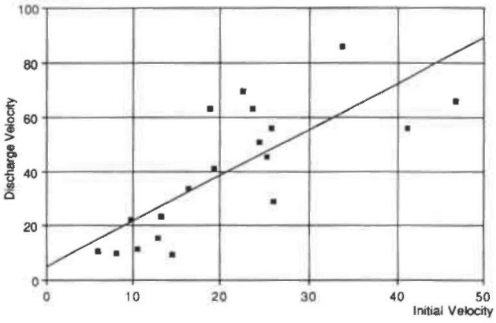

Fig. 2. Change in Velocity in all Subjects Over the Period of Gait Training

(Pearson Correlation r = 0.78)

was excluded from the analysis as he was discharged using a rollator. The mean percentage change in velocity per day for the total sample and each Group is presented in Figure 1. A one way factorial analysis of variance showed significant differences between the Groups. ($F = 4.55$, $p = 0.02$). At $p<0.05$ there is a significant difference between Groups A and D, B and D, and C and D.

The mean percentage change in velocity between days 1–15, 15–30, 30–45, 45–60 and 60–75 for the total sample and the Groups is

Table 1. Percentage Gain in Velocity per Fifteen Day Cycle during Gait Retraining

Patients Group	Number	Duration of Gait Retraining (Days)				
		1–15	15–30	30–45	45–60	60–75
A	3	75.30	10.50	*	*	*
B	5	43.00	37.30	−2.70	19.1	*
C	6	26.40	39.30	30.00	6.60	*
D	5	−7.20	2.20	*	*	*
A–C	14	55.70	31.20	20.30	10.30	−0.50
A–D	19	29.70	25.80	23.70	8.83	−6.00

*As the number of patients decreased with length of the gait retraining programme, cells of $n < 3$ were deleted.

illustrated in Table 1. Initial and discharge velocity and symmetry (difference between the duration of single limb stance on prosthetic and non-prosthetic limb), ambulatory aid, age and length of rehabilitation stay is presented in Table 2. The same characteristics are displayed in Table 3 for vascular (n = 16) and nonvascular (n = 4) Groups. Figure 2 represents a correlation between initial velocity and final velocity (r = 0.78) and Figure 3 shows the correlation between initial and final symmetry measures (r = 0.50).

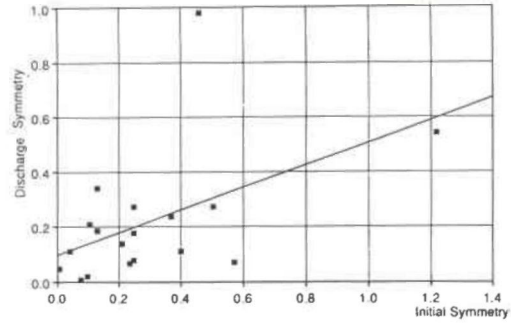

Fig. 3. Change in Symmetry in all Subjects Over the Period of Gait Training

(Pearson Correlation r = 0.50)

Discussion

Velocity is the rate of forward progression and is the best single index of walking ability (Skinner and Effeney, 1985). Symmetry as measured by a

Table 2. Characteristics of Groups

	Group A	Group B	Group C	Group D
Number	3	5	6	5
Age	53.3	51.8	68.3	78.2
Length of Stay (Days)	90.3	62.2	70.6	53.0
Walking Aid	Nil	1 Stick	2 Sticks	Frame
Initial Velocity	32.6	26.7	17.9	11.3
Discharge Velocity	70.3	53.3	35.6	9.7
Change in Velocity (%)	115.6	99.6	98.8	−14.2
Initial Symmetry	0.14	0.33	0.32	0.33
Discharge Symmetry	0.06	0.03	0.14	0.46
Change in Symmetry (%)	57.1	90.9	56.2	−39.3

Table 3. Characteristics of Vascular/Nonvascular Groups

	Vascular	Nonvascular
Number	16	4
Age	73.1	33.0
Length of Stay (Days)	64.0	79.0
Initial Velocity	17.8	30.1
Discharge Velocity	37.4	62.0
Change in Velocity (%)	110.1	106.0
Initial Symmetry	0.21	0.56
Discharge Symmetry	0.02	0.02
Change in Symmetry (%)	90.5	96.4

comparison of the duration of single limb stance on either leg indicates that limb's willingness to accept the body weight. Even weight-bearing on the prosthetic and non-prosthetic side is encouraged during gait training sessions. Velocity and symmetry therefore were selected as indicators of gait training progression.

The major velocity increases in amputee gait retraining programmes occurs within the first thirty days. Table 1 displays the percentage gain in velocity per fifteen day cycle during gait retraining. The total subject result is displayed, then the sub-groups as determined by ambulatory aid at discharge and finally the Group score minus Group D (frame walkers) as Group D was found to respond to the gait training programme in a significantly different ($p<0.02$) manner (Fig. 1). Overall, patients (excluding group D), can expect around 55% increase in velocity between day one and day fifteen followed by a 30% increase between days fifteen to thirty of the gait retraining programme. As the programme lengthens the percentage gain in velocity decreases until such a time as negative gains are recorded. The better the walking outcome of the Group the greater the velocity gain within the first 15 day cycle, with Group A recording a 75% gain in velocity during this period. Overall, subjects (excluding group D) experienced approximately 100% increase in velocity from initial velocity to discharge velocity during the gait training period.

Group D patients were the oldest, required a walking frame at discharge and had the slowest initial velocity. Their initial symmetry was comparable to Groups C and B but it must be remembered that the initial testing was done within the parallel bars, a very stable support. The discharge velocity and symmetry measures for Group D patients were lower than their initial measurements. Group D patients averaged 15 days gait retraining within the parallel bars approximately twice that of the other Groups ($A=8.6, B=7.5, C=7.0$). Three patients within Group D returned home, one went to a special accommodation house and the other to a hostel. In terms of accommodation outcome Group D patients were successful.

