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CHAPTER **ONE**

GENERAL INTRODUCTION



OSTEOARTHRITIS OF THE HAND

Osteoarthritis (OA) is the most prevalent joint disorder leading to serious functional limitation and reduced quality of life, as well as to considerable social and economic costs¹⁻³. The hand is one of the most common sites of OA. Hand OA frequently occurs together with OA at other joints such as the hip or knee¹.

Prevalence

Prevalence rates of hand OA vary depending on definition, measurement methods, and study populations. Some authors report prevalence data on radiographic OA, which is not necessarily associated with pain and disability, while others concentrate on symptomatic OA, whose prevalence is considerably lower⁴.

In the hand, the distal and proximal interphalangeal (DIP and PIP) joints, as well as the trapeziometacarpal (TMC) joints, are most often affected by OA. Symmetrical localisation in the same joints of the two hands is often seen, as well as clustering by row (DIP or PIP joints) and by ray (finger)^{5, 6}. Radiographically proven hand OA is most prevalent in the DIP joints (35 - 54%), followed by the TMC joints (7 - 21%), and the PIP joints (8 - 18%)^{4, 7, 8}. Both hand and TMC OA occur more frequently in women and their prevalence increases significantly with age^{4, 7, 8}.

In the 60-70 age group, prevalence rates of radiographically proven TMC OA are between 24%⁷ and 57%⁹ and increase up to 91% in people over the age of 80^{7, 9}. In contrast to radiographic TMC OA, only 2.9% of women in a population older than 60 years report symptoms at the thumb base¹⁰.

Aetiology

Hand OA has a multifactorial aetiology, and can be considered the product of an interplay between systemic and local risk factors¹¹. Age seems to be the most important determinant^{1, 3, 12, 13}. Furthermore, family disposition plays a major role, with genetic factors contributing up to 59% of the variance of risk for developing hand OA^{1, 12, 14}. Recent studies further suggest an association of hand OA with obesity, repetitive joint use, bone mineral density, a history of hand injury, joint laxity, and generalised OA^{1-3, 8, 12, 13, 15}. As men have a significantly lower risk of 0.81 for hand OA than women¹⁶, the role of hormones in postmenopausal women has been discussed with conflicting conclusions¹².

Diagnostic and classification criteria

There are no uniform criteria for the diagnosis and classification of hand OA¹³. The American College of Rheumatology (ACR) Committee on Diagnostic and Therapeutic Criteria defined and validated the system most frequently used for the classification of hand OA (Box 1)¹⁷.

These classification criteria are intended to select the clinical features which identify those with hand OA and which separate them from patients without hand OA. This set of criteria has a sensitivity of 94% and a specificity of 87%¹⁷. It is useful for the classification of hand OA as a single entity for study purposes but it is not intended for use in the diagnosis of an individual patient^{3, 17}.

For the diagnosis of hand OA, the European League Against Rheumatism (EULAR) published ten key recommendations based on research evidence and expert consensus (Box 2)¹⁵. They are intended to assist clinicians in diagnosing hand OA but, unlike the ACR classification criteria, not to classify hand OA for research¹⁵.

Box 1 The American College of Rheumatology (ACR) classification criteria for osteoarthritis of the hand¹⁷

Hand pain, aching, or stiffness AND 3 or 4 of the following features:

- Hard tissue enlargement of 2 or more of 10 selected joints*
- Hard tissue enlargement of 2 or more distal interphalangeal (DIP) joints
- Fewer than 3 swollen metacarpophalangeal (MCP) joints
- Deformity of at least 1 of 10 selected joints

* The 10 selected joints are the 2nd and 3rd DIP, the 2nd and 3rd PIP, and the TMC joints of both hands

Box 2 Summary of recommendations for the diagnosis of hand OA, as defined by the EULAR¹⁵

- Consider risk factors.
- With typical symptoms (pain, stiffness, intermittent symptoms, and characteristic sites) a diagnosis can be made in adults aged over 40.
- Clinical hallmarks of hand OA are Heberden and Bouchard nodes and / or bony enlargement.
- Functional impairment in hand OA may be as severe as in rheumatoid arthritis.
- Patients with polyarticular hand OA are at increased risk of knee OA, hip OA and generalised OA.
- Recognised subsets with different risk factors, associations, and outcomes include interphalangeal joint OA, thumb base OA, and erosive OA.
- Erosive hand OA has specific characteristics.
- The differential diagnosis for hand OA is wide. Consider psoriatic arthritis, rheumatoid arthritis, gout, and haemochromatosis.
- Plain radiographs provide the gold standard for morphological assessment of hand OA.
- Blood tests are not required for diagnosis of hand OA but may be required to exclude coexistent disease.

