Dynamic Splinting of the Rheumatoid Hand

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The effect of orthotic devices in the modification of hand deformities in rheumatoid arthritis is essentially unknown. Immobilization of acutely involved joints has long been known to provide symptomatic relief, and it was recently shown that immobilization also results in local improvement of joint involvement. **(Fig.1,2)** Beyond this, however, little is known about the prevention of deformities caused by rheumatoid diseases.

There is little agreement as to the significance of multiple factors in causing rheumatoid hand deformities, but there is a consensus among most authorities that synovitis, capsular distension and instability are the primary etiologic features. Mechanical stresses and various types superimposed upon an unstable joint then result in progressive deformities. **(Fig.3,4,5)** Intimately associated with the soft tissue involvement is the destruction of articular cartilage and bone.

Many clinicians believe that prolonged splinting to protect diseased joints from the adverse effects of mechanical stress might prevent or retard the development of typical deformities. This contention, however, has not been established. The ideal splint, as described by Bennett, "must permit the normal planes of motion necessary for essential function. but block all faulty planes that result in functionally significant deformity." **(Fig. 6)**

For the past seven years, a dynamic hand splint designed to maintain motion, improve function, relieve pain and prevent the progression of deformity has been used on the Rheumatoid Arthritis

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Service at Rancho Los Amigos Hospital. This device **(Fig. 1)** is similar to the paralytic splints found to be valuable in the rehabilitation of patients with residual deficits from poliomyelitis and spinal cord injuries. The splint **(Fig. 2)** has an action wrist, an action metacarpophalangeal joint with extension assist and plastic loops to support the proximal phalanx and apply a radial deviation force.

MATERIAL

During the period 1959 to 1965, sixty-one patients with definite rheumatoid arthritis were fitted with this splint. Ten patients who later underwent surgical procedures were not included in the series. Twenty-two patients (42%) wore the splint for more than one year and thirty-one patients (58%) used the splint for less than a year. Of these thirty-one, nineteen patients (36%) would not wear them at all.

Twenty-seven hands in seventeen patients, who wore the splints one to five years with a mean use period of thirty-four months, are available for review. Thirteen hands in eight patients, who were fitted but did not use the splints and were evaluated more than one year after fitting with a mean follow-up of thirty-two months, are available for comparison. The mean age of the splinted group was forty-six years, and of the comparison group forty-eight years.

RESULTS

Function:

The splint is bulky and cumbersome, and in many cases hand function was reduced. The patients with the least deformity were the ones who disliked the splints the most. It seemed that the splints decreased function in inverse proportion to the degree of deformity present. Despite many attempts, it was not possible to document increased hand function while using the splints.

Wrist:

The splints adversely affected motion in those wrists that had good extension at the beginning of the program **(Fig.

Figure 1

Figure 2

3-A). Thirteen wrists were in this group — eleven lost extension, eight lost flexion range, and three developed significant deformities. The mean loss of total range in this group was forty-seven degrees.

In the wrists with pre-existing deformity **(Fig. 3-B)** the adverse effects were not so apparent. One wrist in fourteen was improved, but there was progression of deformity in three others. The mean loss of total range in this group was only eight degrees, which is probably not a significant figure, but does indicate that wrist motion was not increased.

In the comparison group the mean extension range was thirty-two degrees initially and at final evaluation of twenty-seven degrees — a mean loss of extension of five degrees with a mean loss of total range of only seven degrees.

Metacarpophalangeal Joint:

The development of metacarpophalangeal deformities was not prevented. Nineteen per cent of the metacarpophalangeal joints that had full passive extension at the beginning of the study developed flexion deformities **(Fig. 4)**. In addition, thirty-nine per cent of these joints lost flexion range with a mean loss of total passive motion of fifteen degrees.