The aim of this pilot study was not to identify criteria necessary for selection into a gait training programme but simply rather to look at the pattern of gait recovery during the training period. Gaining information on how patient groups respond to gait training should enable therapists to intervene at the most appropriate time and ensure each patient spends no longer than absolutely necessary within such a programme. Older patients with low initial velocity should be carefully monitored. It is not necessary to have expensive gait analysis equipment as velocity can be easily measured with a stop watch within the parallel bars. Once the group average of 7.5 days within the parallel bars is reached all patients' progress should be carefully reviewed. Only those patients with particular difficulties which threaten their safety (eg. unreliable knee control in the above-knee patients, poor self-monitoring) could need their time spent in the parallel bars extended.

No relationships could be found between velocity or symmetry and progression of ambulatory aid. Therapists stated the progression of an ambulatory aid, (bars → single sticks), was largely based on the patient's confidence level.

Six patients experienced skin breakdown during the gait training programme ($A=1, B=1, C=3, D=1$) which resulted in a mean loss of 13 days gait training. The total stay for the patients ($n=6$) with skin breakdown was 91.5 days compared to the group average of 66.9 days. These patients all had discharge velocity scores in excess of the average discharge velocity scores for their respective groups. One subject missed 25 days as a result of problems with the remaining foot but he also was discharged with a velocity higher than his group's average.

There was an average of 22.4 days (range 10–59) between amputation and admission to Caulfield Hospital. The total stay at Caulfield Hospital was 66.9 days. 55% of the subjects had both in-patient and out-patient programmes. The average in-patient stay being 36.4 days and the average out-patient stay 55.4 days. The total time from amputation till discharge from rehabilitation was 89 days. This figure compares closely with previous Australian studies (Hubbard and Hurley, 1988; Katrak and Baggot, 1980).

Like previous studies, Table 3 indicates that patients who require amputation for reasons other than vascular problems do well with regards to walking speeds. It is interesting to note that as a rule of thumb an 100% increase in velocity from initial to discharge measurement over a gait retraining period appears to be the norm.

Conclusion

This is a pilot study with a small group of patients. Firm conclusions cannot be reached. Several trends however are interesting.

The following may be suggested: Major velocity gains are made within the first 30 days of a gait retraining programme. Initial velocity scores recorded within the parallel bars can be used to predict discharge velocity. Skin breakdown although elongating the rehabilitation phase does not detract from final velocity outcome. Subjects who do not show velocity gains

within the parallel bars after the average stay of seven days should be encouraged to try a frame unless unsafe as prolonged stay within the bars has not been shown to enhance final velocity.

Further studies should be carried out to learn more about gait training programmes. Therapists must have sufficient objective data to determine patients' progress and the plateaux in performance, in order that this group of patients with a poor health pattern and high mortality rate post-amputation should spend the least amount of time required within gait training programmes.

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Technical Note

Splinting for CDH: Temporary Splinting for the Neonate

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Abstract

A simple method of maintaining hip abduction in the neonate with suspected congenital hip instability is described. Clinical observations and parental impressions are initially favourable.

Introduction

There is a high awareness of congenital hip problems and the examination of every neonate includes tests for the stability of the hips (Barlow, 1962; Ortolani, 1976). This results in the detection of "clicky" hips and subluxing or frankly dislocatable hips. The initial treatment of an abnormal hip is not universally agreed, with some believing many stabilize without treatment (Palmen, 1984) whilst others begin early splintage (Fredensborg, 1976; Dunn et al., 1985; Visser, 1985). The types of splint (Visser, 1985; von Rosen, 1962; Wiersma, 1976) and the duration of their use (Hadlow, 1979; Dunn et al., 1985) are also varied.

Frequently there is an interval between the time the diagnosis is made and the time a baby is seen in the out-patient department by an Orthopaedic surgeon. Double nappies are often used during this period to keep the hips abducted but are bulky and inconvenient. Furthermore, certain splint designs do not cater for the very small baby and there is a need in this group for a method of maintaining abduction simply and satisfactorily before a decision is made whether formal splintage is required or not.

Parental compliance is very important if any form of splintage is to succeed (Villar et al., 1987) and a design that is easy to use and to clean, and unobtrusive in appearance will increase this compliance. It is with these factors in mind that the following is presented.

Description

A small pair of pants is adapted to accept an expanded polythene foam ("Plastazote") insert between the legs by fitting a sleeve from front to back (Figs. 1 and 2). The Plastazote is removable and the pants can be washed as normal. Any size of pants can be used, as appropriate to the size of the baby, and the insert is easily cut to fit. The example shows a 10cm × 25cm rectangle of perforated Plastazote, 0.6cm thick, that has been rounded off at the corners.

The Pants slip over towel or disposable nappies alike and the insert prevents hip adduction (Fig. 3). Thus, much the same effect is achieved as with double nappies but with much less difficulty. These pants, locally known as "Rixnix", have been used in six cases over the past few months and have been well received in five cases. In the sixth case their use was criticised because the pants were too large for the baby; it is now planned to expand on this pilot study and will have a wider selection of sizes will be made to overcome this problem. On the basis of these

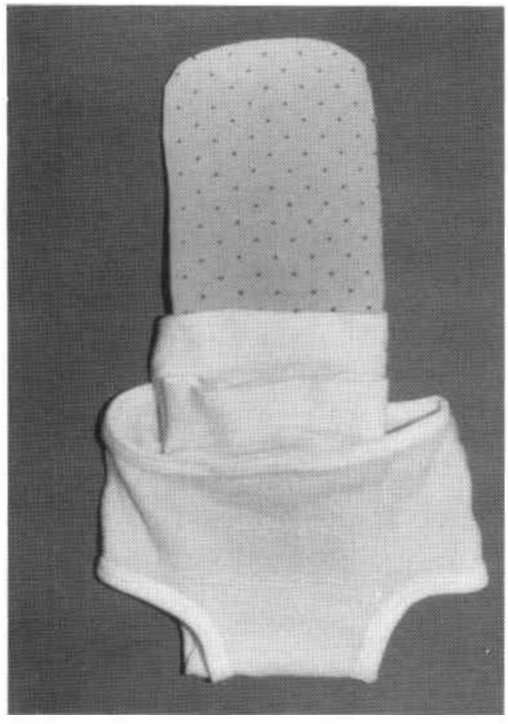

Fig. 1. Plastazote being inserted into sleeve in pants.

