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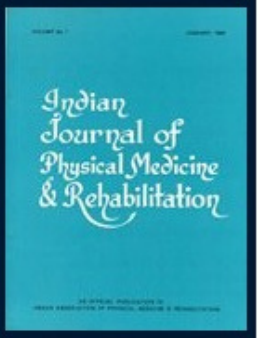
**Contents**



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Dr AK Agarwal

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# Editor's Page

The Annual Conference of Indian Association of Physical Medicine and Rehabilitation held at Coimbatore was remarkable in the sense that the association decided to have its official publication. From 1972, the year of birth of IAPMR to 1986, the association has crossed the era of childhood and is going into its youth. Every year a handful of members meet and exchange their notes and plans for the next year. Times come and go, but only unforgettable memories remain which haunt everybody. Well it was not too long an innings, for our elders who had a real difficult time but in their praiseworthy efforts to keep the candle burning, there was a message of perseverence for the younger generation.

Inspite of all the odds, the association has made the beginning not only in the field of Disabled welfare but in the field of academics as well. Thanks to the efforts made by our respectable elders, Medical Council of India recognised the need of the time and gave a directive to create a chair for Physical Medicine and Rehabilitation in all the Medical Colleges.

Further with their efforts the National Board of Examination has already started Diplomat in Physical Medicine and Rehabilitation. Not only this, Government of India has started Pilot projects in Rural Rehabilitation at Bombay, Madras, Lucknow and Cuttack. There is over all progress in recent years in the field of Physical Medicine. But we have to accelerate the pace of work, we have to add professionalism in our speciality and we have to come up to the expectations of the common disabled. This needs community participation in our endeavour so that the vast majority of the disabled living in remote places, can have the fruits of our labour. For achieving Health for all by 2000 A.D., the Association has envisaged the above, in its aims and objectives.

Lastly I feel proud to have constant encouragement and guidance from our Director Dr. (Miss) S. Varma in preparation of this issue. There are bound to be mistakes and shortcomings but we assure you Sir, with your continuous love, affection and interest it will come up to your expectations. Again we look forward to your constructive suggestions and thoughts.

**A. K. Agarwal**

# Comparative Study of Traumatic Paraplegia Institutional Versus Community Level Rehabilitation

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**The existing rehabilitation facilities for traumatic paraplegia is purely institutional. There is no rehabilitation facility in community which can effectively implement the institutional training in the community. This paper is a preliminary effort in highlighting the factors responsible for failure of institutional rehabilitation, when practised in community.**

This study was conducted in the Department of Rehabilitation, Safdarjung Hospital, New Delhi. Only those cases of traumatic paraplegia, who were rehabilitated fully were included. In planning of rehabilitation programme, due consideration was given to needs and requirements of patient in their community. Assessment of architectural barriers and methods of overcoming them were also done. They were sent back to their community after excellent to good achievement of physical and vocational rehabilitation. Rehabilitation aids, wherever indicated were provided from the institution. During implementation of rehabilitation programme, expert service of physiatrists, physio-therapist, occupational-therapist, clinical psychologist, orthotist, medico-social worker and vocational counsellor were used.

These patients were followed up with the help of pre-tested questionnaire after 1-2 years. Only those patients, who responded to questionnaires were included in this study. The results were assessed in terms of community level usefulness of physical and vocational rehabilitation as per determinants shown in Table 1. On the basis of total score, the final results were calculated, Table 2.

**Table 1**

| *Determinants* | *Score* |
|---|---|
| A. PHYSICAL REHABILITATION | |
| 1. *Subjective opinion* | |
| – Fully or satisfactorily useful | 2 |
| – Useful at times | 1 |
| – Not useful | 0 |
| 2. *Activities of Daily Living (ADL)* | |
| – Full independence | 2 |
| – Partial independence | 1 |
| – Full dependence | 0 |
| 3. *Ambulation* | |
| – Complete independence | 2 |
| – Assisted ambulation | 1 |
| – Not ambulatory | 0 |
| 4. *Indoor ambulation aids* | |
| – Using | 2 |
| – Sometimes using | 1 |
| – Not using | 0 |
| 5. *Outdoor ambulation aids* | |
| – Using | 2 |
| – Sometimes using | 1 |
| – Not using | 0 |
| B. VOCATIONAL REHABILITATION | |
| – Fully useful | 10 |
| – Partially useful | 9-1 |
| – Not useful | 0 |

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Paper Selected for ALIMCO award, 1982.

**Table 2. Grading of final results according to total score**

| Grades | Percentage |
|---|---|
| Excellent | 75+—100 |
| Good | 50+— 75 |
| Fair | 25+— 50 |
| Poor | 0 — 25 |

## OBSERVATIONS AND DISCUSSION

Only 48 patients responded to the questionnaire. 30 patients were male and 18 were female. Maximum number of cases were in the age group of 24-40 years (36 patients) and 10 patients were less than 20 years of age. Rural patients (36 cases) predominated with a rural-urban ratio of 3 : 1. Most of the patients had institutional care for 2-4 months (44 cases) except 4 cases, who were in hospital for lesser period. Forty-six patients were given ambulation aids as shown in Table No. 3. Two patients did not require any aids. All the patients were discharged from institution with excellent, or good results.

**Table 3. Type of rehabilitation aid**

| Name of rehabilitation aid | Male | Female | Total |
|---|---|---|---|
| Crutches | 6 | — | 6 |
| Calipers + crutches | 8 | 6 | 14 |
| Calipers + crutches & tricycle | 8 | 2 | 10 |
| Wheel chair | — | 4 | 4 |
| Caliper, crutches & wheel chair | 2 | 2 | 4 |
| *Tricycle | 6 | — | 6 |
| Trolley | — | 2 | 2 |
| Total | 30 | 16 | 46 |

*Only tricycle was given to those cases where no rehabilitation aid for indoor activities was possible due to architectural barriers.

During follow-up *Subjective opinion* of patients revealed that institutional rehabilitation was (1) fully or satisfactorily useful in 26 patients (2) useful at times in 10 patients and (3) not useful in 12 patients (Table 4). Last two categories of useful at times and not useful showed deterioration of institutional rehabilitation in community level achievement.

**Table 4. Subjective opinion on community level utility of institutional rehabilitation**

| Utility | Male | Female | Total |
|---|---|---|---|
| Fully useful | 10 | 4 | 14 |
| Satisfactorily useful | 6 | 6 | 12 |
| Useful at times | 6 | 4 | 10 |
| Not useful | 8 | 4 | 12 |
| Total | 30 | 18 | 48 |

A.D.L. assessment revealed that 20 patients retained full independence in A.D.L. while 16 patients could retain only partial independence in A.D.L. in their community, and 12 patients became completely dependent in A.D.L, when they went back to community (Table 5).

**Table 5. Activities of daily living (ADL) (at community)**

| A.D.L. | No rehabilitation aid | Crutches | Calipers & crutches | Tricycle, caliper & crutches | Wheel chair | Wheel chair, calipers & crutches | Tricycle | Trolley | Total |
|---|---|---|---|---|---|---|---|---|---|
| Fully independence | 2 | 6 | 4 | 4 | 2 | — | — | 2 | 20 |
| Partial independence | — | — | 6 | 4 | — | 4 | 2 | — | 16 |
| Dependent | — | — | 4 | 2 | 2 | — | 4 | — | 12 |
| Total | 2 | 6 | 14 | 10 | 4 | 4 | 6 | 2 | 48 |

*The community level achievement of the institutional rehabilitation deteriorated in patients with partial independence and full dependence.*

This can be further improved by better understanding of the A.D.L of patients individually in the institution.

*Ambulation :* Only 30 patients retained complete independence in ambulation in the community—of which 28 were using ambulation-aids and 12 were not using them. Rest of the patients, either had to take the assistance of one person, or did not find ambulation aids helpful in their community (Table 6). They rejected them and fulfilled their ambulatory requirement by crawling and lifting by others. *The community level achievement deteriorated in patients, who needed assistance for ambulation and those who did not use rehabilitation aids*— which can be minimized by assessment of a right type of aid and adequate training.

**Table 6. Ambulation (at home)**

| Level | No. of cases |
|---|---|
| Independent with or without ambulation aid | 30 |
| Dependent with ambulation aid | 6 |
| Not using ambulation aid | 12 |
| Total | 48 |

*Ambulation aids :* On analysis of ambulation aids for indoor activities and outdoor activities, it was observed that out of 46 patients, who were given ambulation aids only 32 patients were using them for indoor activities and 28 patients were using them for outdoor activities in their community. 14 and 18 patients rejected the ambulation aids for indoor and outdoor activities respectively because they found it unsuitable to their needs (Table 7, 8).

*These cases again reflect the community level deterioration of institutional rehabilitation.*

Proper prescription of ambulation aids, with right modification can increase their usefulness in community.

It was further observed that rejection of ambulation aids for indoor activities was not seen in patients, who were given crutches, trolley and wheel chair, caliper and crutches. It was seen only in 6 out of 22 patients, who were

**Table 7. Use of ambulation aids for indoor activities**

| | Crutches | Caliper & crutches | Tricycle, caliper & crutches | Wheel chair | Wheel chair, calipers & crutches | Tricycle | Trolley | Total |
|---|---|---|---|---|---|---|---|---|
| Yes | 6 | 10 | 8 | 2 | 4 | — | 2 | 32 |
| No | — | 4 | 2 | 2 | — | 6 | — | 14 |
| Total | 6 | 14 | 10 | 4 | 4 | 6 | 2 | 46 |

**Table 8. Use of Ambulation aids for outdoor activities (in the community)**

| | Crutches | Caliper & crutches | Tricycle, caliper & crutches | Wheel chair | Wheel chair, caliper & crutches | Tricycle | Trolley | Total |
|---|---|---|---|---|---|---|---|---|
| Yes | 6 | 8 | 6 | — | 2 | 4 | 2 | 28 |
| No | — | 6 | 4 | 4 | 2 | 2 | — | 18 |
| Total | 6 | 14 | 10 | 4 | 4 | 6 | 2 | 46 |

given caliper and crutches for indoor activities. Maximum rejection was seen in those cases who were given either wheel chair or tricycle (Table 7). *So, it was observed that whenever advisable for indoor activities, crutches and trolley were best, caliper and crutches were satisfactory and single appliance like wheel chair and tricycle were quite unsatisfactory.*

The rejection of ambulation aid for outdoor activities was not found at all in patients on crutches and trolley. So it was observed that wherever indicated crutches and trolley were most acceptable, caliper and crutches were satisfactory, while wheel chair showed very poor utility for outdoor activities (Table 8). The reasons for rejection of ambulation aids were architectural barrier and deterioration of general condition of patient.

On analysing the repair of these ambulation aids, it was observed that out of 88 ambulation aids, only 24 required repair of minor wear and tear during 1-2 years of follow-up period, 14 by local artisan and 10 by patients themselves. None of the ambulation aid require services of rehabilitation workshop for repair (Table 9). This clearly shows that enough skill is available in the community for dealing with problem of minor wear and tear.

*Vocational Achievement :* It was found that level of vocational rehabilitation achieved in the institution was retained to some extent in community only in 8 patients, while 12 patients found it useless in their community. 28 patients used the vocational training in community but could not get sufficient monetary return (Table 10). *Community level achievement deteriorated in 40 patients.*

On analysing the above determinants of community level achievements of institutional rehabilitation, it was considered that vocational independence could be taken as the final guiding factor. On this ground, only 8 patients could retain the full rehabilitation status. (Table 10).

