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# A test to detect hand dysfunction

**Hand function is fundamental to carrying out activities of daily living. A new, simple and quick three-part hand test has been used in a study of 4706 subjects in the age range 40–70 years. The test demonstrated a pattern of inflammatory hand disease characterised by reduced strength, reduced hand mobility, and pain caused by hand grip**

**T**HE OCCURRENCE of hand disability in able-bodied persons is unknown. This may be due to a deficiency of easily reproducible parameters for the assessment of hand function. The activities of everyday life require only a very limited number of grips or grip combinations of the hand (Evans and Lawton, 1984). Grip strength has been claimed to be an important parameter for the assessment of hand function in cases of rheumatoid arthritis (Lansbury, 1968), especially in the early stages (Dickson and Nicolle, 1972).

In the present study we decided to develop a simple self-applied hand test as an epidemiological tool. This was constructed on the basis of an index described for the assessment of joint function in rheumatoid arthritis (Helin and Rasmussen, 1983). A zero stage has been defined for hand and arm function, corresponding to the normal functioning of these joints. There are five other stages indicating worsening degrees of joint impairment. The specific purposes of the study were to investigate whether the test can be regarded as reliable, allowing the estimation of the prevalence of hand disability and what significance the hand disability had for the individual.

## The subjects tested their hand function at home

The instructions were mailed with an introductory letter. Non-respondents were sent a new scheme with a reminder.

The hand test consists of three parts, illustrated in figure 1.

(1) Ability to grasp firmly another person's hand, including all distal phalanges.

(2) Ability to hold a pencil firmly with all four fingers, with extended metacarpophalangeal (MCP) joints and maximum flexion of proximal and distal interphalangeal joints (PIP, DIP) while another person pulls the pencil with a flat pincer grip.

(3) Ability to hold on to a piece of paper firmly with rounded pincer-grip when the other person pulls the paper with a rounded pincer grip with sub-maximal strength. Hand function is considered normal when all three parts of the test can be accomplished by both hands without causing pain.

The assumptions of the test were that the flat pincer grip was weaker than the four-finger grip and the round pincer grip was weaker than the flat one (Hellin and Rasmussen, 1983). A further assumption was that subjects with known inflammatory joint disease could not carry out the test and that subjects with healthy hands could perform it.

The study population comprised all residents of Sjöbo municipality who were aged between 40 and 70 years. Some 5262 subjects were traced.

Those persons who were unable to carry out some part of the test (n=873) were called for a special examination. To check those who did succeed those born on the 19th and 29th of every month (totalling 240 subjects) were called in for control purposes.

Three groups of patients were defined based on the following criteria:

(1) those with inflammatory joint diseases with subjective complaints of morning stiffness lasting at least 30 minutes, tender joints and swelling of MCP of PIP joints of digits 2–5 coupled with objective

findings of synovitis in two or more of these joints;

(2) patients who did not fulfil these criteria but were nevertheless suspected of having inflammatory joint disease;

(3) those with degenerative joint diseases with subjective complaints of pain with or without impaired mobility, localised to PIP or DIP joints of thumb joints; objective findings of tenderness and restricted mobility of the PIP and DIP joints, periarticular deconfiguration, Heberden's or Bouchard's nodes.

Other hand diseases included a wide spectrum of complaints, such as physical injury, tendinitis, Dupuytren's contracture, and neurological diseases.

The ability of investigated subjects to cope with their occupation, household chores and ADL was assessed by interview.

To test the differences between mean values we applied Student's t-test and to test differences between proportions we used the  $\chi^2$ -test.

**Results**

Of the 5262 subjects comprising the population, 4706 answered the inquiry. Of these 55 had to be excluded because of incomplete answers or because the respondent could not co-operate due to illness or disease. The response to the first mailing was 3739 (71%), with a further 967 (18%) after the reminder. There was a higher response among older subjects. Altogether 873 screened persons were called to the examination; of these 758 actually reported.

Of the 758 subjects who stated that they had been unable to carry out the test on their own 689 were 'positive' according to the physician's later assessment. The predictive value of a positive screening test was thus 91%. The prevalence of hand dysfunction for the entire population was 13%.

Of 240 randomly chosen who were negative on screening 215 reported for the investigation. Of these 195 accomplished the test while 20 were incapable. The predictive value of a negative screening test was thus 91%.

As regards the distribution of disability, table 1 shows that degenerative diseases

**Figure 1 Can you shake hands firmly, hold a pencil and grip a piece of paper without feeling pain?**



accounted for nearly half of the cases whereas inflammatory diseases accounted for 17% and other hand complaints 35%. The proportion of women in the inflammatory group was 71% and in the other groups, approximately 65%. In the degenerative group 66% were over 55-years old while in the inflammatory group the corresponding proportion was 55% and for the group with other hand complaints, 44%.

Work capacity was assessed in all persons aged 40-64 years (n=556). As table 2

shows 49% were fully able to cope with their occupation, 28% could manage to a limited extent while 10% were completely incapacitated. In the age group 40-54 years 57% could cope with their job compared to 40% of 55-64-year olds. Those with an inflammatory hand disease had greater disability than those in the other two diagnostic groups (p<0.001).

