Acta orthop. scand. 46, 52–60, 1975

The Rheumatism Foundation Hospital, Heinola, Finland.

# THE NORMAL AND PATHOLOGICAL MOBILITY OF THE METACARPO-PHALANGEAL JOINT

## *An Analysis of 100 Patients*

J. E. BELTRAN

Accepted 15.x.74

The mechanics of production of ulnar drift of the fingers in the course of rheumatoid arthritis is still under discussion. However, the chain of events that finally leads to this deformity necessarily has to start at the level of the metacarpo-phalangeal joint.

Already in a very early study of the illness, infiltrations of the structures that surround the metacarpo-phalangeal joint can be found.

It is possible that capsular and ligamentous changes reduce joint stability much earlier than the appearance of bony or cartilaginous lesions (Brewerton 1957). Other causes of an exaggerated mobility of the metacarpo-phalangeal joints can be attributed to racial or geographic factors.

A degree of abnormal mobility, whatever its origin, will affect the function of the hand and will therefore influence the election of a particular surgical procedure. Consequently, we believe that the measurement of the mobility of the metacarpo-phalangeal joints can be of value not only at the moment of deciding on a certain surgical procedure, but also for the long-term study of the progressive deformities of the rheumatoid hand.

## MATERIAL AND METHODS

Measurements were made between the third and fourth metacarpo-phalangeal joints of the right hand of 100 patients admitted to the Rheumatism Foundation Hospital in Heinola, Finland, from September to November 1973. Following the same scheme 100 patients, not affected by rheumatoid arthritis, admitted to the Accident and Plastic wards of the "Ciudad Sanitaria Principes de España" in Barcelona, Spain, were measured. These latter results have been used as control material.

The ages of the patients affected by rheumatoid arthritis, varied between 21 and

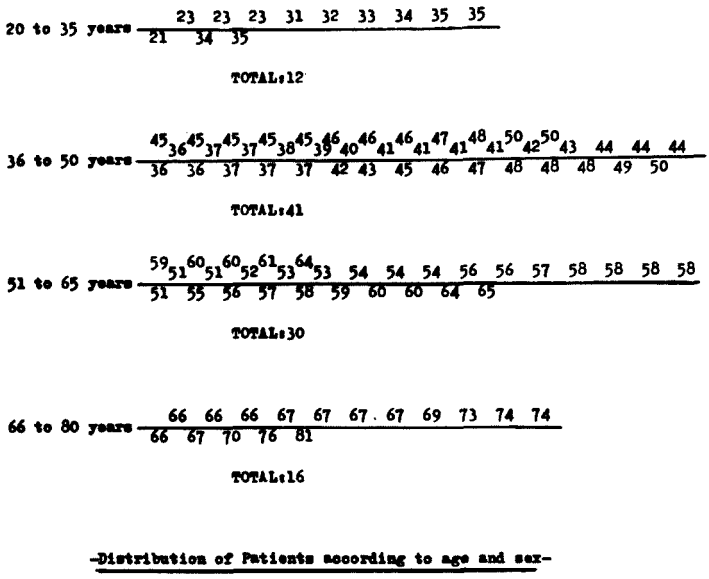



*Figure 1. Distribution of patients according to age and sex. The figures represent the exact age of the patients expressed in years. Figures above the line: females. Figures below the line: males.*

81 years. There were 33 males and 77 females (Figure 1). The duration of the illness at the time of measurement varied from 3 months to 31 years. Twelve per cent of this group of patients were under corticoid treatment.

In the control group, the ages varied between 20 and 71 years. In this group there were 67 women and 33 men. Of the two methods described by Loeb (1972) for the measurement of the mobility of the metacarpo-phalangeal joints, the one that was used is a modification of the measurement method by mutual abduction of the joints at a flexion of 90°. It is thought that this method gives more exact values for the degree of abnormal mobility, and that it is a more exact indicator of the degree of articular laxity, due to normal or abnormal causes. The mechanics of the apparatus used for these measurements is self-evident (Figure 2) and its application is shown in Figure 3. In all cases the measurements were made, forcing the reciprocal abduction of the fingers by adding weights of 1 and 2 kg (Figure 2).