**Table 10. Institutional versus community level achievement**

| Achievement | Institutional achievement | Community level achievement |
|---|---|---|
| Full rehabilitation | 48 | 8 |
| Partial Rehabilitation | — | 28 |
| Rehabilitation failure | — | 12 |
| Total | 48 | 48 |

The results were analysed on the basis of score chart given in methodology. The total score of 48 cases is 960. On the basis of above scoring, those patients who maintained their institutional rehabilitation achievement in community could score only 360 (fair), while those patients whose institutional rehabilitation achievement deteriorated, scored only 172 (poor) marks. Thus the overall achievement in

**Table 9. Repair of rehabilitation aids (in the community)**

| Place | Crutches | Calipers | Wheel chair | Tricycle | Trolley | Total |
|---|---|---|---|---|---|---|
| No Repair | 26 | 20 | 6 | 10 | 2 | 64 |
| Self Repair | 4 | 4 | 2 | — | — | 10 |
| Local Artisan | 4 | 4 | — | 6 | — | 14 |
| Rehab. Units | — | — | — | — | — | — |
| Total | 34 | 28 | 8 | 16 | 2 | 88 |

both the groups can be ranged from fair to poor only. On one hand, it will imply that there is some use of institutional rehabilitation in community, on the other hand, it also indicates that there is substantial deterioration in institutionally rehabilitated cases from excellent to fair when practised in community. This strongly points towards developing proper community level rehabilitation services, which can utilise the maximum from institutional training.

## CONCLUSION

This study shows that the rate of failure of institutional rehabilitation of paraplegics in the community is quite high.

Therefore community oriented planning for their rehabilitation programme is the only alternative. Thus rural approach to the present methods of institutional rehabilitation for paraplegic is a must in order to overcome the high rate of failure.

# The Sublimis Opponensplasty for Median Nerve Paralysed Thumb in Hansen's Disease

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**The ubiquitous sublimis tendon had been transferred for loss of opposition of the thumb in one hundred and forty-five hands of one hundred and twenty-two Hansen's Disease patients with median nerve paralysis, between 1972 and 1981 at the Christian Medical College Hospital, Vellore. Restoration of opposition was good in 70.3% and fair in 20.68% of hands. Terminal interphalangeal joint flexion of the thumb was encountered in 18% of the cases as a late feature even in presence of good abduction and internal rotation. As an end stage in itself or in combination with claw finger correction, the procedure greatly contributes to the overall rehabilitative effort so very essential in these patients.**

The distal median nerve paralysis commonly seen with proximal or distal ulnar nerve paralysis in Hansen's Disease produces a total claw hand deformity. The thumb is adducted and supinated and constitutes one of several primary deformities that can be encountered in these patients.

A patient with a purely ulnar claw hand may develop new habit patterns that may help him to partly overcome his disablement; but when there is an associated loss of opposition of thumb no amount of substitution patterns in movement can adequately compensate for the amount of functional loss acquired. It is essential that this deformity be corrected early to minimise secondary deformities of ulceration, absorption and contracture that will further add to the misery.

Historically the sublimis as a motor for opponens replacement was first described by Krukenberg in 1921, who used the radial half of the middle finger sublimis. But it was Bunnell (1924) who, while describing the sublimis opponensplasty, emphasized and defined the role of the route and pulley for the success of this tendon transfer. Various other modifications (Thompson 1942, Riordan 1960 and Palazzi 1962) of routing and inserting the sublimis tendon followed thereafter. However, Brand (1966) introduced the concept of sublimis tendon transfer with dual insertion to achieve stabilization of the metacarpo-phalangeal joint, abduction and rotation of the first metacarpal and extension of the distal segment of the thumb.

At the Christian Medical College Hospital, Vellore, sublimis opponensplasty was routinely combined with claw finger reconstruction for claw hand deformity for the last three-and-a-half decades. The results of the sublimis opponensplasty adopting Brand's route and dual insertion are here analysed and presented.

## MATERIAL AND METHODS

During a period of ten years between 1972 and 1981, for two hundred and sixty eight hands, opponensplasty was performed at the Christian Medical College Hospital, Vellore. However, one hundred and forty five opponensplasties using the sublimis tendon had beens tudied since all the necessary details were

available for this number and all had a minimum of one year's follow-up after surgery. There were one hundred and twenty-two patients, of whom twenty three had bilateral opponensplasty. There were 102 males and 20 females. The average age of these patients was 30.8 years, the youngest patient being 12 years of age and the oldest 66 years old. Seventy-five of them had borderline type of leprosy, twenty-nine were of the Tuberculoid type and in eighteen patients it was Lepromatous. Records show that all of them were smear negative at the time of surgery and had received sufficient duration of anti-Hansen's Disease treatment before and were continuing their medical treatment. The flexor digitorum sublimis of the ring finger (F.D.S.R.) was used in one hundred and twenty-eight hands and the flexor digitorum sublimis of the middle finger (F.D.S.M.) was used in seventeen. Adjuvant procedures numbered one hundred and fifty-one and are enlisted in Table 1.

**Table 1. The adjuvant procedures performed with sublimis opponensplasty**

| *Claw finger correction* | | *Others* | |
|---|---|---|---|
| E. F. 4. T | 58 | Thumb web plasty (Brand) | 8 |
| E. E. 4. T | 13 | I. P. arthrodesis | 5 |
| P. L. 4. T | 3 | Dermis graft | 2 |
| *S. S. 4. T | 60 | | |
| Zancolli Capsulorraphy | 2 | | |

*S. S. 4. T :—Single sublimis four tails.

The procedure of opponensplasty that was followed is described:

The F.D.S.R. or F.D.S.M., is approached through a mid-lateral incision placed on the radial aspect of the respective P.I.P. joint region of the finger. The tendon is detached just proximal to its insertion. It is withdrawn 5 cms. proximal to the wrist crease. A tunneller is passed from a one cm. transverse incision made just distal and radial to the pisiform bone. Loose fat seen through this incision verifies the presence of the tunneller in the Guyon's canal which serves as the pulley. The tendon is tunnelled subcutaneously from here to an incision made midway between the base and head of the first metacarpal. Here, the tendon is split longitudinally into two. One slip is tunnelled dorsal to the M.C.P. joint to the region of the adductor pollicis insertion and the other slip to the E.P.L. tendon just proximal to the interphalangeal joint. With the wrist kept in about 30° flexion and thumb in maximum palmar abduction and pronation, the first slip is attached to the adductor pollicis insertion without tension but removing the slack. The second slip passing volar to the axis of the M.C.P. joint is attached to the E.P.L. tendon with tension adjustment of 2 to 4 mm pull on the slip before its attachment. Adjuvant procedures of claw hand correction, I.P. arthrodesis or thumb web plasty (Brand) wherever necessary was done as a routine.

## RESULTS

The results of sublimis opponensplasty was graded as good, fair or poor, depending upon the amount of abduction, opposition, M.P. joint and I.P. joint status and the type of pinch. A result was considered a failure if the tendon transfer failed to improve appearance or function. The earlier method of assessing these parameters in the department were somewhat different from what the author currently adopts and considers to be a functional assessment (Table 2). The post-operative assessment done on the day, the patient is discharged from hand physiotherapy and occupational therapy treatment is the first assessment. In this study, this assessment showed that 109 (75.17%), hands had good results. (Table 3). There were six poor results and three failures. The results were not much different between the first follow-up assessment done six months

**Table 2. Author's* criteria for assessing results in opponensplasty**

| | Good | Fair | Poor |
|---|---|---|---|
| I. Active abduction | >40° | 20°-40° | <20° |
| II. Excursion of thumb | Full | At least to middle finger | Only to index |
| III. Pronation of thumb | To ulnar side of all fingers | Radial side of fingers | Nil |
| IV. M. C. P. Joint | 30°-40° Flexion in pinch | 40°-60° Flexion during pinch | Stiff or > 60° |
| I. P. Joint | 0°-10° During pulp pinch | 10°-45° During pulp pinch | Above 45° Flexion during pinch |
| V. Power of radial tripod or key pinch | 40%-60% Of normal hand | <40% | Marginal increase or no difference |

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**Table 3. Results of sublimis opponensplasty in 145 hands**

| | Good | Fair | Poor | Failure |
|---|---|---|---|---|
| Post-operative assessment: | 109 (75.1%) | 27 (18.6%) | 6 (4.14%) | 3 (2.07%) |
| First follow-up: (between six months to one year after surgery) | 103 (71.03%) | 31 (21.37%) | 6 (4.14%) | 5 (3.45%) |
| Late follow-up: (periods after one year) | 102 (70.34%) | 30 (20.68%) | 8 (5.52%) | 5 (3.45%) |

to one year after the operation and the late follow-up done after this period. There were 102 (70.34%) hands that had a good result in the late follow-up period (Fig. 1, 2 and 3). Complications of infection at the insertion sites, tendon tethering, inadequate tension were the factors that contributed to poor and failed results in the post-operative period. Whereas,

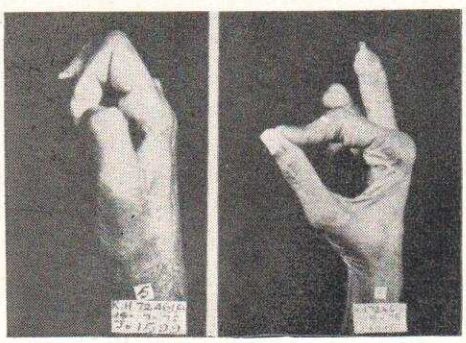

Fig. 1
Excellent result of sublimis opponensplasty after 3 years follow-up. Note good abduction and rotation with M.C.P. joint and I. P. joint stability.

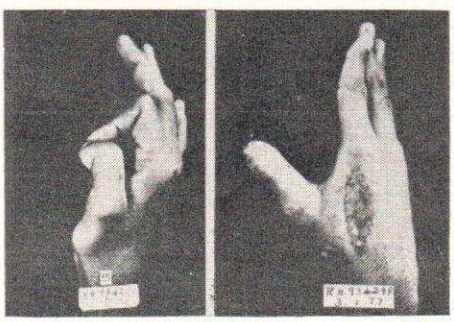

Fig. 2
Sublimis opponensplasty with Brand's thumb web release and skin grafting for opponens paralysis and thumb web contracture that never improved after adequate pre-operative hand physiotherapy.