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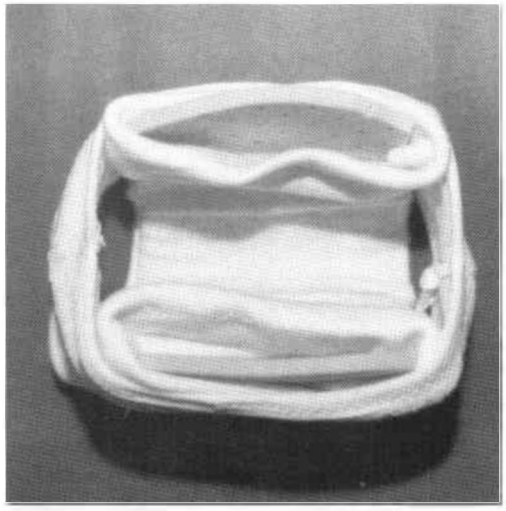

Fig. 2. Insert viewed from above.

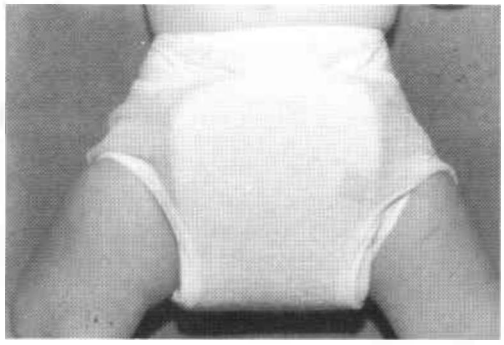

Fig. 3. Pants used over a towel nappy. Note how the hips are held in abduction.

experiences it is felt that these pants can be recommended to others who require to treat congenitally unstable hips from birth.

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International Newsletter
Summer 1990

News from several national member societies indicates the breadth of ISPO activities.

Netherlands National Member Society is involved with minicongresses, multidisciplinary practical courses, and a "twinning" project, among other activities. The Society is also planning for a collaborative scientific meeting in Norwich, England, at the campus of the University of East Anglia, on April 10-12, 1991. The programme will feature guest speakers from the Netherlands. Topics include management of the elderly amputee, orthopaedic footwear, orthotics for spinal cord injury, and computer aided design and manufacture. The meeting will also encompass free presentations and clinical and technical notes. The annual meeting of the society occurred in March at the Erasmus University, Rotterdam.

Canadian National Member Society published in its latest newsletter a comprehensive report of the VI World Congress.

Indian Association of Physical Medicine and Rehabilitation is organizing an international conference in January 1991, at which ISPO has been invited to be an active participant. The conference will afford the opportunity to conduct a workshop or symposium on a significant topic.

Japan National Member Society reported an increase of membership to 321, including 121 prosthetist-orthotists, 128 physicians, 35 therapists, 30 engineers, and 7 in other professions. At the general meeting of the Society, Dr. Seishi Sawamura was elected Chairman and Dr. Sakuya Nakajima is the new Secretary General. Vice-Chairmen are Kazuo Tsuchiya, Ichiro Kawamura, and Eiichi Sukizono. Dr. Sawamura, Secretary General of the VI World Congress, presented a detailed report. Total registration was 1759, including 662 participants from more than 40 foreign countries. Eighty-nine exhibition booths were sold to 23 foreign and 25 domestic companies, exceeding the anticipated sale of only 60 commercial booths. The social programme attracted very large crowds who enjoyed maximum exposure to oriental culture. Problems of day-to-day management, scientific programming, and budget were also addressed. Dr. Yasuhiro Hatsuyama won the Iida Prize. The Society supported the recent meeting of the Rehabilitation Engineering International Seminar in Nagoya. The conference attracted 220 participants, including several speakers from Canada, Italy, Germany, and the United States. The main subject was "Practical Application of Gait Analysis"

United States National Member Society is proceeding with planning the VII World Congress in Chicago, June 28 to July 3, 1992. Secretary General Dudley Childress is preparing brochures for the first announcement of the congress. A management company has been hired and a hotel selected. A growing number of professional organizations have endorsed the congress, including the American Academy of Orthotists and Prosthetists, the American Orthotic and Prosthetic Association, and the American Physical Therapy Association. The biennial Pacific Rim Conference held in April attracted 106 participants; planning is underway for the 1992 conference in Kauai, Hawaii in January. The society was represented at **Invaltech** 90, an exposition held in Moscow, USSR; formal agreements were signed by delegates proposing future co-operation and training efforts. In October an instructional programme will be presented on the theme, "Sports and Recreational Prosthetics and Orthotics" in North Carolina. The programme will highlight winter sports, various international competitions, running prostheses and components, upper limb recreational devices, and sports injuries and their orthotic management. A new support group, Amputee Coalition of America, Inc. has been formed; its major objectives are to assemble information on how to form local support groups, develop a manual on training amputee peer visitors, develop a computerized membership programme for support groups, and represent amputees in the pursuit of national issues that may affect them. The Central American Association for the Educational Advancement of Orthotists, Prosthetists, Rehabilitation Professionals, and Affiliates (ACOPPRA) completed its premier project, ACOPPRA 90 Congress in March in San Jose, Costa Rica, under the co-ordination of John Craig, CPO, President of the Texas Chapter of the American Academy of Orthotists and Prosthetists (AAOP), and Rosie Saez, licensed orthotist-prosthetist from Panama. Delegates participated in three days of scientific seminars and two intensive days of practical sessions during which patients were given physical therapy and fitted with orthoses or prostheses using the techniques and materials discussed during the seminar. Simultaneous English and Spanish translation was provided. The generosity of many commercial exhibitors, the Texas Chapter of AAOP, and the Texas Physical Therapy Association supported the meeting. The next congress will be January 19-24, 1992 in Panama City, Panama.