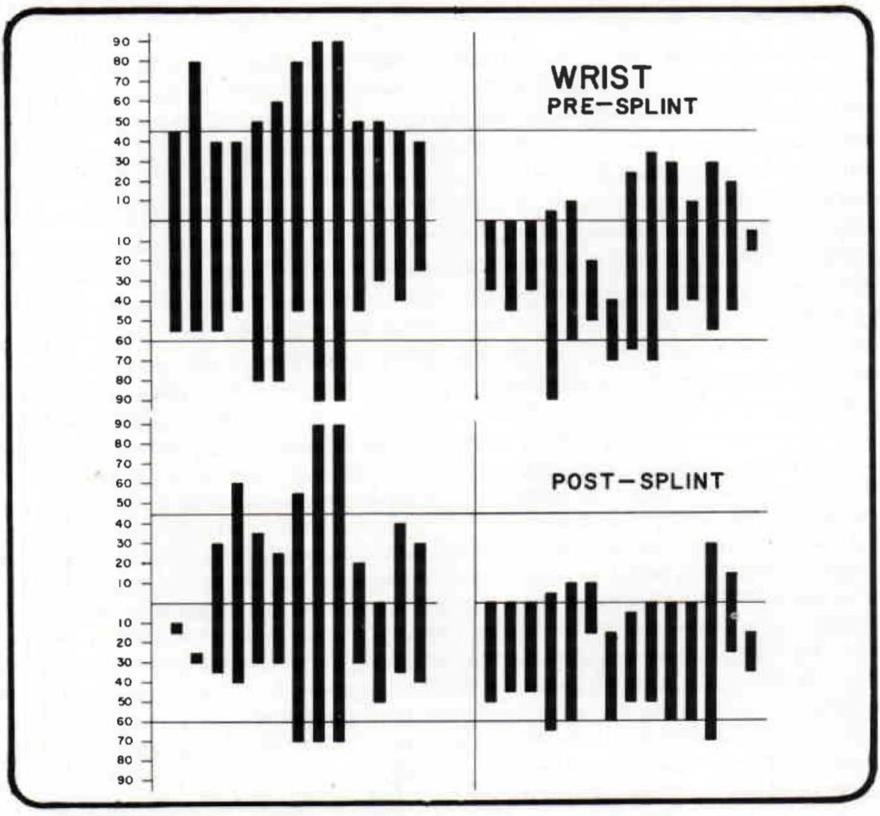
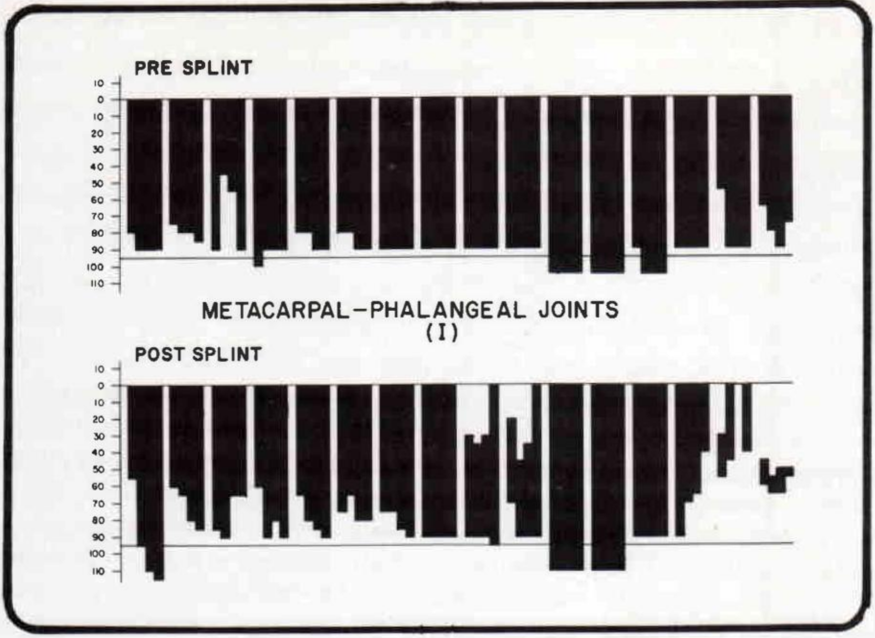


Figure 4



Correction of flexion deformities of the metacarpophalangeal joint was not consistently achieved **(Fig. 5)**. Nineteen metacarpophalangeal joints had a flexion deformity at the onset of the splint program. Of these, eight improved, eight were worse and three did not change. In addition, five more joints developed flexion deformities during the splinting program. The mean loss of total motion in this group was thirteen degrees.

In the comparison group twelve per cent of the metacarpophalangeal joints developed flexion deformities and thirty-two per cent lost flexion range. The total range, however, was essentially unchanged.

Proximal Interphalangeal Joint:

The proximal interphalangeal joint was not directly splinted, but the mechanics of this joint were altered by the splinting of the metacarpophalangeal joint. Splinting seemed to adversely affect this joint also, in that there was a mean loss of total range of fifteen degrees, which can be compared to a mean loss of seven degrees in the group that would not use the splints. This may not be a significant change.

DISCUSSION

It must be emphasized that this is a very select group of patients. The fact that these patients were cared for at Rancho indicates that their disease was more often of severe magnitude, of prolonged duration, and usually not amenable to out-patient management. Furthermore, an artificial selection occurred, in that most data was recorded during in-patient treatment, which eliminated some patients that were in remission or lost to follow-up.

The data recorded throughout was that obtained by passive motion. There are many deficiencies in this method, particularly at the metacarpophalangeal joint. It was felt, however, that because of the wide variations in active motion, depending upon the amount of pain present, that passive motion was a more consistent and thus reliable figure.

The group of patients used for comparison is extremely small. The term "control" has been purposefully and carefully avoided, for in no sense of the word can this group be considered a control. The difficulties involved in attempting to match patients with rheumatoid disease for control purposes have been widely stated. Many of these patients were fitted bilaterally and some had surgical procedures on the opposite hand, thus eliminating the opposite hand as a control. However, the comparison group does match well in terms of age, duration of follow-up and presumably the nature of their disease.

All of the patients in this series, in addition to being splinted, underwent a regular in-patient regimen of occupational and physical therapy designed to increase motion and strength, as well as correct or prevent deformity. It is not possible to separate the effects of this program as distinct from those occurring as a result of splinting. The comparison group also took part in this program, but the number of variables and size of the group prevents any real observation in this regard.

Figure 5

ACKNOWLEDGEMENTS

The conscientious and dedicated effort of the occupational therapists of Rancho Los Amigos Hospital must be acknowledged. Without their frequent, tedious and laborious recording of joint range this paper would not be possible.

CONCLUSIONS

A review of fifty-one patients with rheumatoid arthritis that were fitted with a dynamic hand splint, designed and used on the Rheumatoid Arthritis Service at Rancho Los Amigos Hospital, suggest the following:

1. Hand function was not increased while using the splints.
2. Progression of deformity was not consistently prevented.
3. Correction of pre-existing deformity was not effectively achieved.
4. Limitation of joint motion occurred that was probably greater than would be expected if the hand had not been splinted.

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