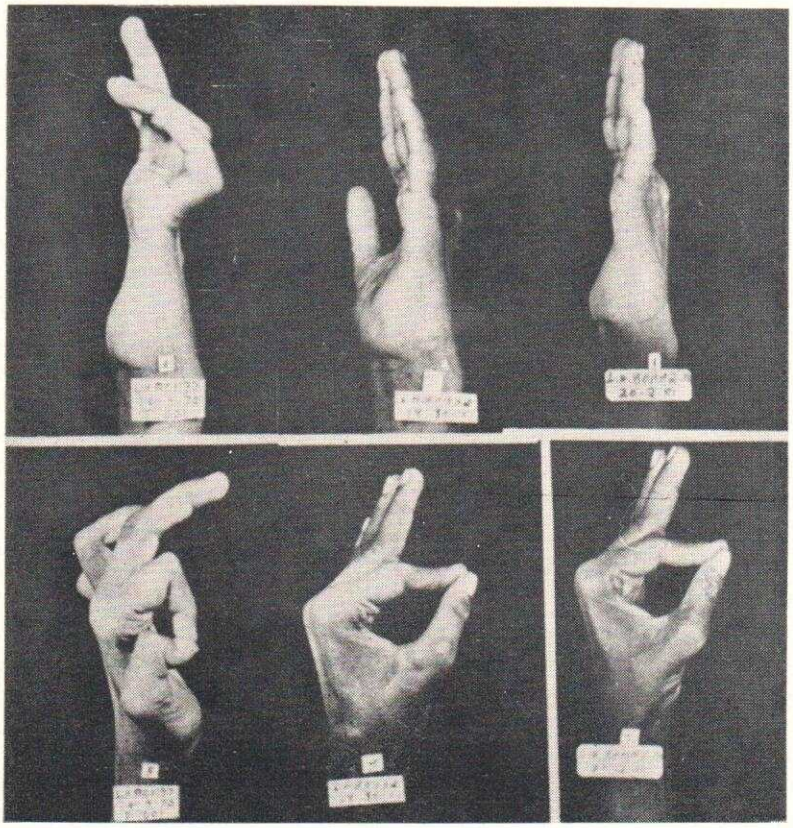

Fig. 3
Total claw hand deformity reconstruction. First column showing the claw fingers with loss of opposition of thumb. Second column showing results of sublimis opponensplasty combined with E. F. 4. T. Third column showing the same good results six years after surgery.

radial migration of the pulley, thumb web contracture not fully corrected earlier, M.C.P. joint instability and C.M.C. joint subluxation were the reasons for the poor results as seen in the late follow-up. No hand that was fair or poor showed any degree of improvement with time. No appreciable reduction in the length of the thumb, by way of absorption was seen in any of the hands with good results.

## DISCUSSION

In the thumb more than the fingers, function involves an orchestration of motor and sensory activities. Absence or defect in any of the instruments of this orchestra produces an imbalance or discord in the rest of the hand. We are fully aware of the fact that both, motor and sensory functions are lacking in the hands of Hansen's Disease patients with neural damage. It is only a matter of time before a paralysed thumb develops thumb web contracture, I.P. joint contracture, C.M.C. joint subluxation or neuropathic change along with the risk of secondary deformities if the primary deformity remains unattended to. The average

duration of deformity preceding surgery in this study was 3.8 years, which is too long a period to remain with the paralysed thumb, unless some form of dynamic abduction splint is provided along with care of the anaesthetic thumb and working aids to help these patients pursue some activities of daily living. Moreover, it was surprising to note that 62 patients (42.75%) had over five years duration of deformity before surgery. This figure truly betrays the kind of inadequate survey and assessment that is being done at the field level. No problems arise from the attitude of patients to accept surgical rehabilitation once they are aware of it. We know that motivation is the keynote for success in total rehabilitation. The earlier surgical rehabilitation is instituted, the easier will be the patient's integration into the family and society, and brighter will be his chances of pursuing gainful employment.

The number of hands that had sublimis opponensplasty without adjuvant procedures was only nine. This number is too small to be subjected to statistical analysis for comparing the results on these hands with the results on the hands that had sublimis opponensplasty with claw finger correction. No difficulty was however found in the post-surgical care and re-education of the hands with claw finger correction and opposition correction. This combination of procedures has been done as a routine in this institution for many years. Of course a certain degree of competence and imaginative supervised hand physiotherapy are required.

The terminal inter-phalangeal joint flexion deformity was seen in 18% of the cases. It only changed a type of pinch pattern that was not desired i.e. tip pinch. These thumbs still had good abduction and opposition.

The long duration of Hansen's Disease with the possibility of disablement setting in at any time, makes it imperative for those engaged in surgical rehabilitation to provide reconstructive measures as early as possible to these patients. The sublimis opponensplasty (Brand's technique) is one of the important ancillaries to rehabilitate Hansen's Disease patients with median nerve paralysis.

## ACKNOWLEDGEMENT

The author wishes to thank Dr. K. Vinodh, M.B.B.S., Non-P.G. Registrar in the Hand & Leprosy Reconstructive Surgery Unit for his assistance in the record work, Mr. Rajakumar Rhenius for his secretarial assistance and the Medical Illustration Department for the photographs.

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# Rehabilitation of Cancer Disable

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Rehabilitation has become a necessary part of comprehensive care for cancer patients, because of the extent and variety of their treatment related and disease related disabilities.

The majority of cancer patients are in their years of greatest productivity, family, social and community responsibility and therefore are a group of great importance. Rehabilitation of the cancer patient has offered a great challenge in direct ratio to the increasing number of cured and controlled patients. Nearly 40 percent of today's new cancer patients will have a cure and 60% with persistent, recurrent or metastatic cancer will have increased survival periods and 15% of this latter group will still be alive 15 years after the first diagnosis.

Since the time of survival is increasing due to improved methods of control of the disease, both cured and controlled patients have frequent need for rehabilitation to improve the quality of survival for each individual, so that they will be able to live as independent and productive life, as possible at minimum level of dependency, regardless of life expectancy.

The first step in provision of rehabilitation care is the prompt recognition of the presence of existing disability and ideally the recognition of potential disability. Initial examination and evaluation of the patient and the provision of the first orders for rehabilitation care can be made at the bed side without waiting to reach a status of readiness for being moved to a rehabilitation service department.

Rehabilitation therapy started early can eliminate development of periods of hopelessness, frustration and despair in cancer patients.

## BACK GROUND

Rehabilitation of disability resulting from cancer or its treatment has not been practised until recently. Cancer patients have not been considered eligible regardless of whether their condition was cured, controlled or advanced.

The diagnosis of cancer is associated with fear of the unknown and carries a stigma of dread and an out of proportion sense of finality. The diagnosis of other disease with lethal potential like coronary occlusion and stroke, is usually accepted with far less emotional reaction. Vast rehabilitation efforts are directed towards stroke and heart patients in comparison to cancer patients. This deep seated fear of cancer has prevented wide spread public understanding of the actual potential that exists for cure or long term survival and associated rehabilitation now possible.

Todays physicians are oriented towards acute disease, and consequently have little interest in disability or its rehabilitation. No cohesive interaction has been developed between various disciplines to assume a role in the comprehensive care of patients to ensure the quality of their survival.

Physicians must be aware of the need for rehabilitation and understand that a proper survival pattern for all patients can provide economic and human returns from the investment in rehabilitation efforts.

## MEANING OF REHABILITATION

Rehabilitation involves treatment and training of the patient to the end that he may attain

his maximal potential for normal living physically, psychologically, socially and vocationally.

There are wide varieties of specific disability found in cancer patients. The problems may be regional related to the site of the disease, or generalized. Brain, spinal cord, or peripheral nerve involvement may cause muscular weakness, sensory loss or paralysis, and require specific care. Peripheral nerve involvement requires splinting or support for wrist or foot drop. Patients who may have developed hemiplegia and paraplegia need a standard care programme. Head and neck surgery frequently produce cosmetic problems. Mastectomy may be emotionally depleting and leave physical deficit. The patients undergoing thoracic surgery, need training and assistance in postoperative respiratory functions. Patients who undergo amputation need training and guidance for a suitable prosthesis. Other disabilities which need attention are joint contractures, osteoporosis, pathological fractures, urinary calculi, phlebothrombosis and pneumonia.

When disease or its treatment leave the patient with severe physical impairment, a resultant need is created for an adjustment to a new way of life. The sudden knowledge of catastrophic illness can find the individual psychologically ill, unprepared for any change in capacities and status. Simple survival becomes no longer the patient's only cause of anxiety. Attention turns to his or her residual physical limitations and unless specific rehabilitation assistance is immediately available, dependency, depression and fear may become source of deeper problems. Experience has indicated that rehabilitation should begin at the earliest possible opportunity, and be continued through out the entire convalescence, until maximum benefits can be achieved.

## GOALS AND OBJECTIVES OF REHABILITATION

The initial goals of rehabilitation of cancer patients are elimination, reduction or alleviation of disability, while the ultimate goal is reestablishment of the patient as a functional individual in his or her environment.

The goals should be selected for each patient after initial evaluation at the onset of care in order to establish a programme that can provide realistic results. Individual goals depend on the certain factors relevant to the patient, and are as follows : —

(1) Preventive: when the disability can be predicted, and the appropriate prior training can reduce the severity of its effect. (2) Restorative: if the patient can be expected only to have minimum residual handicap and can return to a fully active life style and work. (3) Supportive: when the patient will have to tolerate ongoing disease or persistent disability but can make appropriate gains, towards control of problems, and improved day to day performances. (4) Palliative: if advanced disease and basic disability exist, that cannot be corrected, but where training can aid comfort, performance, and emotional support. This is also important if pain is to be reduced, for the correction of hygienic problems, treatment and prevention of decubitus ulcers, and maintenance of whatever independent function, the patient can assure for remaining period of his life.

Other factors to be considered for the programme include age of the patient, type and stage of the disease, other unrelated disabilities present, physical control, social and vocational back ground and basic education. Patient's home circumstances and surroundings must also be considered.

The treating physician should provide initial assessment on which appropriate rehabilitation programme can be based. Planning can then be started early for patient's rehabilitation needs, or referring the patient to the rehabilitation area is likely to be more effective, the sooner such rehabilitation efforts are started.

This early approach is important because bed rest alone allows nearly 3% per day loss of combined muscle power and endurance, and can carry a patient beyond an independent ability to get out of bed. This is also complicated by emotional disability that can result from prolonged inactivity of any kind. The immobilized patient should have a suitable physical and occupational therapy bed programme, prescribed and instructed.

To meet the goals, the following objectives should be considered.

**(a) General objectives**

1. To provide rehabilitation care for the greatest variety of needs, so as to minimize disability, dependency, emotional stress, and the complications of illness or treatment. 2. To contribute to discharge planning and future purpose of individual patient, as needed.

**(b) Specific objectives (According to individual Goal)**

1. To provide preventive measures so as to improve function and reduce morbidity and disability. 2. To provide restorative measures for patients with potential cure of cancer, whose residual disability can be appropriately controlled, or eliminated. 3. To provide supportive measures for patients who must continue with cancer, but can expect relative control or remission for appreciable time, and in whom disability, emotional stress or discomfort can be lessened by rehabilitation care. 4. To provide palliative measures for patients whose disease is advanced and relentlessly progressive, but whose disability, discomfort, and stress can be mitigated by rehabilitation.

The psychological problems faced by patients, are sometimes as devastating as the physical consequences of disability, therefore attention should be given to psychosocial as well as physical and vocational rehabilitation. Prompt rehabilitation attention can reduce the disability and the time needed for recovery of the patient's handicap.

## CONCLUSION

(1) Disability from cancer or its treatment can be considered by the same criteria as are used for non-cancer disabilities.

(2) It is essential to establish early recognition of patient's existing and potential disability and of rehabilitation needs and to stimulate prompt referral for rehabilitation care.

(3) Rehabilitation therapy started early can reduce the disability and time needed for recovery of patient's handicap.

(4) Each patient should be considered on individual basis, with evaluation of the medical findings, the prognosis, and maximum eventual gain to the patient, his family, and the community, then comprehensive medical care be provided to patient, for improvement in his quality of survival.

(5) Realistic goals are necessary for rehabilitation of the cancer patient. The patients should be assisted in reaching improved performance levels. Even in instances where the patients life expectancy is limited, efforts towards maintaining function at maximum potential may produce results that transcend an economic return.

(6) The physician should commence intensive medical care and early rehabilitation of the handicapped in acute hospital setting, incorporating rehabilitation services into ongoing hospital programme, is therefore part of comprehensive care for all cancer disabled patients.