Clinically, hand OA presents with pain, stiffness, reduced hand function, and restriction of movement^{18, 19}. Other symptoms include crepitus, joint deformity, or joint swelling leading to patients being dissatisfied with the appearance of their hands (Figure 1)^{18, 20, 21}. In addition to the history and clinical examination, the diagnosis of hand OA is often confirmed on radiography¹⁵.

Thumb base OA

Osteoarthritis at the base of the thumb occurs as a result of degenerative changes in the TMC joint. It may be associated with generalised osteoarthritis or it may rarely arise as a consequence of trauma or injury²². In the osteoarthritic TMC joint, the joint space width is decreased because of a reduction in cartilage thickness as well as a loss of bone stock²³. Furthermore, the scaphoid-metacarpal distance is reduced by a combination of subluxation, ligament laxity, and loss of cartilage or even trapezium bone²³.

Patients affected by TMC OA usually complain of pain at the base of the thumb with some distal and proximal radiation, thumb weakness, and crepitus at the thumb base^{18, 19, 22}. They



Figure 1 Hand OA with swollen PIP and DIP joints and a thumb adduction contracture

typically report difficulties or pain during pinch related activities such as writing or grasping small objects²². Clinically, there is often a dorso-radial subluxation and / or an adduction contracture (Figure 1), preventing the patient flattening the hand¹⁸. Subluxation and laxity of the joint are present in the early stages of the disease, while the joint becomes stiff in the later stages²⁴. In order to compensate for the limited flexibility of a stiff and adducted thumb, hyperextension of the metacarpophalangeal (MCP) joint, known as Z-deformity, is often seen (Figure 2)^{24, 25}. This compensatory mechanism allows the patient to abduct the thumb far enough to grasp large objects²⁴.

Two specific clinical tests for OA at the TMC joint are the axial grind test and the traction-shift test²⁶. For the grind test, the examiner rotates the metacarpal bone under axial compression in the direction of the trapezium^{20, 24}. The traction-shift test provokes subluxation and subsequent relocation of the TMC joint through alternated dorsal and palmar pressure at the base of the metacarpal bone under traction. Both tests are positive when the procedure elicits pain^{22, 26}. However, the traction-shift test shows greater sensitivity and specificity than the grind test²⁶.

If TMC OA is suspected, physicians usually confirm the diagnosis by plain radiographs (Figure 2)²². In the literature, staging of radiographically proven TMC OA according to Eaton²⁷ is very common, although its inter-rater reliability remains questionable²⁸. Looking at the radiograph, the examiner should also consider the scaphotrapeziotrapezoid joint, because symptoms may also originate from this site²².



Figure 2 Radiograph of the right hand showing a TMC OA grade IV according to Eaton and a Z-deformity of the MCP joint.

PATIENTS' LIMITATIONS IN DAILY LIFE

A comprehensive framework to describe functioning and disability is the International Classification of Functioning, Disability and Health (ICF)²⁹. The ICF defines functioning as a complex interplay between the health domains of body functions and structures, activities and participation, personal factors, and environmental factors²⁹. Hand OA leads to considerable functional consequences, which can be allocated to the first two domains and are influenced by personal and environmental factors^{19, 30}.

Patients affected by hand OA usually report significant restrictions in their daily life. Pain combined with reduced finger joint mobility and decreased grip strength forces the patient to reduce his daily hand-related activities or even to avoid special tasks. The most commonly described difficult tasks are wringing out washcloths, and opening jars and bottles¹⁰. In a population of more than 2,000 US people older than 60 years, 38% of the persons with symptomatic hand OA report difficulties with carrying an object of approximately 4.5kg. Dressing and eating was difficult for 23% and 14% of these people, respectively¹⁰. Furthermore, patients complain about aesthetic aspects of their hands^{3, 20, 21}. Overall, hand OA leads to a considerable reduction of health-related quality of life^{3, 21, 31}.