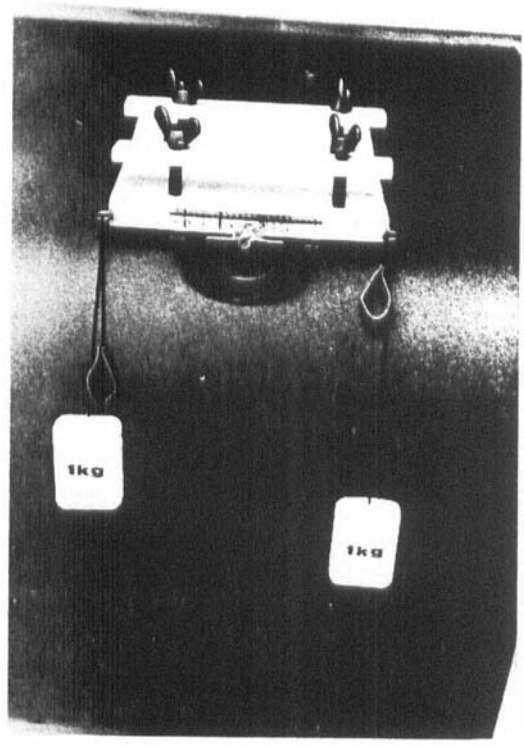
It was important when making the measurements, both in the affected group with rheumatoid arthritis as well as in the control group, to keep in mind the ages of the patients and the duration of the illness, this last parameter being a very important one for this study.

## RESULTS

### *Patients affected by rheumatoid arthritis* (Figures 4 and 5)

*Group 1:* In this series, only 26 patients had suffered from the illness for less than two years. The exact duration of the illness is im-

*Figure 2. The mutual abduction apparatus.*




possible to determine; therefore the date of onset has been taken as the date whereon each patient was diagnosed (criteria of A.R.A.) as having rheumatoid arthritis. The maximum and minimum measurements taken in this group were 30 and 10 degrees, respectively, whereas the majority gave an average result of 17 degrees of mutual abduction, when the weight used was 1 kg.

However, using a double force the values obtained rose roughly proportionally. The minimum and maximum limits of this measurement were 15 and 35 degrees, respectively. The average, however, rose from 17 degrees with a force of 1 kg to 20 degrees with a force of 2 kg.

*Group 2:* Forty-four patients had suffered from the illness for from 2 to 6 years.

In this group of patients, the forced abduction with a 1 kg weight gave 38 and 14 degrees as the absolute maximum and minimum values, the average value being 24 degrees.

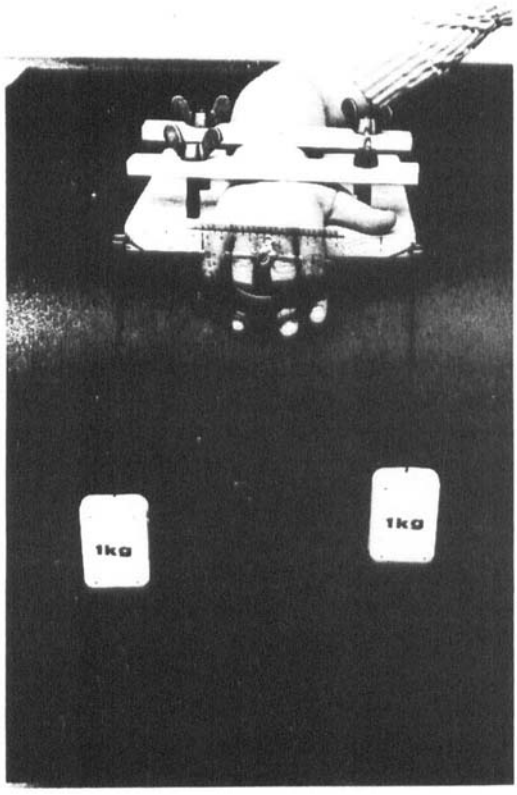



*Figure 3. The way the apparatus is used.*

Raising the force to 2 kg, the limit values rose from 24 to 45 degrees; average 34.5 degrees.

*Group 3:* Thirty patients in this series belonged to this group. They had suffered from rheumatoid arthritis for more than 6 years.