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# Extension Prosthesis

## (Types and Indications)

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**Congenital deformities existed since the beginning of mankind, and the prosthetic replacement of these missing limbs has been relatively recent. The Medical Professionalists found it difficult to rehabilitate these patients, because the prosthetic development was slow, due to small number of patients effected.**

**An analysis of 50 patients seen at Institute of Rehabilitation Medicine, Madras, indicated the possible causes in our country as consanguineous marriage and drugs like analgesics and sedatives, taken by pregnant mothers during first trimester.**

**Since these patients have gross deformities and limb length discrepancy, they need to be fitted with a special type of prosthesis called Extension Prosthesis.**

The recorded incidence of prosthesis started from our country from Rig Vedas, which is believed to have been written between 3500 and 1800 B.C. It recorded that the leg of Queen Visphala was amputated in battle and an Iron leg was fitted to enable the Queen to walk and return to the battle field. In Tamil Nadu the King Porkai Pandian (meaning the King with the golden arm) was fitted with a golden arm.

The prosthesis for normal classical amputations in order to replace the missing limb, is called as replacement prosthesis. Apart from this, there is another category of prosthesis given for gross shortening of the limb, by providing a special type of prosthesis termed, as Extension Prosthesis. This has some additional components to accommodate any abnormal shape, curvature or to correct a gross limb length discrepancy, in cases where surgery is not desired or indicated, as in Pseudoarthrosis.

We broadly classify the Extension Prosthesis as :

1. Caliper Type
2. Limb Type

### Caliper Type Extension Prosthesis

It contains aluminium straight bars for both medial and lateral sides of limb from the level of ischial seat. A separate platform is provided for foot, below this a wooden shin and foot piece are given to compensate the shortening.

### Limb Type Extesnsion Prothesis

The socket for the foot is made of plastic resin, and is fixed on a wooden shin piece and foot piece. The whole prosthesis is covered with plastic resin, and the weight bearing is at the level of foot itself. It is suspended by cuff suspension.

In this paper we propose to discuss the various types of Extension Prosthesis, fitted to cases of limb deficiencies.

An analysis of five cases is presented. The causes for shortening of lower limbs in pa-

tients discussed here are :

1. Congenital Fibular Hemimelia ... 1
2. Congenital Femoral Phocomelia ... 2
3. Congenital Tibial Hemimelia ... 1
4. Congenital B. K. Amputation ... 1

## LIST OF THE PATIENTS

1. Baby Kanniammal : 8 years.
   (Fibular Hemimelia)
   (a) Absence of Fibula
   (b) Absence of lateral 2 toes
   (c) Forward curvature of Tibia
   (d) Gross shortening
2. Seethalakshmi : 22 years.
   (Femoral Phocomelia)
   Absence of Proximal half of Femur.
3. Usha : 7 years.
   (Tibial Hemimelia)
   (a) Absence of Tibia and Medial 2 toes
   (b) Gross shortening
4. Vedanaygama : 18 years.
   (Femoral Phocomelia)
   Shortening
5. Karuppuswamy : 23 years.
   (Congenital B. K. Amputation)
   With flexion contracture of knee.

## DISCUSSION

Although the anamolies existed since the beginning of the mankind, the prosthetic replacement of these missing limbs has been relatively recent. (Hall, C. B. et al., 1962, Neff, G. 1978, Agarwal, A. K. et al., 1984.)

Systematic research has been carried on in many countries however the progress has been slow, because the number affected was rather small and the cultural considerations in many areas have also delayed the application of prosthesis.

An analysis of 50 patients seen, indicates probable causes, as consanguineous marriage, and taking of drugs like analgesics and sedatives by pregnant mothers during the first trimester. There is no evidence of hereditary playing a role in these cases. The girls are more affected than boys, and lower limbs are commonly involved.

The medical professionalists found it difficult to treat and rehabilitate these patients, as they posed a number of psychological, medical and social problems.

The amputation surgery is not contemplated in these patients because of the problems with a small surgically provided stump, regarding weight bearing, balance and later training. Although some workers like Kruger & Talbort (1961) are of the view to undertake radical surgery followed by the prosthesis.

The Extension Prosthesis is the choice, which could be useful to the patient and avoid the risk of psychological trauma to the patient and the parent.

The retention of foot is of considerable importance and advantage, as these patients gain early balance and mobility, because of the better proprioceptive feed back from their intact feet. The natural foot though deformed and small in size is sometimes useful for purposes of squatting especially over Indian type of toilet, while child gets up during night.

One must consider very strongly, the parent cooperation and consent, the home and school situation and accessibility of a good prosthetic care. The recommendation to amputate is never an easy one. The parent sees the limb as an essential, normal appendage and would prefer that it remains. It is difficult with words, diagrams, X-rays and photographs to explain to a parent, as how the philosophy of amputation surgery will benefit the patient.

Lack of normal joint connections, between the extremities and the pelvis is one of the main factors contributing to the difficulties in the production of functional lower limb prosthesis. Other factors which make the fitting difficult are severe deformities of limb and of-

ten severely reduced muscle strength. It is of great importance to utilize the existing function of the deformed limb, improved by training and not to inhibit the development of the muscular capacity as well as the growth of the limb.

## CONCLUSION

In early stage of childhood, splints are necessary to prevent deforimties and to maintain limb buds in anatomical functional position, and prosthesis should be prescribed as the child reaches stage of walking (about one year).

The lower limb deficient patients should be fitted with Extension Prosthesis, which help to compensate the limb length, shape and make the child stand erect and walk normally. It also improves their psychological status and gives them a normal look. The personality of these patients also changes and enhances their function and social acceptance.

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# Low Cost Orthosis – A Follow-up Study

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**Seventy nine cases out of one hundred cases fitted with low cost orthosis were followed up for a period of 14 months, to consider the suitability and acceptability of this type of orthosis among the children of 2-8 years of age. Only 6% cases rejected the orthosis and 44.5% cases needed either adjustment of height or change of the orthosis. Minor wear and tear in the tyre sole sandals could easily be repaired at village level by the local artisans. Parents of the children found it quite convenient to afford new set of orthosis after a period of 6 months at such low cost.**

On the eve of the 21st Century, Poliomyelitis is still an endemic disease in various developing and under developed countries. Inspite of the mass immunization programme by UNICEF and Local Bodies and the different government agencies, a large number of cases of Poliomyelitis are being reported daily. It is being envisaged that by the year 2000 A. D. Poliomyelitis will be no more a problem. However most of them are using different kinds of orthosis for ambulation and support etc. Orthosis which is often out of reach to a common man, due to its cost, non-availability even in the cities, frequent repairs, inability of persons to travel to district or regional centres for the repairs and long waiting time for its finalization.

Considering the magnitude of problem and past experiences of rural camps in which about 20,000 cases have been examined by our Rural Rehabilitation programme team, we have designed a low cost orthosis for the children suffering from poliomyelitis (Agarwal et al., 1984). In the present study we wish to present the follow-up of these cases who are using the low cost orthosis for one year and an endeavour has been made to know its suitability and acceptability of the low cost orthosis in Polio affected children.

## METHODS AND MATERIAL

Old worn out tyres of heavy vehicles were used for making the foot-wear i.e. sandals and the uprights were made up of locally available ironstrips (Agarwal et al., 1984), the total cost of the one HKAF Orthosis was approximately Rs. 45 and KAF Orthosis Rs. 30 only. (Including the cost of raw material, padding and labour charges etc.)

The children fitted with these types of orthosis were called for regular follow-up at the interval of 8 weeks and points of wear and tear were noted. Assessment regarding the utility and acceptability of the orthosis was also considered and accordingly further modifications were done.

## OBSERVATIONS

These low cost orthosis were fitted to 100 children in a period of 6 months and all the

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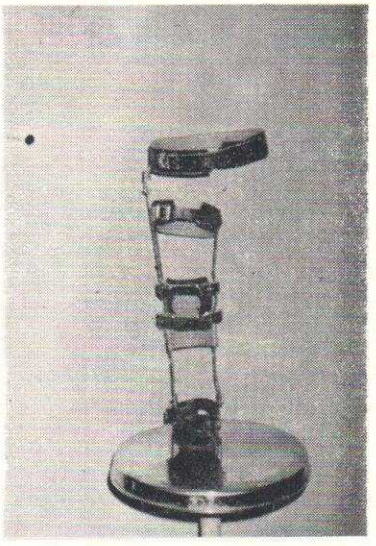

Fig. 1. Low Cost Orthosis.

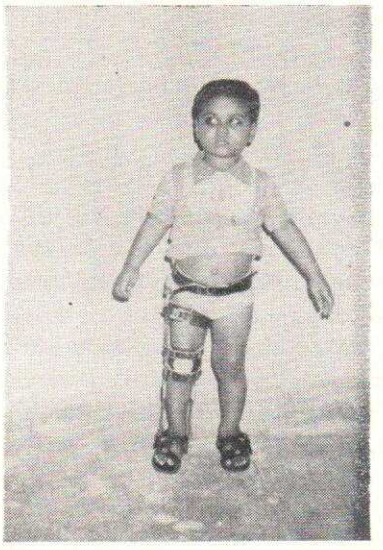

Fig. 2. Polio affected child wearing Low Cost Orthosis.

Fig. 3. Child is trying to ambulate with Low Cost Orthosis.

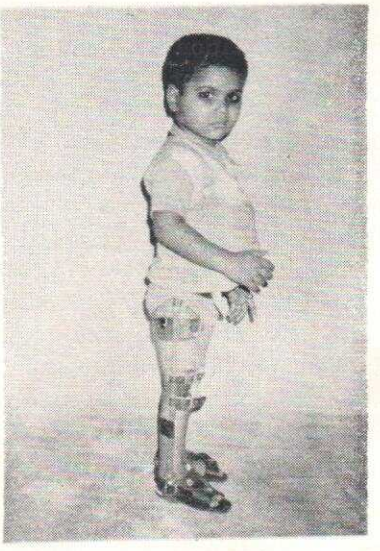

Fig. 4. Side view of the same case.

cases were followed up as described above.

The table I shows that maximum number of children fitted with orthosis were in the age group of 2-8 years of both sex.

**Table I. Age-sex distribution of patients fitted with low cost orthosis**

| Age Group (Yrs.) | Male | Female | Total |
|---|---|---|---|
| Less than 2 | 16 | 4 | 20 |
| 2 to 3 | 35 | 17 | 52 |
| 3 to 5 | 11 | 4 | 15 |
| 5 to 8 | 10 | 3 | 13 |
| Total | 72 | 28 | 100 |

Maximum number of cases had unilateral involvement of the lower limb who needed full bracing of the limb and were fitted with HKAF Orthosis. KAF Orthosis were fitted in only 4 cases (Table II).

**Table II. Types of orthosis**

| Type | Fitted |
|---|---|
| H. K. A. F. | 67 |
| Bil. A. K. with P. B. | 29 |
| K. A. F. | 4 |
| Total | 100 |

All the cases were followed up as patients reported for check up every 2 months. The maximum follow-up was 14 months and minimum for 4 months. Only 79 cases were followed up (Table III).

**Table III**

| | |
|---|---|
| Total cases | 79 |
| Minimum follow-up | 4 Months |
| Maximum follow-up | 14 Months |

Maximum wear and tear in the orthosis was at the ankle stirrup, fitted with the sole of the sandals, 5 cases had breakage of the orthosis at the Hip Joint (3 Bilateral and 2 unilateral HKAF Orthosis) (Table IV).