Osteoarthritis at the thumb base causes substantially more pain and disability than OA of the PIP or DIP joints, which has been shown in a population of 308 patients with OA at different joints of the hand³². If a patient suffers from TMC OA, both pinch related activities and grasping large objects exacerbate pain^{22, 24}. Typically, writing, moving small objects, turning keys in locks, and unscrewing jar tops, are most uncomfortable for the patient^{22, 24}.

A particular issue in daily life is the opening of different kind of packaging. Rahman et al.³³ evaluated the forces applied to different household containers by healthy elderly persons. Their results show that people found it most difficult to apply force to a small medicine bottle requiring push-down and rotational movements³³. An analysis of a Dutch web-based medicine reporting system, where individuals can report their experience with medicine anonymously, revealed that 10% of the reports concerned the package of the drug³⁴. Primarily, patients complained about difficulties in opening the package, such as blister packs or bottles³⁴.

Another relevant issue is the opening of food containers. Up to 90% of people older than 60 years experience difficulties opening peelable packaging, such as cheese / meat packaging or are even unable to do so³⁵. In particular, patients with hand disorders have problems in opening food containers due to pain, loss of grip strength, and reduced dexterity³⁶⁻³⁸. Due to the ageing society, the number of people with hand conditions and thus difficulties opening packaging will rise correspondingly. Packaging of the future should therefore be developed according to the needs of the consumers³⁹.

MANAGEMENT OF HAND OA AND TMC OA

Management of hand OA

Treatment options for patients with hand OA include pharmacological, non-pharmacological, and surgical procedures^{1,40,41}. As hand OA is heterogeneous regarding its clinical and radiological presentation, the treatment strategy has to be considered for each patient individually¹. There are various therapeutic approaches, depending on the site of OA, the degree of pain and disability, and the patient's expectations¹. The EULAR developed eleven recommendations for the management of hand OA (Box 3)⁴².

Because of the considerable and diverse functional consequences of hand OA, multidisciplinary and multidimensional rehabilitation programmes have been proposed^{19,43}. However, there is no

Box 3 Summary of recommendations for the management of hand OA defined by the EULAR⁴²

- Individual combination of non-pharmacological and pharmacological treatment.
- Treatment according to the individual clinical presentation and patient characteristics.
- Joint protection education and exercises.
- Heat and ultrasound are beneficial.
- Orthoses for TMC OA are recommended.
- Local treatment is to be preferred over systemic treatment.
- Paracetamol is the oral analgesic of first choice.
- Oral non-steroidal anti-inflammatory drugs (NSAIDs) should be used at the lowest effective dose and for the shortest duration.
- Symptomatic slow acting drugs for osteoarthritis (SYSADOAs) may give symptomatic benefit.
- Intra-articular injection of long-acting corticosteroid is effective.
- Surgery is effective for severe TMC OA and should be considered when conservative treatment has failed.

evidence about the effectiveness of a non-pharmacological treatment programme in the short term⁴⁴, as can be seen, for example, in patients with rheumatoid arthritis^{45, 46}.

Conservative management of TMC OA

For TMC OA, treatment strategies consist of either conservative or surgical management, with corticosteroid injections, splinting, and resection arthroplasty being the most popular interventions⁴⁷.

Conservative management includes injections, splinting, hand exercises, activity modification, acupuncture, heat, electrotherapy, and analgesics^{22, 48}.

In a survey among more than 1100 American hand surgeons, 89% of the responders reported preferring corticosteroid injections in the conservative treatment of TMC OA, while the rest use hyaluronic acid or do not usually give injections⁴⁷. Other healthcare providers involved in the conservative management of TMC OA are physiotherapists and occupational therapists. In contrast to surgeons, they use a range of treatment strategies with no predominant methods⁴⁸. Splinting, exercise therapy, and advice on activities of daily living are the most commonly used treatment modalities⁴⁸.