Joan E. Edelstein,
Editor

Calendar of events

National Centre for Training and Education in Prosthetics and Orthotics
Short Term Courses and Seminars 1990-91

Courses for Physicians, Surgeons and Therapists

NC504 Lower Limb Orthotics; 19-23 November, 1990.
NC508 Orthopaedic Footwear; 26-27 November, 1990.
NC502 Upper Limb Prosthetics and Orthotics; 7-11 January, 1991.
NC505 Lower Limb Prosthetics; 14-18 January, 1991.
NC511 Clinical Gait Analysis; 6-8 February, 1991.
NC503 Introductory Biomechanics; 25 February-1 March, 1991.
NC510 Wheelchairs and Seating; 5-7 March, 1991.

Courses for Prosthetists

NC205 Above-Knee Prosthetics; 5-16 November, 1990.
NC211 PTB Prosthetics; 11-22 February, 1991.
NC212 Hip Disarticulation Prostheses; 22 April-3 May, 1991.
NC218 The Ischial Containment Above-Knee Socket; 27-31 May, 1991.

Courses for Orthotists

NC201 Ankle-Foot Orthoses; 10-14 December, 1990.
NC202 Knee-Ankle-Foot Orthotics; 15-19 April, 1991.

Course for Orthotists and Therapists

NC217 Ankle-Foot Orthoses for the Management of the Cerebral Palsied Child; 13-15 March, 1991.

Course for Rehabilitation Engineers

NC801 An Appreciation of CAD/CAM Technology; 4-6 June, 1991.

Seminars

NC718 Knee Orthotics; 19 October, 1990.
NC719 CAD/CAM; 7 June, 1991.

Further information may be obtained by contacting Prof. J. Hughes, Director, National Centre for Training and Education in Prosthetics and Orthotics, University of Strathclyde, Curran Building, 131 St. James' Road, Glasgow G4 0LS, Scotland. Tel: 041-552 4400 ext. 3298.

3-6 October, 1990
44th Annual Meeting of the American Academy for Cerebral Palsy and Developmental Medicine, Orlando, USA.
Information: AACPDM, PO Box 11086, Richmond, VA 23230, USA.

10-12 October, 1990
Clinical Orthopaedic Society Meeting, Houston, USA.
Information: COS, 222 S. Prospect Ave., Park Ridge, IL 60068, USA.

11-13 October, 1990
1st IFMBE Far Eastern Conference on Medical and Biological Engineering, Tokyo, Japan.
Information: Prof. Yoshimito, West 12, South 17, Sapporo 064, Hokkaido, Japan.

14-18 October, 1990
Western Orthopaedic Society Meeting, San Antonio, USA.
Information: WOA, 2975 Treat Boulevard, Concord, CA 94518, USA.

15-19 October, 1990
Conference and Scientific Symposium of the International Federation of Multiple Sclerosis Societies, Dublin, Eire.
Information: Conference Secretariat, POB 5, Dun Laighore, Co. Dublin, Eire.

15-19 October, 1990
Combined Meeting of the Asian Orthopaedic Association and the Thai Orthopaedic Association, Pattaya, Thailand.
Information: The Secretary, Organising Committee, 10th AOA/12th TOA Meeting, TOA Office, Supavadee Tower, 100 Soi Mitanant Nakornchaisri Rd., Dusit, Bangkok 10300, Thailand.

17-21 October, 1990
Eastern Orthopaedic Society Meeting, Southampton, NY, USA.
Information: EOA, 301 8th St.-Suite 3 F, Philadelphia, PA 19106, USA.

22-24 October, 1990
International Cerebral Palsy Symposium, Prague, Czechoslovakia.
Information: I. C. P. Symposium, c/o Assoc. of the Czechoslovac Medical Societies, J. E. Purkyne, tr. Vitezneho Unora 31, 120 26 Praha, 2, Czechoslovakia.

26-30 October, 1990
9th Asia/Pacific Rehabilitation International Conference, Beijing, China.
Information: J. Morrison, RADAR, 25 Mortimer St., London W1N 8AB, UK.

29-31 October, 1990
Functional Electrical Stimulation; Practical Aspects for Clinicians, Glasgow, Scotland.
Information: Dr. C. A. Kirkwood, Bioengineering Unit, Wolfson Centre, 106 Rottenrow, University of Strathclyde, Glasgow G4 0NW, Scotland.

1-4 November, 1990
12th IEEE Engineering in Medicine Annual International Conference, Philadelphia, USA.
Information: B. Onaral, Biomedical Engineering and Science Institute, Drexel University, Philadelphia, USA.

5-8 November, 1990
European Conference on the Advancement of Rehabilitation Technology, Maastricht, The Netherlands.
Information: ECART, Congress Organization Services, Van Namen and Westerlaken, PO Box 1558, 6501 BN Nijmegen, The Netherlands.

9-11 November, 1990
Rehab '90 Conference and Exhibition, Minneapolis, USA.
Information: Rehab '90, National Rehabilitation Association, 633 S. Washington St., Alexandria, VA 22314-4193, USA.