The first measurement (1 kg) gave some limit values from 18 to 53 degrees, whereas the second measurement (2 kg) gave minimum and maximum values from 26 to 52 degrees.

*Control Group* (Figure 6)

The measurements obtained in the control group varied from 8 to 32 degrees. In this group it was found that the age of the subject did not affect the degree of articular mobility. However, this study seems to point out that females have a higher degree of articular mobility than males. The measurements made on males gave a mobility arc from 8 to

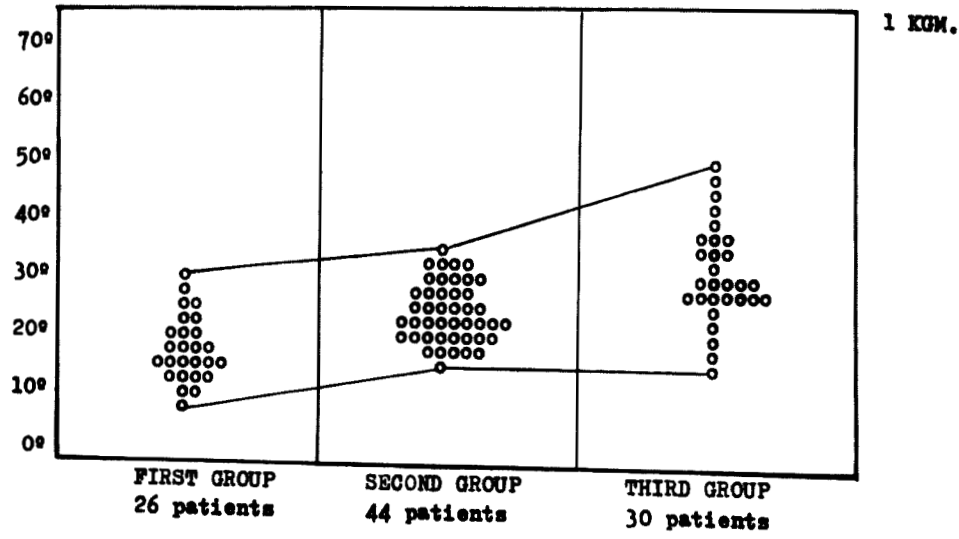



*Figure 4 a.*

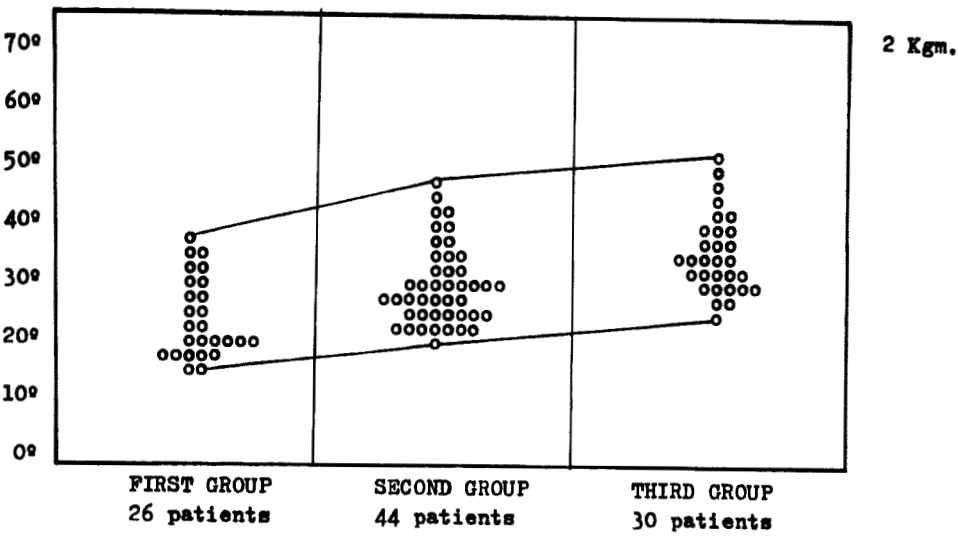


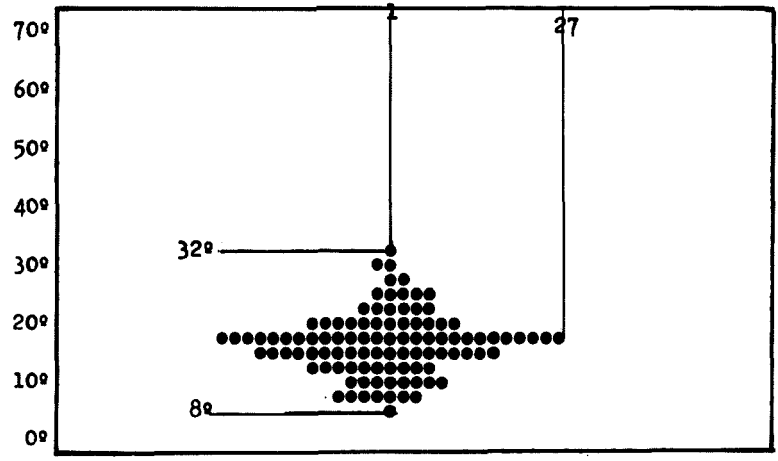

*Figure 4 b.*

*Figure 4. Rheumatoid group. Maximum and minimum measurements obtained applying 1 kg (a) and 2 kg (b) weights in the three different groups (see text).*

| | | |
|---|---|---|
| FIRST GROUP | 7 6 5 20 21 14 3 7 6 24 20 20 18 23 21<br>12 10 6 20 19 13 11 24 21 11 | less than two years<br>(figures in months) |
| | | TOTAL =26 |
| SECOND GROUP | 2 4 3 3 4 3 4 4 2 3 2 4 3 5 3 2<br>5 2 5 2 3 5 2 6 6 3 4 6 2 2 2 5<br>3 4 4 3 6 3 4 5 3 5 2 5 | from 2 to 6 years<br>(figures in years) |
| | | TOTAL=44 |
| THIRD GROUP | 20 19 24 31 7 9 10 10 11 14 15 18 7 6 9 12<br>26 24 36 6 8 17 20 29 16 13 19 29 30 6 | more than 6 years<br>(figures in years) |
| | | TOTAL=30 |

**Distribution of patients in groups according to duration of the disease**

*Figure 5. The rheumatoid group subdivided into three sub-groups according to the duration of the disease. The exact duration of each case is represented in this table.*




GROUP CONTROL
(100 PATIENTS)

*Figure 6. Maximum and minimum measurements obtained in a control, non-rheumatoid group.*

26 degrees, whereas the same measurements on females gave a mobility arc that began at 12 degrees and reached its limit at 32 degrees.

## DISCUSSION AND CONCLUSIONS

*Duration of the illness and its relationship with metacarpo-phalangeal joint hypermobility* (Figures 4, 5 and 6)