**Table IV. Site of wear and tear**

| Site | No. of cases |
|---|---|
| Hip Joint | 5 |
| Knee Joint | Nil |
| Ankle stirrup | 15 |

Adjustment of the height of the orthosis and change of orthosis were essential in 35 cases after a period of 6 months (Table V).

**Table V**

| | |
|---|---|
| Adjustment of height | 15 cases |
| Change of Caliper in six months | 20 cases |

About 94% cases accepted the brace and used it regularly till the follow-up and the rejection rate was only 6%.

## DISCUSSION

It is a long cherished desire of every worker in the field of Rehabilitation to provide aids to the disabled persons at a minimum cost and the aid should be simple, strong, durable and easily repairable. The conventional orthosis are expensive and need trained man-power, big establishment and the fabrication takes longer time. For a poor child who is in growing age, it is not possible to change the orthosis frequently as well as travelling to distant district or regional rehabilitation centres for the repairs etc. This is one of the greatest cause of the rejection of orthosis.

Reported incidence of Polio cases in a Rehabilitation set up is 14% and the commonest age group involved is between 1-3 years in both the sexes (Rastogi et al., 1983).

Most of these cases need long leg bracing

for the ambulation. The different joints in an orthosis are the common sites for wear and tear. These joints are also responsible for increased cost of the orthosis. The knee joint was not provided till age of 5 years and in every case limited ankle motion was provided irrespective of the type of dynamic deformity. This limited ankle motion gave good results inspite of minor varus or valgus imblance. The commonest site for wear and tear was at the ankle stirrup for which we found it difficult to anchor with tyre sole, but later this problem has been overcome by putting additional layer of tyre sole in these sandals. It also prevented the forefoot drop. The buckles and the rivets used in these sandals were the other sites of wear and tear, but this was easily repairable in the villages, as this is the commonest foot-wear used in our villages. The orthosis broke at the hip joints after 6 months use in only 5 cases. In 3 cases who were fitted with bilateral HKAF Orthosis and 2 cases with unilateral HKAF Orthosis, the breakage was at the level of screws and all these cases needed the replacement.

Since all the children were in the growing age, 15 cases needed adjustment of height after 6-8 months of use of orthosis and 20 cases needed replacement of the orthosis after 12-14 months.

Out of 79 cases followed up, 96% cases continued to wear the orthosis which is quite encouraging response. The added advantages are given in Table VI.

**Table VI. Advantages**

| |
|---|
| Cheap |
| Short duration in assembling |
| No trial hangup |
| Light |
| Comfortable |
| Easy Maintenance |

The only disadvantage with the orthosis was that it could only be used successfully in younger children i.e., upto the age of 8 years or before school going age. This orthosis cannot be used for spastic cases and in cases with gross foot and ankle deformities.

To conclude, this orthosis is a simple, cheap, locally repairable, comparatively lighter in weight and requires not much time for fabrication and can be easily fabricated in the rural environment with locally available materials only.

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# Comprehensive Rehabilitation of A Deserted Amputee

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Rehabilitation is a treatment process designed to help physically handicapped individuals to make maximum use of residual capacities and to enable them to obtain optimal satisfaction and usefulness in terms of themselves, their families and their community. This is based on two main processes. i.e. physical restoration and socio-vocational rehabilitation.

These two processes are complementary to each other and comprehensive rehabilitation programme is not complete even if either one of these process is absent.

*Case*: Rani Mangamma, aged 25 years, young lady, good looking, attempted suicide by throwing herself in front of the train because of ill treatment by in-laws. She sustained multiple injuries and she was revived but left with an above-knee amputation on the left side and a below-knee amputation on the right side. She was first seen as totally non-confident, mentally disturbed with no mind to accept the disability and completely deserted by her in-laws and parents.

## MEDICAL REHABILITATION

The success of medical rehabilitation of an amputee lies in achieving near normal gait after fitting artificial limb. The alignment of a prosthesis is easy in the case of a single limb amputee. In bilateral amputees, a combination of above knee on one side and below knee on other side, is the most difficult combination to deal with. The problems faced in this case are 1. Selection of height of the individual, 2. The dynamic alignment of the prosthesis, 3. Cosmetic appearance, 4. Patient's acceptance.

In the case cited as an example Rani Mangamma is a bilateral amputee, below knee

on the right side and above knee on the left side. Added to the problem in this case, is a short above-knee stump which will tend to come out of the socket. This problem has been sorted out and is fitted with an above-knee prosthesis on left side and the below knee prosthesis on the right side with which she is able to stand and walk.

## SOCIAL REHABILITATION

Rani has studied upto 3rd standard and with the help of the special school situated at the Institute. She has learnt to read and write fluently. Now she writes letters to her father who is very happy to receive letters in his daughter's own writing.

A counselling session was conducted with Rani Mangamma's father who is a peon in a bank in Erode. He agreed to write to her and visit her once a month. Rani Mangamma was donated with a tricycle and wheel chair by voluntary agencies.

Rani Mangamma has overcome all the disabilities and her social out-look has changed after medical treatment including fitting of the limbs and social counselling. She is bold enough to face the people who have deserted her.

## PSYCHOLOGICAL REHABILITATION

Rani Mangamma came to the Institute in a depressed state. She was very shy and withdrawn. A few counselling sessions with her, helped her to accept the disability and build up her morale. She became very determined and wanted to live, to support herself and not to be a dependant on either her in-laws or on her parents.

## VOCATIONAL REHABILITATION

Rani was found to be interested in tailoring. Intense coaching in tailoring was given by the vocational instructor at the Institute. Rani was also donated with a sewing machine. Now she is confident to start a new life with what she gained medically, socially and psychologically from the rehabilitation team. Such unfortunate girls are plenty in our society who need to be identified and rehabilitated. Such programmes are by means of District Rehabilitation centre, who takes rehabilitation to the doorstep of the disabled.

# Rehabilitation of Rehabilitation Medicine

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It is estimated that some 300-400 million people, or about 10% of the world's population is affected by chronic disability. Disability can thus be considered one of the most important health problems in our society, and its magnitude is expected to increase in the future.

In 1976, the Twenty-ninth World Health Assembly adopted a new policy and programme for disability prevention and rehabilitation, suggesting a number of new and quite radical changes in present policies and services for the disabled throughout the world. These consisted of:

(a) Placing emphasis on prevention of disability rather than rehabilitation;
(b) efforts to make services universally accessible to everyone in need;
(c) the promotion of appropriate technology and more effective measures for rehabilitation;
(d) changes in the manpower structure to render rehabilitation less expensive and more accessible.

## OBJECTIVE OF REHABILITATION

The first question we should ask ourselves is: why do we want rehabilitation? What is our main objective? Let us for a few moments look into the background for our decisions on objectives.

During the last few years more and more people have come to an increased awareness that economic growth as such is not a sufficient measure of progress. Equally important is the distribution of the fruits of such growth. Thus, we have seen major efforts in our societies to redistribute wealth through transfer payments from the more affluent to the poor, mainly in the form of social insurance, unemployment benefits, pensions, contributions to children and social welfare payment etc. But there is also an increasing awareness of the fact that just redistribution of resources —or money—is not enough. There must also be a more fair distribution of opportunities.

## THE SITUATION IN AND SOLUTIONS FOR DEVELOPING COUNTRIES

### Present situation

Most developing countries have at least some rehabilitation services. In a typical situation we will find some government services, usually in the form of a rehabilitation institution in the capital and/or in other major cities. There would also be one or several small centres, usually operated by non-governmental organizations, e.g. for the blind, the deaf, the crippled & the mentally retarded etc. In most such countries there are services to cover less than 0.1 per cent of the disabled population. These services are usually expensive—costs amount to US $ 1,000 to 3,000 per child per year in a typical institution. Many disabled stay for a considerable length of time, and the results are often poor. Disabled persons in institutions are separated from their families and villages and they often develop unfavourable psychological attitudes and behaviour. Institutions often contribute to increased dependency rather than creating active independent individuals. Although institutional rehabilitation services have been available for the last 50-100 years, there has been no serious attempt to evaluate their effectiveness.

**Disability Prevention**

Disability prevention thus emerges as priority, especially in the following areas:

(a) *Malnutrition*—more than hundred million children under five years of age are affected by protein-calorie malnutrition, goitre, anaemia and vitamin A deficiency;

(b) 50-100 million persons are disabled by communicable diseases, such as tuberculosis, leprosy, poliomyelitis, trachoma, and so on;

(c) Millions of people each year are disabled by accident—at work, on the roads, at home or in wars or civil unrest;

(d) Frequent complications during delivery and the perinatal period give rise to unnecessary life-long disability in millions of persons each year.

Proper prevention of the above-mentioned causes could reduce the world-wide prevalence by at least one third, may be one half.

Lack of curative care of sufficient quality also leads to disability in a high proportion of patients with fractures, wounds, cardiac failure, epilepsy, schizophrenia and tuberculosis, to give only a few examples. Second level prevention could reduce the disability effects of such diseases.

**Priority concerns**

In order to promote community-based essential rehabilitation, mannuals, training material and packages should be available for use by primary health care workers and family and community members. There is also a need for efforts to promote the appropriate central planning procedure to ensure the final aim of providing the most essential services to the total population.

The type of rehabilitation just described was recently planned for a developing country. In spite of the fact that country has a population of less than one million and is the size of France, it was shown to be possible to implement full population coverage at the cost of only 2% of the health budget. This includes all necessary medical, social, vocational and educational rehabilitation measures. Individual costs calculated showed that 100 children could be given rehabilitation in the community for the same cost as one child in an institute.

## THE SITUATION AND PROBLEM AREAS IN DEVELOPED COUNTRIES

It is difficult to generalize the situation in the developed, industrialized countries. Some countries have health services still, to a great extent, in the private sector, at the other end of the scale we find what is often called "socialized medicine".

There are various degrees of population coverage for the disabled in these countries. There is no doubt that rehabilitation services often achieve good results and that the applied technology has been evaluated. Nevertheless, I would like to take this opportunity to examine and discuss the main problem areas.

**The administrative problem**

Rehabilitation has in most countries been split up in its medical, vocational, educational and social components. Different branches of government are often responsible for their own sector of rehabilitation. This has led to uneven development, poor cooperation and high costs.

**The manpower problem**

Rehabilitation services have become highly dependent on the availability of many different training, and in addition it needs the temporary services of a high number of consultants. It is impossible to provide community or home care at a reasonable price, when rehabilitation is divided up among so many professionals and thus the only service provided is institutional. The fact that rehabilitation utilizes such a complicated manpower, structure

has led to spiralling costs for the services. We can in many parts of the world now find daily average costs in rehabilitation hospitals of US $ 200 to 300 a day.

**The technology problem**

We are facing technology problems in various ways. Prevention does not seem to be effective for a number of disabling conditions: for instance rheumatic arthritis, psychotic and neurotic conditions, chronic alcoholism, drug abuse, etc. In some other areas, e.g. heart disease and cerebro-vascular accident, there are more encouraging developments. More efforts are needed to undertake research to prevent disability caused by these disorders. Rehabilitation technology has developed into a rather unfortu nate situation. To quote Dr. Halfdan-Mahler, Director General of the World Health Organisation: "Health technology can be divided into three different types, namely: one that is truly fundamental to the solution of health problems, another that might be termed placebo technology at the other estreme, and a third intermediate, palliative technology. This classification based on an assessement of health technology according to its results, and these results have to be measured in terms of problem-solving and not in terms of the efforts expanded or the efficiency of performance."