15-16 November, 1990
14th Annual Meeting of the American Society of Biomechanics, Miami, USA.
Information: Dr. T. Khalil, Dept. of Industrial Engineering, University of Miami, Coral Gables, Florida 33124, USA.

17-18 November, 1990
9th Southern Biomedical Engineering Conference, Miami, USA.
Information: Dr. Gautam Ray, Mechanical Engineering Dept., Florida International University, University Park, Miami, Florida 33199, USA.

19-22 November, 1990
2nd North Sea Conference on Biomedical Engineering, Antwerp, Belgium.
Information: Luk Pauwels, Technologisch Instituut-KVIV, Desguinlei 214,2018 Antwerpen, Belgium.

5-7 December, 1990
6th East Coast Clinical Gait Conference, Michigan, USA.
Information: R. W. Soutas-Little, College of Osteopathic Medicine, Dept. of Biomechanics, Michigan State University, East Lansing, MI 48824, USA.

6-8 December, 1990
6th International Conference on Biomedical Engineering, Singapore.
Information: Secretary, 6th Biomed. Conference 1990, Dept. of Orthopaedic Surgery, National University Hospital, 5 Lower Kent Ridge Rd., Singapore 0511, Republic of Singapore.

1991

31 January-3 February, 1991
Combined Sections Meeting of the American Physical Therapy Association, Anaheim, USA.
Information: Information Dept., APTA, 1111 N. Fairfax St., Alexandria, Virginia 22314, USA.

17-20 February, 1991
1st European Conference on Biomedical Engineering, Nice, France.
Information: SEPFI, 8 Rue de la Michodiere, F-75002 Paris, France.

19-24 March, 1991
AOPA Annual Meeting and Scientific Symposium, San Diego, USA.
Information: AOPA, 717 Pendleton St., Alexandria, Virginia 22314, USA.

8-10 April, 1991
American Spinal Injuries Association Annual Meeting, Seattle, USA.
Information: Lesley M. Hudson, 2020 Peachtree Rd. NW, Atlanta GA 30309, USA.

10-12 April, 1991
ISPO (UK) Annual Scientific Meeting in Collaboration with ISPO (Netherlands), Norwich, UK.
Information: Brendan McHugh, NCTEPO, University of Strathclyde, Curran Building, 131 St. James' Road, Glasgow G4 0LS, Scotland.

14-17 April, 1991
11th Annual Scientific Meeting of the Australian College of Rehabilitation Medicine, Perth, Australia.
Information: Mrs. A. Worden, Australian College of Rehabilitation Medicine, 55 Charles St., Ryde, N.S.W. 2112, Australia.

5-9 May, 1991
4th International Pre-Prosthetic Surgery Conference, Adelaide, Australia.
Information: Multinational Meetings Information Service BV, J. W. Brouwersplein 27, PO Box 5090, 1007 Amsterdam, Netherlands.

8-12 May, 1991
Orthopaedic and Rehabilitation Technology Trade Fair and Congress, Berlin, Germany.
Information: AMK Berlin Ausstellungs-Messe-Kongress-GmbH, Messedamm 22, D-1000 Berlin 19, Germany.

3-6 June, 1991
American Orthopaedic Association Annual Meeting, Palm Beach, USA.
Information: AOA, 222 S. Prospect Ave., Park Ridge, IL 60068, USA.

22-26 June, 1991
14th Annual RESNA Conference, Kansas City, USA.
Information: Susan Leone, RESNA, 1101 Connecticut Ave. NW, Suite 700, Washington DC 20036, USA.

23-27 June, 1991
Annual Conference of the American Physical Therapy Association, Boston, USA.
Information: Information Dept., APTA, 1111 N. Fairfax St., Alexandria, Virginia 22314, USA.

7-12 July, 1991
16th International Conference on Medical and Biological Engineering, Kyoto, Japan.
Information: Dr. O. Z. Roy, IFMBE, c/o National Research Council of Canada, Room 164, Bldg. M50, Ottawa, Ontario, K1A OR8, Canada.

28 July-2 August, 1991
11th Congress of the World Confederation for Physical Therapy, London, England.
Information: Secretariat, WCPT, Conference Associates, 27A Medway St., London SW1P 2BD, England.

5-7 August, 1991
4th European Congress on Research in Rehabilitation, Ljubljana, Yugoslavia.
Information: Cŕt Marinček, University Rehabilitation Institute, Linhartova 51, 61000 Ljubljana, Yugoslavia.

7-11 August, 1991
Southern Orthopaedic Association Meeting, Colorado Springs, USA.
Information: SOA, 222 S. Prospect Ave., Park Ridge, IL 60068, USA.

6-8 September, 1991
2nd Scientific Meeting of the Scandinavian Medical Society of Paraplegia, Copenhagen, Denmark.
Information: Centre for Spinal Cord Injured, Rigshospitalet, TH2002, Blegdamsvej 9, DK-2100 Copenhagen, Denmark.

16-20 September, 1991
Dundee '91-International Conference and Instructional Course on Orthotics, Dundee, Scotland.
Information: Dundee '91 Secretariat, c/o Dundee Limb Fitting Centre, 133 Queen St., Broughty Ferry, Dundee, Scotland.

Prosthetics and Orthotics International, 1990, 14, 92–94

Seventh World Congress

28 June–3 July, 1992, Chicago, Illinois, USA

An Invitation

We, of the USA Member Society, cordially invite you to Chicago for the **Seventh World Congress of the International Society for Prosthetics and Orthotics** (ISPO). We are pleased that ISPO has selected North America for the Seventh World Congress and look forward to your attendance and participation.

The theme of the 1992 Congress is, **"Find the New World of Prosthetics and Orthotics Developing Around the Globe."** This theme acknowledges the past and the 500th anniversary of Columbus' voyage to the Americas, but more importantly it directs us to the future and to the new world of prosthetics and orthotics that people are developing around the globe. These people will be coming to Chicago to share their new knowledge, new developments, and new visions. We hope you will join them.