In the first group (duration less than two years) it was found that the values obtained were slightly higher than the limit values obtained in the control group; however, the majority of the patients of this group gave results which were compatible with the control ones. No patient surpassed 32 degrees (control maximum), and only one reached 30 degrees. Thus, it can be considered that this group has the same articular characteristics as those in normal people, perhaps with a statistical tendency towards joint laxity.

In the group of patients included in the second group (duration of the illness from 2 to 6 years), and even more in those in the third group, it was found that the values obtained were statistically significantly above the normal, i.e., in the second group the minimum value was 14 degrees (eight in the control group) and in the third 18 degrees. The maximum values are even more significant, as the second group reached 38 degrees and the third group 53 degrees. There is a tendency to consider that the values obtained in the three groups have a direct relationship with the duration of the illness. Logically the most destroyed joints must have some degree of greater mobility, but in view of this study there seems to be little doubt that the joints of the patients affected by rheumatoid arthritis have a greater laxity the longer the disease has been present, even in patients with no local involvement of the hand.

*Relationship between deforming forces and deformity* (Figure 7)

Raising the force employed by 100 per cent (i.e., from 1 to 2 kg) would be expected to result in a proportional rise in the values obtained in the three groups; however, it was found that raising the weight by 100 per cent in the third group, did not give proportionally higher values. In fact the maximum values obtained in the first measurement were hardly altered. The maximum values obtained in the first measurement were higher than those in the second one.