Most of us would agree that this kind of examination and classification of rehabilitation measures is desirable and necessary if we are to make rehabilitation more effective and keep costs reasonable.

A recent Swedish study of the effectiveness of rehabilitation for long term sickness, patients have shown quite interesting results. The follow-up period was five years, and the two hypotheses examined were:

(1) that rehabilitation should contribute to an early return to work;
(2) that rehabilitation should lead to decreased dependency on medical care.

This study used randomised controls for comparison. In the final results there were no difference in working days between the rehabilitated group of patients and the patients in the control group. There were only small differences in the demand for medical care, mainly indicating an increased dependency among rehabilitated patients for such care.

In summarizing the situation in developed countries, we realise that there is a pronounced need for research. We are efficientely delivering rehabilitation that may be totally ineffective. The costs for doing this are very high.

The means to avoid a future crisis are not quite clear to any of us. We must search for better means to screen out and assess persons that are at high risk of being future invalid persons. We must try to prevent early elimination from the labour market of people with a marginal working capacity. We must find means to prevent disabling accidents and chronic diseases. We must find better ways for the delivery of effective rehabilitation to all those in need, and at a cost that is acceptable. We must pay more attention to services that can be delivered in the community and at home, not by whole team of rehabilitation professionals but by multipurpose workers.

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# Splints in the Rehabilitation of Injured Hands

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**The broad principles in the use of splints and their fabrication are discussed. The various types of splints used for the common problems in the hand are discussed in detail.**

It is well known that splints are as important as surgery when the hand is concerned. Sometimes the splints do a better job than what surgery can offer.

The origin of word "Splint" is not exactly known. In 1946, Capner called the triangular segment of the armours surrounding the movable parts at the elbows, knees and ankles as splints. These splints afforded protection while still permitting movements.

The function of any splint is to maintain correct posture in a position of (1) rest; (2) realignment; (3) controlled activity.

The splints are broadly classified into three types:—

(a) **Static or passive splints**

The aims are:

1. To immobilise or limit the joint activity. The main aim here is to put the hand and wrist into a position of physiological rest and control, thereby limiting those movements which might be harmful to the process of healing.

2. To position and maintain correct joint alignment. A classical example is the use of static splint in correction of the claw deformity or the night splints used in the early stages of ulnar drift in rheumatoid hands.

3. To arrest the developing contractures. In a number of situations one gets the contractures as in shortening and fibrosis of paralysed muscles, shortening of joint capsules, diffuse fibrosis as a result of oedema, burns, etc.

In all these situations, static splints if used in the early stages can ward off the development of contractures.

4. To maintain improvement obtained by Therapeutic passive stretching of contractures between treatments.

5. To stabilise and/or position one or more joints enabling other joints to function correctly. A classical example is the wrist cock up splint used to support the wrist in extension allowing the hand to grasp effectively.

(b) **Lively or dynamic splints**

This word lively was coined by Capner in early part of First World War. The aims are:

1. To prevent progressive deforming changes which can develop following segmental imbalance, e.g. preventing the development of claw hand in situations where it is likely to develop (Fig. 1).

2. To enable normal muscle to maintain

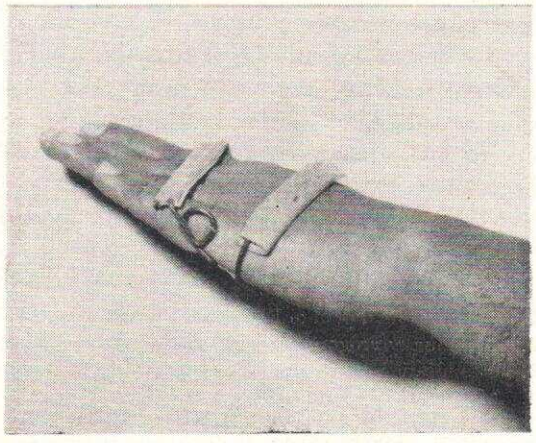

Fig. 1. Claw Correction Splint

power and tone, encouraging weak muscles to strengthen.

3. To correct the deformity caused by imbalance or paralysis while allowing normal muscle to maintain activity.

### (c) Functional appliances designed for irreversible loss of function

They are meant for patients with profound loss of function as in congenital malformations, brachial plexus or spinal injuries. A number of new devices are available.

In the fabrication of the splints to the hand one should be careful in assessing the shape of the hand particularly the arches of the hand.

There are three planes for the hand. Two on the dorsum and one on the palm. These three constitute a triangle. The first and fifth metacarpals form the base and the index metacarpal the apex. In all positions of the hand the triangle remains although the shapes may be altered.

The three planes of the hand which form the triangle narrow towards the wrist and if these were continued they would meet as the apex of a pyramid.

Another feature to be taken into account is the fact that there is very little space in the palm, when all the fingers are brought into opposition with the thumb. This implies that any palmar bar or area of support should, as far as possible lie within this space, so as not to interfere with MP flexion and thumb rotation. The transverse arches of the hand formed distally by the metacarpal heads and proximally by the carpal bones are dynamic ones. They deepen as the finger tips come together. But on opening the hand the arches are flattened.

This dynamic nature is seen at work. The arch gets flattened when grasping a broom handle, spade or spanner. When holding tools of precision such as pen, small screw driver, there is deepening of metacarpal arch as the finger tips come together.

Particular attention should be paid to the arc of motion of each finger. When the individual finger is flexed each tip points to the bony land mark of Trapezial ridge. In grip it will be noted that the terminal interphalangeal joints of the index, middle and ring fingers lie in close proximity to the thenar eminence with that of the little finger lying at its base. With the fingers in the position of the grip if a pencil is inserted through the fingers, one can observe the oblique angle of the pencil lying across the palm. This only shows that in making any splint which requires a band or bar across the palm this angle should be observed. When the fingers are relaxed with the pencil in same position it will be seen that there is a space between the centre of the palm and the pencil. However, if the pencil is pressed into the palm the arch will flatten. This will be the effect of palmar bar across the hand if it is not shaped to this arch. So care should be taken to shape the bar according to the arch.

Thus the following principles have to be kept in mind before fabricating the splints for the hand:

1. Any dorsal bar must angulate and be shaped to the curve of the dorsum.

2. If full range and arc of movement of fingers and thumb is maintained, any material or bar crossing the palm should not interfere with thumb rotation nor with the flexion of the MP joints.

3. Care should be taken to maintain the transverse metacarpal arch.

4. The palmar surface of the hand should have as little covering as possible so as not to interfere with sensation.

5. Forearm supports for static splinting should follow the physiological position of rest. In the construction of lively splints, forearm supports should allow for the longitudinal rotation function, wherever possible.

## REQUIREMENTS OF A GOOD SPLINT

1. It should be as comfortable as possible. An adverse comment, made by the patient, should be respected and adjustments made, provided this does not interfere with the object of the splint.

2. Should be as simple as possible. Anything cumbersome and unsightly will be discarded by the patient.

3. The materials should be cosmetically acceptable to the patient.

4. Should avoid friction damage to the skin.

## GENERAL PRECAUTIONS

1. *Circulation:* We should prevent circulatory disturbances by padding the points of pressure and distributing the pressure over an area as wide as possible.

2. *Timing:* No splint should be worn continuously for all the 24 hours. Initially it is removed frequently till, he feels comfortable. He must be given clear instructions regarding the period of time during which it should be worn.

3. *Skin Reactions:* Any redness or rashes should be noted which may be an indication that the material used, causes allergy.

## SPLINTS USED FOR PREVENTION OF DEFORMITY

The most important area, where these splints are used, is in preventing the deformity, seen in peripheral nerve injuries. It is known that the paralysed muscles will be over stretched by the unopposed action of the antagonists if some form of splinting is not done. For example take the radial nerve palsy, the extensor muscles for the hand and forearm are paralysed. They are likely to be stretched if the wrist is not held in extension. Similalry in unlar nerve palsy, the hyperextension of the MP joints of the ring and little finger tends to stretch the capsular ligaments of these joints. In median nerve palsy, we do find the over action of the extensor pollicis longus, which is not opposed by the usual Opponens pollicis and abductor pollicis brevis. With the result, the thumb will be adducted and kept close to index finger and this will stretch the thenar muscles. In a combined median and ulnar palsy, the metacarpo-phalangeal joints of all the fingers would become hyperextended.

In preventing the deformity, the aim is not only to provide a static splint that will prevent or correct the deformity, but to provide a dynamic splint which will help in preventing deformity and also help in encouragment of function. Taking the example of radial nerve palsy, the splint which has been in use for a long number of years, is the cock up splints [Fig. 1] which Mr. Parry calls it as, "Dead

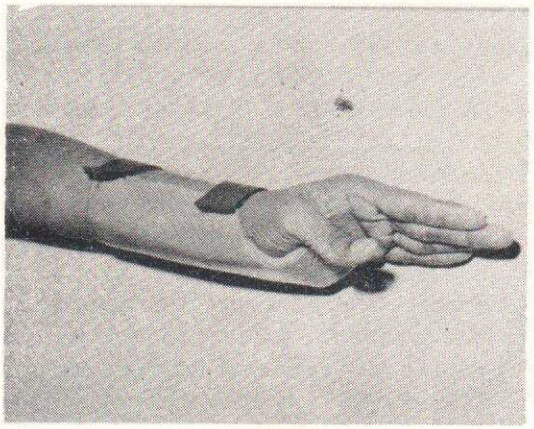

Fig. 1a. Static Cockup Splint

Splint". This does not allow any movement of the wrist. Instead if you can provide a lively splint [Fig. 2] that patient can actively flex the wrist and the splint tension will extend the wrist. This device can be easily constructed and is quite comfortable to wear. Patient do find that they attain good function and in many instances they can resume their normal work