Chicago is a major medical centre of the USA, with strong traditions in rehabilitation and orthopaedics, and with well-known educational, clinical, and research programmes in prosthetics, orthotics, and rehabilitation engineering. Chicago is a vigorous and enjoyable city – a city of working people from all over the globe. We think you will enjoy the culture, beauty, diversity, and friendliness of this midwestern city by Lake Michigan. The Illini Indians called this place "Che-ca-gou" for the "wild onions" that grew along the river where it entered the lake. The first Europeans, Pere Jacques Marquette and Louis Joliet, arrived in 1673 and used Chicago as a portage at this continental divide of waterways. The city remains a transportation centre. It is accessible and waiting for you. Mark your calendars and plan a new voyage to find a new world of prosthetics and orthotics.

Dudley S. Childress, Ph.D.
General Secretary, Seventh World Congress

Maurice LeBlanc, M.E., C.P.
Chairman, US National Member Society of ISPO

Programme

The ISPO Seventh World Congress will consist of scientific, technical, clinical, and surgical papers; plenary sessions; instructional courses; scientific and commercial exhibits; poster sessions; a video and film programme; and technical tours. The Rehabilitation Institute of Chicago, near the site of the Congress, will host an "open house" where participants can also visit Northwestern University's Prosthetic-Orthotic Education Programme, the Prosthetics Research Laboratory, and the Rehabilitation Engineering Centre in Prosthetics and Orthotics.

A social programme and accompanying persons programme is planned so that you will find it easy to experience Chicago's outstanding architecture, parks, boat cruises, swimming and beaches. Plan to take part in the Independence Day celebration with a concert and fireworks on the evening of July 3 and with festivities on the 4th of July. Extend your stay with post-conference tours to the Grand Canyon, Canadian Rockies, or cities such as Washington, D.C.; San Francisco; or New Orleans. Chicago has direct flights to most points in North America.

Topics

Amputation & Surgical Procedures ⋆ Biomechanics: Modeling of Human Movement, Tissue ⋆ Consumer Viewpoints ⋆ CAD/CAM ⋆ Education ⋆ Footwear & Foot Problems ⋆ Management of Children ⋆ Orthotic Management of Fracture ⋆ Gait Analysis: Clinical, Research, Instrumentation ⋆ Historical & Cultural Issues ⋆ Locomotion Aids such as FES, Crutches, and others ⋆ Lower and Upper Limb Orthotics/Prosthetics ⋆ Materials ⋆ Patient Management ⋆ Recreation ⋆ Rehabilitation in Developing Areas ⋆ Seating, Positioning, & Wheelchairs ⋆ Spine Management & Spinal Orthotics ⋆ Testing & Standards ⋆ Physical/Occupational Therapy

General Information

Dates: 28 June–3 July, 1992

Location: Hyatt Regency Chicago Hotel
151 East Wacker Drive
Chicago, IL 60611 USA

Located in one of the USA's largest urban developments, the *Illinois Center,* the Hyatt is on the south bank of the Chicago River near the Michigan Avenue bridge. It is near the heart of the city, within easy walking distance of the Loop, North Michigan Avenue, Grant Park, and Lake Michigan; and close to many museums, shopping areas, restaurants, points of interest, and public transportation. The Hyatt Regency is accessible

to persons with disabilities. High temperatures in Chicago during late June and early July average 28°C (83°F). However, the continental weather is highly variable and deviations of ±10°C (±18°F) from the norm are not uncommon.

Official Language: English.

Letter of Invitation: An official letter of invitation will be sent upon request. The invitation does not obligate the Organizing Committee to assume any financial burden for costs of attending the Congress.

Housing: A block of rooms has been reserved at the Hyatt Regency Chicago Hotel at attractive conference rates. Hotel reservation forms will be included with the Congress' Second Announcement.

Congress Airlines and Travel Bureau: American Airlines has been selected as the official airlines of the Seventh World Congress. Participating co-carriers include Midway Airlines, British Airlines, and Trans World Airways. Discount travel rates are available. Reservation information will be available with the Second Announcement.

Carlson Travel Network is the travel agency for the Congress and will be organizing post conference tours. Reservation information for these tours will be available with the Second Announcement.

For more travel information, call 1-(800) 331-8132 (outside Illinois, USA) or (312) 372-3313 (within Illinois, USA). This number is available from 8.30 to 17.00 hours Monday through Friday, USA Central Standard time.

Visa and Travel Regulations: Persons planning to attend the Congress from countries other than the USA should determine from the US Consulate in their country whether a visa is required in addition to a valid passport for US entry. If a visa is required, your Congress confirmation/receipt should be taken to the US Consulate office as evidence of your intention to attend the Congress. Immunizations are not required by the US Public Health Service.

Second Announcement: The second Congress Announcement, to be mailed in 1991, will include a pre-registration form, hotel reservation form, abstract/exhibit/presentation submission forms, travel information, and a preliminary programme for the Congress. To receive the second announcement and other Congress mailings, fill out the reply card, detach, and mail.