Corticosteroid injections can significantly reduce pain in the short term, with a single injection being effective for about 4 weeks to 6 months⁴⁹⁻⁵². It has also been shown that patients with early stages of TMC OA (Eaton stage I or II) reported longer symptom improvement (median 17 weeks) compared with patients in stage III or IV (median 4 weeks)⁵².

If therapists decide to splint the thumb, there are two possible types of orthosis for patients with TMC OA: a soft neoprene splint or a custom-made rigid thermoplastic orthosis (Figure 3). There is evidence that both types decrease pain and improve hand function, with the soft neoprene splint being more comfortable for the patients⁵³⁻⁵⁵.

Exercise therapy includes exercises to strengthen the intrinsic thenar and extrinsic thumb muscles in order to improve joint stability²². Stretching of the first web space may help to prevent an adduction contracture²². Exercise therapy seems to have only a minor effect on pain and hand function, although it might increase grip strength in patients with TMC OA for a short time^{53, 54, 56}. In the long-term, however, pain relief from various conservative treatment strategies (drug therapy, physiotherapy, orthoses, and corticosteroid injections) has not been observed⁵⁷. Since evidence for the long-term effectiveness of conservative management is limited, Damen et al. suggested operating on the patient, especially in cases where pain is limiting the patient's daily activities⁵⁷.

Surgical management of TMC OA

Surgical treatment options include trapeziectomy alone or in combination with ligament reconstruction (LR), tendon interposition (TI), or both (LRTI). Other surgical treatments are arthrodesis of the TMC joint, implant arthroplasty, arthroscopic or open debridement of the TMC joint, metacarpal osteotomy, and partial trapeziectomy with or without interposition^{47, 58}.

Trapezium resection with LRTI was the primary choice for 62 - 68% of American hand surgeons who had performed surgery^{47, 58}. Evidence about the superiority of one procedure over another in terms of pain reduction and restoration of hand function is, however, limited⁵⁹⁻⁶¹. Some studies suggest that trapeziectomy alone results in fewer adverse events than trapeziectomy with LRTI⁵⁹⁻⁶¹. Whether LRTI produces better long-term outcomes because of the preserved scaphoid-metacarpal distance has still to be confirmed⁶¹.



Figure 3 Soft neoprene splint (left) and rigid custom made TMC splint (right)

The hand surgeons in the Schulthess Clinic (Zurich, Switzerland) primarily perform the LRTI according to the description of Epping⁶² or Weilby⁶³ using the flexor carpi radialis (FCR) tendon as interpositional material (Figure 4):

Both surgical techniques start with a curved incision over the radial aspect of the wrist using a modified Moberg technique. The branches of the superficial radial nerve are located and preserved. Using blunt dissection, the radial artery is identified in the fatty tissue between the tendons of the extensor pollicis brevis and extensor pollicis longus and protected as well. The wrist capsule is opened and the trapezium is removed, taking care to preserve the FCR tendon which runs deep to the bone. A second incision is made in the mid-forearm in the proximal course of the FCR tendon. The ulnar half of the tendon is released proximally and mobilised distally to its insertion on the base of the second metacarpal bone. Ligament reconstruction according to Epping is realised by pulling the FCR tendon strip through a channel drilled at the base of the first metacarpal bone. After pulling it tight, the tendon slip is blocked with a trapezium fragment and sutured at the metacarpal base. Using the Weilby technique, the FCR tendon strip is wound around the abductor pollicis longus (APL) tendon and fixed in the remaining portion of the FCR tendon. Finally, in both techniques, the tendon is rolled up and placed in the gap remaining between the distal part of the scaphoid and the first metacarpal