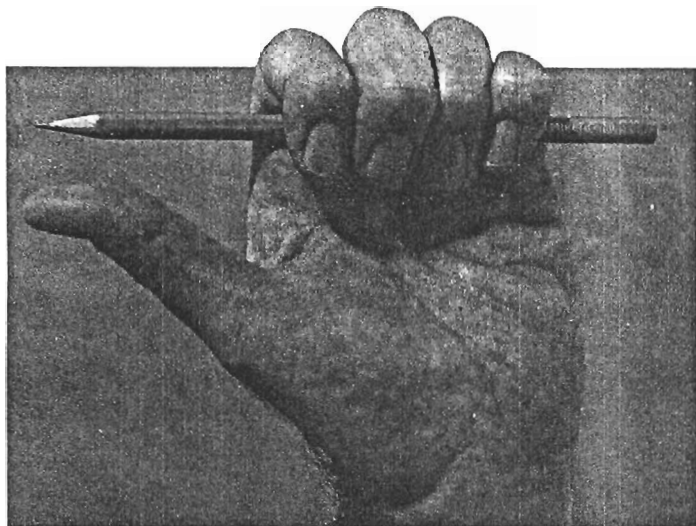
Some 53% were able to cope with housework though barely one-third could cope with the heavier chores. Those with inflammatory hand disease did not man-

**Table 1 Subjects who were unable to carry out some part of the self-test, distributed according to diagnostic group, age and sex**

Age	Sex	Diagnostic group			Total
		Inflammatory hand disease	Degenerative hand disease	Other hand disease	
40-54	Men	14	35	42	91
	Women	40	76	93	209
55-70	Men	20	83	42	145
	Women	45	134	65	244
Total	Men	34	118	84	236
	Women	85	210	158	453
	Total	119	328	242	689

**Table 2 Persons (aged 40-64 years) unable to carry out some part of the self-test, distributed according to work capacity and to diagnostic group (percentages)**

Work capacity	Diagnostic group			Total
	Inflammatory hand disease	Degenerative hand disease	Other hand disease	
Managed completely	22	57	53	49
Managed partly	43	26	22	28
Completely incapacitated	20	6	10	10
Not applicable	16	11	15	13
Total (%)	100	100	100	100
N	96	251	209	556



age as well as the other two groups ( $p < 0.001$ ).

More than 90% managed ADL completely, 5% to a limited extent, and 1% were completely dependent on assistance. With regard to ADL ability in relation to diagnosis: those with an inflammatory hand disease fared worse ( $p < 0.001$ ) than the other groups.

Nearly half of the total population required some form of referral or treatment. For patients with an inflammatory joint disease the proportion was 80% while for those with a degenerative joint disease it was 50 and for other hand diseases, 33%.

Patients could have one, two, or even three limitations of hand function in any combination.

The distribution of handicaps in relation to the three diagnostic groups shows the inflammatory group to be distinctly different from the other two groups. Two-thirds of the patients with inflammatory hand disease had three limitations, while in the other two groups two-thirds of patients had only one limitation.

## Discussion

A simple test in primary care that can establish, by means of acceptable parameters, the early threat to hand function has long been sought.

We have described the various procedures in a hand test that can be applied quickly and simply to assess the strength and flexibility of the hand and to ascertain if there is pain under load. We have demonstrated that the strength of the four-finger grip is diminished if the investiga-

tor can draw out a pencil from the subject's closed hand with a flat pincer-grip. Furthermore, the strength of the four-finger grip can be increased by flexing the knuckles. The patient should grip the pencil with straight knuckles and the investigator with a flat pincer-grip to make the test as sensitive as possible.

These results are in agreement with those of other investigators (Mathiowetz *et al*, 1985; Thorngreen, 1979; Wright 1959) who have used various types of measuring apparatus to evaluate the strength of the same grips as used in our hand test.

The reliability of the test when carried out by the examinee was high. We found a predictive value of 91% for both positive and negative results among those screened. However, it must be stressed that the investigation was not made concomitantly with the screening test. It was also impossible to control all the 5262 subjects who were screened and therefore it is not possible to determine the sensitivity and specificity of the test.

Inflammatory hand diseases revealed a distinctive pattern. This could be anticipated as the test measures pain under load, restricted mobility and diminished strength, which are symptoms resulting from the inflammatory process.

In primary health care one can let the patient be responsible for measuring his or her own hand function. If one combines the self-applied hand-test with a clinical investigation of those with a positive screening result, one can elicit information about the prevalence of hand disability. In this population study the prevalence

amounted to 13% of which two-thirds were unknown to the medical authorities. In future studies we shall pursue the hypothesis that the test can be used to screen for rheumatoid arthritis in an early stage. The theory is based on the fact that RA often makes its appearance first in the hands and that the variables used in the test are a consequence of the inflammatory process.

Early intervention in hand diseases could lead to earlier and better therapy. At the same time one must be aware that to detect and treat the small fraction of inflammatory joint diseases it will be necessary to investigate large numbers of people, with minor hand disabilities who will not require any treatment. For a better understanding of this problem prospective studies are needed.

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