Reply Form

International Society for Prosthetics and Orthotics
VII World Congress
June 28 to July 3, 1992
Chicago, Illinois, USA

Please print

Name in **Full** (*Prof., Dr., Mr., Mrs., Ms.*) _____

Title and **Affiliation** _____

Mailing **Address** _____

City _____

State or **Province** _____ **Postal Code** _____

Country _____

Telephone _____

Fax _____

Are you planning

To submit a Paper? Yes ___ No ___

To present **Audiovisual** material? Yes ___ No ___

A **commercial Exhibit?** Yes ___ No ___

A **scientific Exhibit?** Yes ___ No ___

To bring an **accompanying person?** Yes ___ No ___

Post-conference **travel?** Yes ___ No ___

Please list below any individuals whom you feel should be on our mailing list:

Congress Secretariat: Moorevents, Incorporated is acting as the Congress Secretariat. Should you have any questions or need additional information, please contact:

Moorevents, Inc.
400 North Michigan Avenue
Suite 2300
Chicago, IL 60611 USA
Phone (312) 644-5997
Fax (312) 644-7591

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Seventh World Congress of ISPO
Moorevents, Inc.,
400 North Michigan Avenue,
Suite 2300,
Chicago,
IL 60611,
USA

Prosthetics and Orthotics International, 1990, 14, 95–96

ISPO Course on
Lower Limb Amputations and Related Prosthetics

18-21 May, 1991
Port el Kantaoui, Tunisia

Introduction

ISPO has organised an International Consensus Conference on Apmutation Surgery of the Lower and Upper Limbs to be held in the University of Strathclyde, Glasgow, Scotland in October 1990.

This Conference will examine literature on Amputation Surgery with a view to identifying the best practice in Amputation Surgery and Level Selection. Subsequent regional courses are being arranged to disseminate the conclusions of this conference.

The first up-date course will be held in Tunisia in May 1991 and will be concerned with lower limb amputations and related prosthetics. Methods of level selection, operative techniques and stump management will be considered together with appropriate prosthetic technology. Reviews of the results of clinical rehabilitation will be presented and discussed in relation to contemporary technological development. Further courses are planned for USA, Thailand and Yugoslavia.

The format of the Course will be review lectures, based on the presentations and conclusions of the Consensus Conference. Ample time will be allocated for discussion and a limited time will be devoted to free papers by the participants. This Course is aimed at surgeons and other interested medical and paramedical professionals.

Venue

Kanta Hotel in Port el Kantaoui, situated about 15 km north of Sousse, Tunisia, and about 40 km from Monastir International Airport.

Course Fee

Covers lectures and consensus materials and will be 3,100 DKK due by March 1, 1991 or 3,800 DKK after that date for ISPO-members and 3,800 DKK or 4,500 DKK respectively for non-members. Refunds will be available until April 15, 1991, with a retention of 800 DKK for administrative costs.

Time

The course will last four days, 18-21 May, 1991. The programme will be of 26 hours duration, arranged in morning sessions from 08.00-12.00 hrs. and evening sessions from 17.00-19.30 hrs.

(continued over)

Reply Form

Lower Limb Amputations and Related Prosthetics
18-21 May, 1991 – Tunisia

Full Name _____
Title _____
Affiliation _____
Address _____

_____

_____

Telephone _____ Fax _____

☐ I enclose an abstract for the Seminar with this form.
☐ I will submit an abstract by 18th February, 1990.
☐ I would be grateful to receive further information.
☐ I would like to book a package tour and enclose DK 400 deposit.

Registration Form

Can be received by mailing the tear-off slip to: ISPO, Borgervænget 5, DK-2100 Copenhagen Denmark. Payment will be due together with returned registration form by a bank-draft in DKK-currency, made payable to ISPO, or copy of post-office Giro draft, made payable to International Society for Prosthetics and Orthotics, Borgervænget 5, 2100 Copenhagen ø, Denmark, Account No 1 61 93 30. Personal cheques are not accepted. The number of participants is limited and will be served on a first come basis.

Free Papers

There will be a limited space in the programme for free papers by the participants. Papers should be concerned with new findings or techniques that have not been presented elsewhere. Abstracts should be submitted by 1st February, 1990 and should be of no more than one A4 page and of a quality ready to print. It should be written in English and the text should be single spaced.

Description of Resort

Port el Kantaoui is a Tunisian and European leisure and holiday resort built around a marina with hotels (Hannibal Palace, Kanta, Kanta Residence, Marhaba Palace and Green Park) and holiday apartments (Maisons de la Mer) with tennis courts, large swimming pools (also indoors) and fitness centres, all situated within walking range of the marina and a 27-hole international golf-course. The average temperature is about 22°C in mid-May.

Pricing in Port el Kantaoui is reasonable. Local tram-service to Sousse 2TND round-trip, main dinner-course about 7TND, wine about 6TND. Daily allowance for Danish civil servants is 35TND.

Accommodation and Transport

Can be arranged through ordinary vacation tour programmes such as: Austria: *Touropa*; Belgium/Luxemburg: *SUN, DAR*; Denmark: *Spies, Tjæreborg*; France: *Chorus, Fram*; Germany: *Airconti, ATT, Neckermann, NUR, Orion Interconti, TUI*; Switzerland: *Kuoni*; Netherlands: *Aquasun, Arke*; Norway: *Saga*; Sweden: *Always, Atlas, Ving*; U.K.: *Enterprise, Intasun, Panorama.*

Furthermore ISPO has arranged with Spies, Rejser, Denmark a package tour out of Copenhagen from Friday May 17 to Friday May 24, 1991 including flight and accommodation in apartments at Kanta Residence at a price of 2,445 DKK in double room and 2,945 DKK in single occupancy. Bookings for this package must be made through the ISPO Secretariat for this special arrangement not later than March 1, 1991 by using the enclosed form, which should be mailed together with a deposit of 400 DKK.

Course Organisers

Professor Emeritus George Murdoch, Dundee, Scotland, U.K.
Dr. J. Steen Jensen, Copenhagen, Denmark.
Dr. H.C. Thyregod, Vejle, Denmark.

This form should be posted on completion, to:

ISPO,

Borgervænget 5,

2100 Copenhagen ø,

DENMARK

Call for Papers
ISPO Scientific Seminar on Clinical Biomechanics of Foot and Shoe — June 10 – 13, 1991

University College of Health and Care, Jönköping, Sweden

Invitation
Dear Colleagues,
This call for papers is sent to interested people within the field. You are invited to participate with a paper in the seminar.