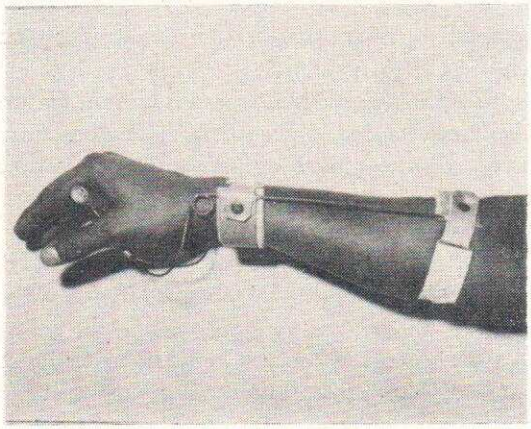

Fig. 2. Dynamic Cockup Splint

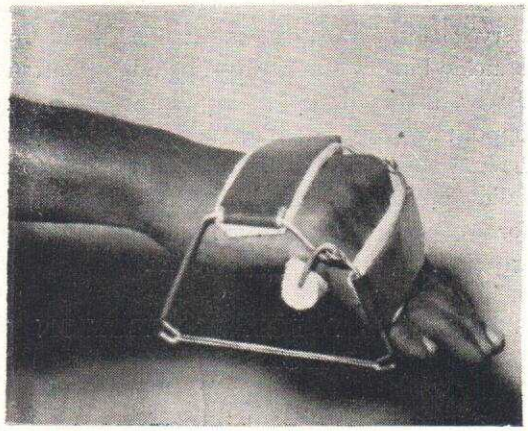

Fig. 4. Dynamic Knuckle Bender

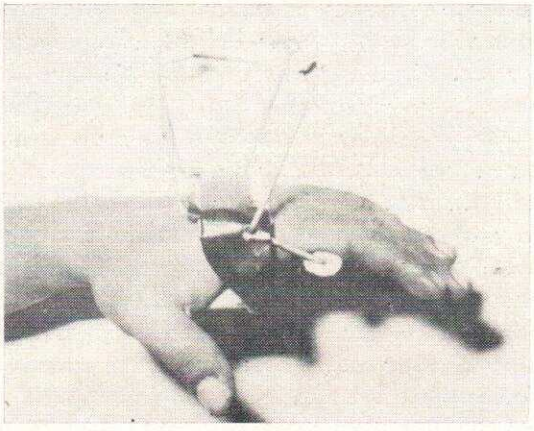

Fig. 3. Reverse Dynamic Knuckle Bender

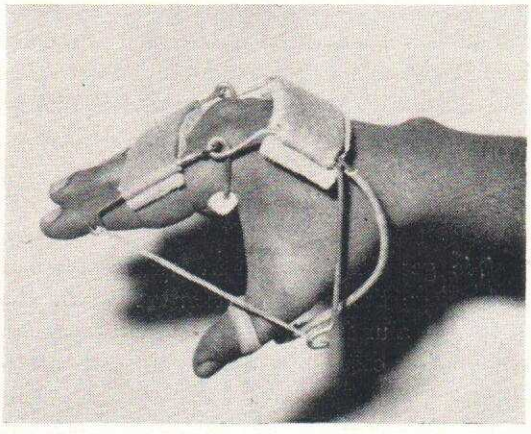

Fig. 5. Dynamic Knuckle Bender with outrigger

while wearing the splint. In cases where the extensors to the fingers alone are not acting, the reverse knuckle bender [Fig. 3] will be of great help. It keeps the fingers in extension and whenever the patient wants to flex the fingers he can do it. He can grip large objects easily. If both the wrist and finger extensors are paralysed this type of splint will be useful in keeping the wrist and IP joints of the fingers in extension.

Similarly for ulnar nerve lesions, a knuckle bender splint [Fig. 4] by which patient can flex and extend the MP joints may be of use. The only disadvantage of using the rubber band is that it occupies space. It may not easily allow proper function of the hand. A static splint of this nature will prevent the deformity. But if a spring is added it will allow good function in addition.

For median nerve palsy a wrist band, to which a leather strap going around the thumb in an oblique manner, is used. This is convenient, but the wrist band has a disadvantage that it does slip and the position will be changing.

In cases where it is in association with the ulnar nerve palsy, a wire can be attached to the main knuckle bender and this can be adjusted in such a way that the thumb is kept in abduction and opposition [Fig. 5]. With this, the patient will be in a position to work and use the hand to the fullest possible limit. In a combined lesion, this form of splint will be very useful. Patient can carry on his work with the splint.

## SPLINTS USED FOR CORRECTION OF DEFORMITIES

*Mallet Deformities:* This is common problem we meet with. Several types of splints are available. We use the simple aluminium strip cut to the size of the patient's finger and strap it with the adhesive. The needed extension at the DIP joint is given easily as the aluminium is malleable. Care is taken to see that the PIP joint is not involved.

## BOUTENIERRE'S DEFORMITY

We get this problem in various stages. In early stage the passive extension is full. Here a simple aluminium strip or rubber tube is enough. In cases of established contracture of the PIP joint, serial stretching with plaster may be needed. When this fails, dynamic finger extensor [Fig. 6] is used.

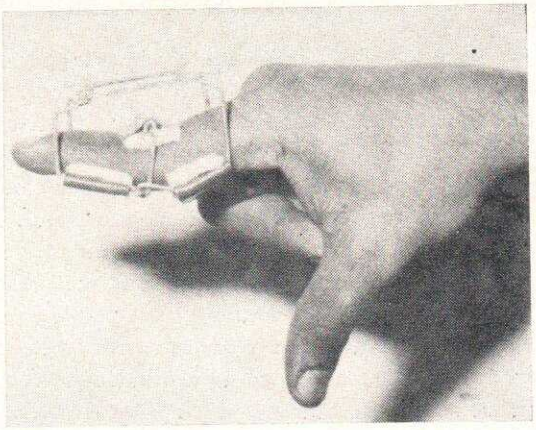

Fig. 6. Dynamic PIP Joint Extensor Assist Splint

Stiffness of the joints, is a common feature following trauma, infection and tendon adhesions. All these lead to deformities of various kinds.

## LIVELY SPLINTS USED TO CORRECT CONTRACTURES IN VARIOUS JOINTS

One should be very careful in using dynamic or lively splints in correcting such contractures. The dynamic splints may exceed the limit of force that is needed and this may cause minute ruptures of the tissues and this will lead to further scarring. So many, prefer serial stretching. Serial stretching has been popularised by Mr. Wynn Parry and others. We have also found it very useful.

In practice where serial stretching is needed intensive massages are given for about 10 minutes and then the deformity or the contracture is gradually stretched within the limits of tolerance and in this position plaster is applied and allowed to set. This is changed three or four times a day following each session of physical therapy and for use in nights, it is little under corrected and the plaster is applied. If this is continued, it is a pleasant surprise to see that majority of these contractures are stretched and the deformities corrected. It has got a very good application in case of tendon repair at various levels. If patients cannot stretch their fingers straight after about six weeks of physical therapy, passive stretches can be started. It gives very good improvement in function. So serial stretching is one of the important armamentorium in the hands of the orthotists to improve the function by correcting the fixed contractures.

The same principle can be applied for stiffness of the MP joints after crush injuries. Oil massage, stretches and serial plasters are success-

ful in these cases. It is important to mobilise the MP joints not only in flexion and extension, but also in rotation. This applies particularly to the Index finger when a cylinder grip is made. The inter-digital webs and the thumb web become fibrotic and same treatment plan is effective. The most useful way of maintaining correction of webs is by application of small plaster wedges which can be made easily and made to mould well to the deformities.

When it is not possible to have further improvement with serial stretching, dynamic splinting [Fig. 7] has to be brought into the

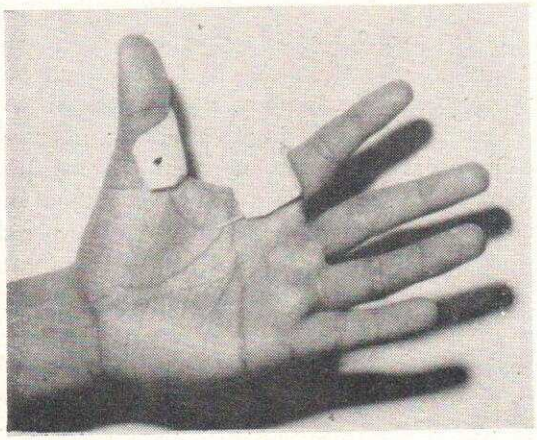

Fig. 1. Dynamic Thumb Web Spacer

picture. The tension of the coil spring can be gradually increased and made to give greater force. As mentioned earlier these devices act best on co-operative patients who are ready to accept them as active exercise and will work against the spring resistance. It is dangerous to use them in the early stage of treatment as they may promote further oedema and fibrosis. Only when fitted to the right patient at the right time, they can be most helpful in correcting the deformities.

*MP Joints :* When it is not possible to have flexion beyond 60 degrees, we use lively knuckle bender splints.

We may have to modify the knuckle bender splint, to suit the individual situations. Here is a case of flap cover to the dorsum of the hand. The flap should not be pressed by the dorsal aluminium strip of the splint. In this patient the support on the dorsum is taken more proximally and by the help of a joint, the dynamic flexion of the MP joints is achieved.

*MP & IP Joints :* Sometimes we have the flexion deformity of the IP joints in combination with collateral ligament contracture of MP joints. This is common after the flexor tendon repair or following severe crush injuries. In such situations, outrigger to each finger connected by a strap is given [Fig. 8]. The fulcrum here is on the proximal phalanges and the PIP joints are extended continuously by the dynamic traction of the rubber bands.

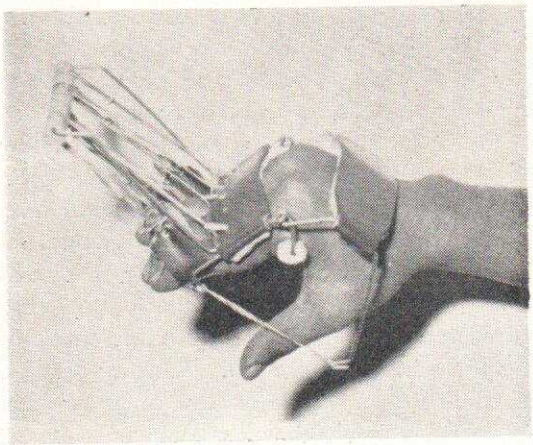

Fig. 8. Dynamic Knuckle Bender with Outrigger

*IP Joints :* The other lively splints are the inter-phalangeal extension and flexion splints. We do get the problem of PIP joint contracture either in flexion or in extension. In extension, we do encourage the flexion by this simple lively splint [Fig. 9] and it is very useful and gradually the deformity is corrected and if at any particular stage there is no improvement then there is an indication for surgery for this pro-

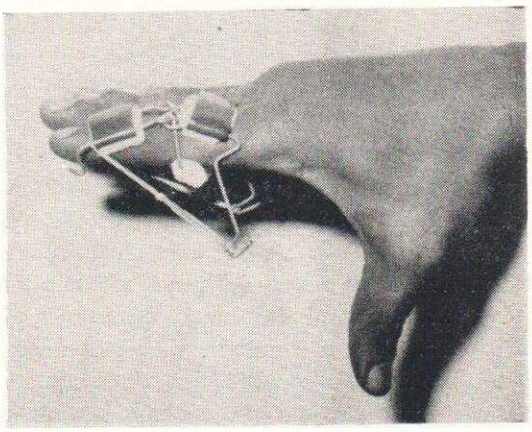

Fig. 9. Dynamic PIP Joint Flexor Assist Splint

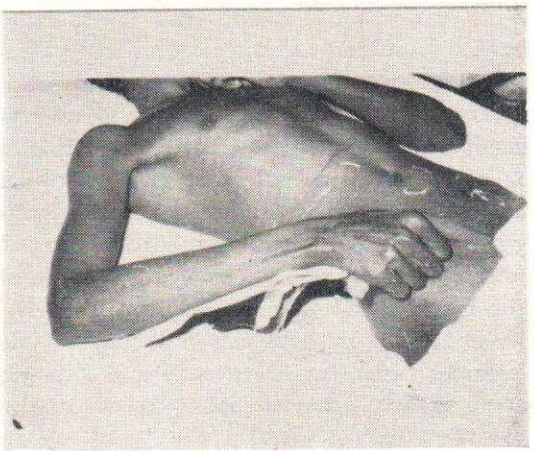

Fig. 10. Flap Supporting Splint

blem. For PIP joint contractures in flexion, the reverse of the same splint is applied to correct the flexion deformity and to have extension of the PIP joint [Fig. 6]. These splints are very easy to fabricate and can be given in about few hours time and it works very well.