While it is easy to understand that lax structures will give to a greater extent, the greater the force applied to them (Groups 1 and 2),

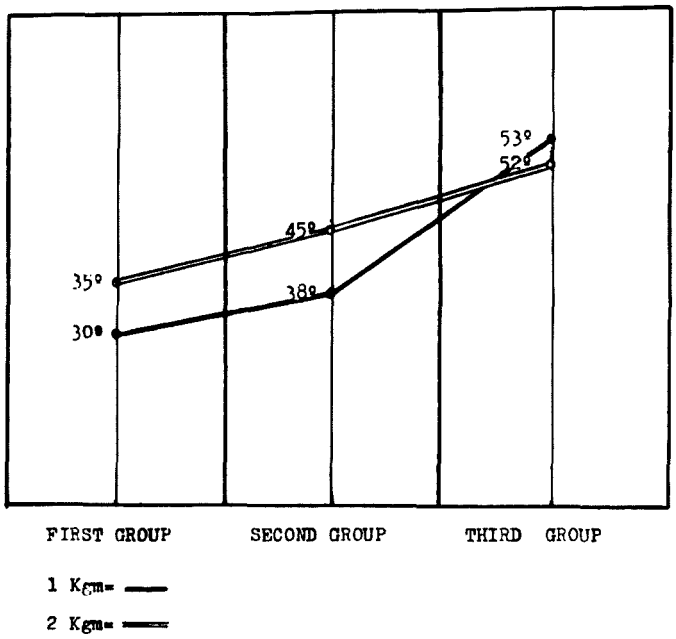



*Figure 7. Raising the force employed by 100 per cent higher proportional values were not obtained in the third group. Note that the maximum value obtained applying 2 kg is less than the one obtained applying 1 kg.*

it is difficult to understand why increasing the force in Group 3 did not result in higher values.

This could be attributable to two factors. In the first place, it is possible that a pathological joint gives without any pain under a certain amount of force. However, when this level is surpassed in a group of patients who have suffered from rheumatoid arthritis for a long time and are therefore more likely to have developed structural joint changes, protective muscle reflexes which are difficult to eradicate start to act, blocking further movement of the joint. Pain would trigger this blocking effect.

In the second place, many of the metacarpo-phalangeal joints in the third group had osteoarthritic changes which could be the cause of a mechanical block in the wider angles of abduction.

It is possible that a long-term series of measurements would confirm the clinical impression that patients who have an articular hypermobility of the metacarpo-phalangeal joints before or at the beginning of the illness are more likely to suffer marked ulnar deviation of the fingers within a few years.

SUMMARY

The pathological mobility of the metacarpo-phalangeal joints of 100 patients affected by rheumatoid arthritis was studied, and the results were analysed and compared with the results obtained in a control non-rheumatoid group.

This report seems to suggest that rheumatoid metacarpo-phalangeal joints become more lax the longer the rheumatoid disease has been present. However, when there is marked local involvement of the joint this hyperlaxity cannot be proven because of pain and/or mechanical blockage.

ACKNOWLEDGEMENTS

This report was made at the Rheumatism Foundation Hospital, Heinola, Finland as part of a Doctoral Thesis. The author is grateful to Professor K. Vainio for his help and stimulus. He is also indebted to Dr. P. Raunio for valuable discussion and to the Workshop Department for their assistance in making the apparatus used for this study.

REFERENCES

Brewerton, D. A. (1957) Hand deformities in rheumatoid disease. *Ann. rheum. Dis.* **16**, 121–124.

Loeb, W. Y. (1972) The assessment of mobility of metacarpo-phalangeal joints. *Rheum. & Physical Med.* **11**, 365–379.

Tubiana, R. & Hakstian, R. (1966) Le role des facteurs anatomiques dans les deviations cubitales. *La main rhumatismale.* G. E. M. Expansion Scientifique Française, Paris.

*Key words:* finger joints, measurement of mobility; rheumatoid arthritis

Correspondence to:

J. E. Beltran, B.Sc., M.D., M.R.C.S. (Eng.), Ph.D.
Orthopaedic Surgeon,
Servicio de Cirurgia Ortopedica
Ciudad Sanitaria "Principes de España"
Bellvitge, Hospitalet,
Barcelona, Spain