Kurt Öberg and Tommy Öberg
For the Organising Committee

Aim of the Seminar
The aim of this seminar is to highlight the latest development and research within the field of Clinical Foot and Shoe Biomechanics. The seminar is subdivided in the following topics:

- Foot and Shoe Science Methodology and Theory
- Foot Instability and Dysfunction
- The Painful Foot
- The Insensitive Foot
- Sport Shoe Science
- The Foot and Shoe in Working Life

Call for Papers
Papers should be concerned with new findings or techniques, that have not been reported elsewhere. The abstract should be of no more than one A4 page and of a quality ready to print. It should be written in English. The text should be single spaced. Use 1 and ½ line space between the title, author and text lines.

Abstracts are to reach the secretariat before Dec 1, 1990.

Language of the Seminar
Speeches, abstracts and final papers should be in English. There will be no simultaneous translations during the seminar.

Preliminary Fees
- Seminar fee $325

Hotel reservation:
- single room $110 per night
- double room $130 per night

Final debit is made later by an invoice from the secretariat.

Organising Committee

Acke Jemberger	Tommy Öberg
Bo Klasson	Gert Walhelm
Kurt Öberg	

REGISTRATION FORM

Full Name: _____

Title: _____

University/Organisation: _____

_____

Address: _____

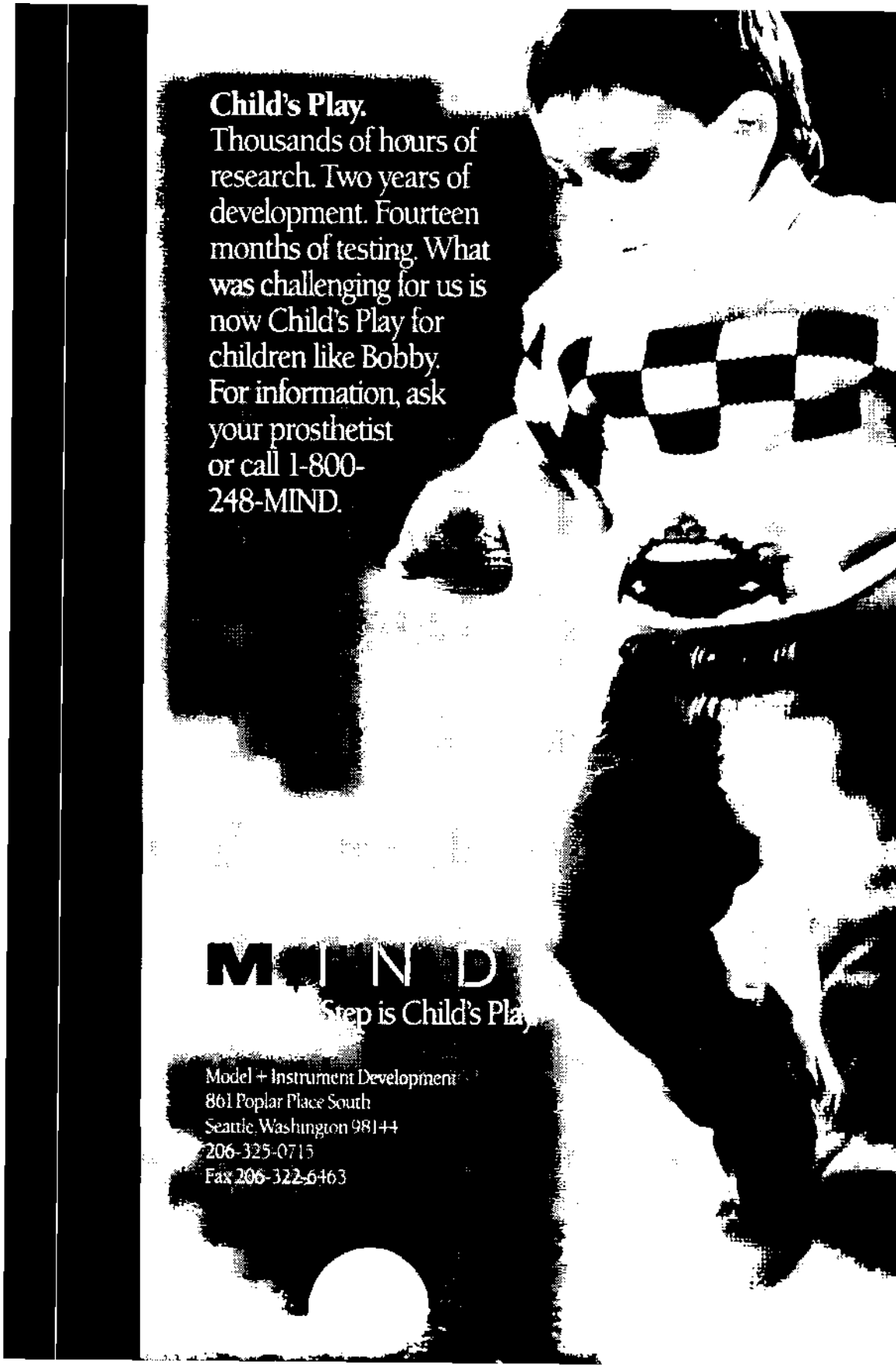
_____

Telephone: _____ Fax: _____

☐ I enclose an abstract for the seminar with this registration form.
☐ I will submit an abstract for the seminar later.

Further information concerning the seminar, such as hotel reservation, complete program, social program etc will be distributed later.

This register form should be sent to: **Secretariat of ISPO Scientific Seminar,** Attn: Ulla-Britt Johansson, Dept of Biomechanics and Orthopedic Technology, University College of Health and Care, P.O. Box 1038, S-551 11 Jönköping, Sweden, Tel. +46 36 10 47 53 Fax. +46 36 10 47 62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