Other splint which we found useful following flap attachment is flap supporting splint. The aim of this splint is to encourage the function in those areas unaffected by trauma. All of us who are engaged in providing skin cover to the hand and forearm in the form of flaps are quite aware of the difficulties in immobilising the hand and forearm. Kinking and undue pressure on the flaps have to be avoided. No doubt, a constant watch and vigil is essential in this type of flap surgery. But it is not possible or feasible to have such a continuous constant watch on these cases. Over the years we have been finding it is a problem and sometimes it is quite distressing to see good flaps getting kinked. In addition, the patient does not use the unaffected fingers resulting in gross stiffness of the joints of these fingers. The rehabilitation team was stimulated to think on these lines and with the result we have evolved two or three splints [Fig. 10].

It is a simple one made of aluminium. It has two components as you see here. A basal plate horizontal in disposition. This part rests on the bed. The other oblique component is connected to the horizontal one by an adjustable support. This supports the forearm and hand which are strapped into position. This basic splint is adjusted to suit the various situations. For cases where only the thumb is lost and a flap is attached to the region of the thenar area, this type of splint is useful. It keeps the forearm and hand away from the trunk and it does not allow the wrist to drop. The remaining fingers are allowed to do exercises freely without disturbing the flap.

# Standardisation and Certification of Wheel Chairs

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**0. What Standardization means**

It is an activity of formulating Indian Standards aimed at solving recurring problems by pooling the knowledge and experience of the experts concerned in the field.

**1. What is a standard**

Any item has a fitness for use. The consumer has some requirements to make that item fit for use, the manufacturer translates those requirements and fabricates that item fit for the purpose, such requirements are termed as characteristics or specifications. The acceptability of these specifications by the majority of all concerned becomes a standard specification.

**2. How wheel chair was selected for standardization**

The Advisory Committee for the Development of Surgical Instruments, Equipment and Appliances, of the Government of India, proposed amongst other items, the item of wheel chair to be taken up for the formulation of National Standard.

**3. Procedure for formulation of a standard**

The Sectional Committee consists of experts representing manufacturers, consumers and technical interests. When an item is taken up on the programme of work, the concerned Technical Committee entrusts the job of drafting the standard to an expert member of the Committee. The draft is considered by the Committee and after suitable modifications, it is issued in wide circulation for eliciting comments throughout the country and some cases abroad also. The Committee then finalizes the document for publication after modifying the document in the light of comments received as a result of wide circulation.

**4. Quality characteristics**

The following are the Indian Standards for wheel chairs:

IS : 6571-1972 Non-folding wheel chairs, institutional model;

IS : 7454-1974 Wheel chairs, folding with removable armrests and swinging footrest;

IS : 8086-1976 Wheel chairs, folding type, junior size.

The above standards contain the following quality characteristics:

(a) Material
(b) Constructional Requirements
(c) Shape and Dimensions
(d) Corrosion Resistance
(e) Workmanship and Finish
(f) Tests
(g) Marking and Packaging

*Material*—The material for wheel chairs include tubing (IS : 2039-1964 Specification for steel tubes for bicycle and allied purposes), aluminium or mild steel sheets for clothing guards, canes (natural or synthetic) or foam rubber or rubberised coir for the seat and back, cast aluminium for footrests, castors (IS : 4034 Castors for hospital equipment), rims (IS: 624 Bicycle rims), spokes and nipples (IS: 630 spokes (plain) and nipples for spokes), tyres (IS: 2415 cycle tyres) and tubes (IS: 2415-1969 Specification for Cycle Rubber Tubes). The use of other materials have also been permitted which may be better to performance than those specified above.

*Constructional Requirements*—The back of the wheel chair should be secured to the vertical side members with four galvanized steel screws and should be removable. The seat should be secured on each side with not less than four galvanized steel screws. The back shall start 50 mm above seat top. The frame of the wheel chair should be made up from steel tubing and it should be of welded construction. The welding should be sound and the joints should be fully dressed and smooth finished. There should be no sharp edges or unsealed formations which might harbour dirt or other foreign matter. The various members by themselves shall each be of single piece without any joints. The rear vertical members should be bent and sealed at the top to accommodate plastic handgrips for pushing the chair by an attendant. The ends of the bottom rails at the rear of wheel chairs should be equipped with soft-rubber bumpers. The wheel chairs should be provided with two cast aluminium footrests with corrugated surfaces. The footrest should be capable of swinging about its own axis so that when a disabled person enters or leaves the chair the footrest shall clear the way and not obstruct. In this raised position the footrest should be at an angle of 120° to its normal horizontal position. Suitable guards should be fixed to the supports to prevent the legs of the disabled person from moving backwards on to the wheels. Armrests shall be fitted to each side of the wheel chair and shall be of such a height and shape as to provide adequate security and prevent the disabled person from falling mid sideway out of the chair. The resting surface for arms should be of timber with adequate foam-rubber padding. Hand Rims should be fabricated from tubing. The ends should be joined by welding. The rim should be attached to the wheel by not less than four spring steel brackets secured by suitable screws. Sufficient finger room should be provided for easy manipulation of the wheel chair. The exterior surface of the rim should be free from defects, such as projecting screw heads and roughness. The wheel chair should be provided with one hand brake on each wheel individually hand-operated by levers. Brake should be lock type to prevent wheel from rolling when a disabled person is entering or leaving the chair or when the chair, including person is standing on an incline of 15° from the horizontal. The handle of the brake should extend up to seat level. The brakes should be capable of easy and comfortable operation and should not be stiff. The wheels should be fixed to the frame in such a manner that the fitting should be rugged enough to withstand the shocks during normal use. Each wheel shall be mounted on two bearings of adjustable cup and cone type. Two self-contained bearings on each axis should also be acceptable as an alternative bearing assembly. The wheels should be removable from the chair without disturbing the bearing assembly. Clothing guards should be securely attached to front and rear vertical members of the chair. The clothing guards should have double hemmed edges for mild steel guards and single hemmed edges for aluminium guards to eliminate possibility of sharp projections which might catch and tear clothing. Suitable provision should be made to lubricate the various moving parts of the wheel chair. Wheel chairs should have two swivelling spoke wheel castors, 200 mm diameter. It should have not less than 16 spokes and shall have a minimum load rating of 25 kg. The hub of the castor should have a self-contained ball bearing. The castor should be provided with a non-making, snap-on-solid rubber tyre with a 25 mm tread width. Alternatively two swivelling castors conforming to Identification No. HN 125 of IS: 4034-1968. Specification for castors for hospital equipment should be provided if specifically desired by the purchaser.

*Shape and Dimensions*—The shape of the wheel chairs is given in the above Indian Stan-

dards. However the overall dimensions for non-folding wheel chairs, Institutional Model are given below:

| *Dimensions* | *Size. mm* |
|---|---|
| Overall length | 1050 |
| Overall width | 680 |
| Overall height | 910 |
| Seat height from floor at the front | 500 |
| Seat height from floor at the back | 450 |
| Arm height from seat | 225 |
| Seat length | 430 |
| Seat width between armrest pipes | 430 |
| Back height | 380 |
| Back width at seat level | 430 |
| Back width at the top | 430 |
| Clearance of footrest to floor | 90 to 200 |
| Back clearance of frame to floor | 100 mm ± 10 |
| Mean rim diameter | 500 |

*Corrosion Resistance*—The steel is susceptible to corrosion. The corrosion is protected by putting a layer of paint or varnish or coating it with the metallic finishes like nickel, chromium, cadmium, etc.

*Workmanship and Finish*—Materials and finishes should be non-toxic. All surfaces of the wheel chair should be capable of disinfection and cleaning by the normal hospital methods for this type of equipment. All exposed metallic parts should be finished by painting or plating. When painted the colour of the paint and the number of coats should be subject to agreement between the purchaser and the supplier. Prior to painting, all parts should be degreased, rust-proofed and then suitably protected by an anti-corrosive primer, either by brushing or by spraying and then finished by spraying stoving enamel or air-drying enamel of the specified shade. In every instance each coat should be separately stoved or air-dried as the case may be. The resulting finish should be hard and should not readily chip or flake. When plated, the plating on the mild steel components should conform to Service Grade No. 2 of IS:1068-1968 'Specification for electroplated coatings of nickel and chromium on iron and steels'. The plating on brass components should conform to Service Grade No. 2 of IS:4827-1968 'Specification for electroplated coatings of nickel and chromium on copper and copper alloys'. The anodising of aluminium components should conform to Grade B or Grade D of IS:1868-1968 'Specification for anodic coatings on aluminium'. Welding should fully penetrate and should be sound in every detail. It should be finished flush on the finished stage; there should be no exposed sharp edges in the frame-work or other unsealed formations which might harbour dust. All exterior surfaces should be free from defects and protrusions to avoid hurting the disabled person or tearing his clothing.

*Tests*—The wheel chair should be subjected to a load of 75 kg. The wheel chair should be wheeled around on an even floor. The chair should move smoothly without any wobbling, rocking or rattling.

*Hazard Running Test*—The effect of this test is to subject the framework of the wheel chair to simulated conditions similar to the worst conditions ever likely to be met in use. A uniformly distributed test load of 100 kg shall be applied on the frame members which normally carry the seat. Under this load the wheel chair should negotiate, at least once in every metre of travel at 1.6 km/h, a hazard having a vertical drop of 10 mm. This test which should be of three hours uninterrupted duration, should not result in any deleterious effect on the chair, such as failure of joints or welds, breaking or flaking of enamel, wobbling and rattling. Measurements of the height above floor level of the top of the seat support members, and the width between the arms taken above the centre of the seat, shall be recorded both before and after the test. No change in dimensions should be permitted. The change in height dimensions of the seat support members should be adjusted to account for tyre

wear resulting from the test, which wear shall be computed from actual measurements of the wheel diameters taken before and after the test. For the purpose of the above test the chair may be mobile and be mechanically pushed at points on the handle roughly corresponding to the position at which an attendant's hands would be placed when wheeling the chair. Alternatively, the chair may be anchored to a stationary pillar at these points on the handle, and the wheels made to contact an oscillating platform (running on rails) or a rotating drum to which the hazards are fixed.

*Marking and Packaging*—Wheel chairs should be suitably marked with the manufacturers name, initials or recognized trade-mark and other available information as may be specified in the standard. The packaging is normally left to the agreement between the purchaser and the supplier.

## 5. ISI Certification Markings

To safeguard the interest of the consumer, ISI is operating a Certification Marking Scheme which gives a third party guarantee to the consumer that the instruments or appliances if carry ISI Marks are in accordance with the requirements of Indian Standards Specifications. ISI Mark is granted on the basis of the testing facilities available in the premises of the manufacturer, qualified personnel to test the product as per the requirements, the product satisfying the requirement of the Indian Standard Specification and their agreeing to implement the scheme of testing and inspection in their processes. There is a continuous supervision of the Indian Standards Institution for maintaining the quality of the product. In case of a complaint from the consumer, the investigation is carried out by ISI and if found substandard, the goods are replaced by the licensee besides some punitive measures taken against them.

ISI Certification Mark has been granted in case of the following two Indian Standards:

IS: 6571-1972 Non-folding wheel chairs, institution model;

IS: 7454-1974 Wheel Chairs, folding with removable armrests and swinging footrests.

## 6. Conclusion

The formulation of Indian Standards is a continuous process. Standards once formulated can be revised on the basis of comments received from all interests and also on the basis of the feed-back given to the Committee by the laboratories etc. As a result of this process, amendments to standards on wheel chairs have been issued. Ad hoc Panel for Wheel Chairs, is presently engaged in the revision of these standards in order to include the latest technological development in the field. It is hoped that with the implementation of the Indian Standards for wheel chairs, the consumer will be benefited against the use of substandard products.

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