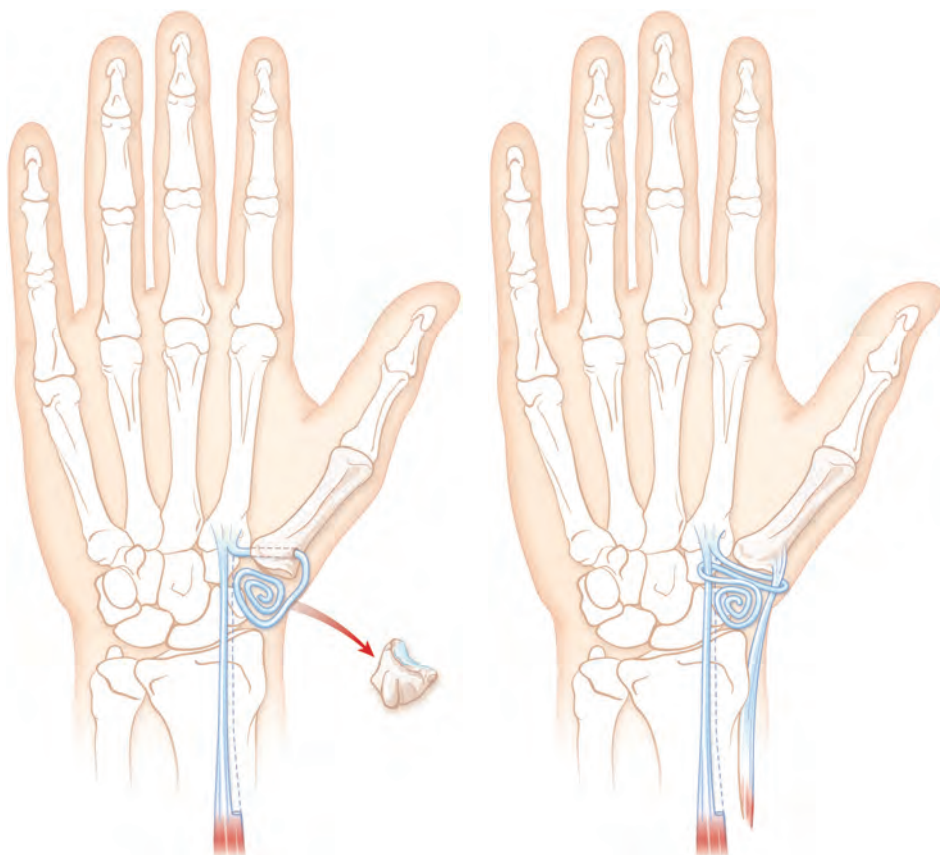


Figure 4 Trapeziectomy with ligament reconstruction and tendon interposition, according to Epping (left) and Weilby (right)

bone. The wrist capsule is closed with interrupted absorbable sutures and wound closure is accomplished using an intracutaneous running suture.

After surgery, all patients follow a standardised rehabilitation protocol consisting of specific instructions, splinting, and hand therapy.

OUTCOME MEASURES FOR PATIENTS WITH HAND OA

Standardised and validated outcome measures are essential to monitor the disease process and to evaluate its outcome¹³. Nowadays, it is not only patients and healthcare professionals who are interested in outcomes, but also hospital managers, lawyers, policy-makers, and the media⁶⁴.

Several specific sets of outcome measures, known as core sets, are relevant for evaluating patients with hand OA. Based on the ICF, a comprehensive and a brief core set have been developed and validated in order to assess patients with any hand condition⁶⁵⁻⁶⁸. These two detailed and complex core sets are known mainly to therapists and are not widely implemented

in clinical practice. A simpler, more general core set of outcome measures for hip, knee, and hand OA was introduced at the Outcome Measures in Rheumatology (OMERACT) III conference. It comprises the assessment of pain, physical function, patient's global assessment, quality of life, and joint imaging⁶⁹. These three core sets do not recommend specific outcome measures but rather areas that are relevant for patients with conditions affecting the hand⁶⁵⁻⁶⁹. The outcome measures that should be used for a comprehensive assessment of the disease status and treatment outcome in patients with hand OA have not yet been defined⁶⁴.

There are several ways to categorise outcome measures. Categories can be based on the ICF domains or OMERACT dimensions, on the body region, or on the type of outcome measure. Different types of outcome measure include clinical tests, imaging, performance tests, and patient-reported outcome measures (PROMs).

Clinical tests are the traditional way of evaluating hand function and include the assessment of grip strength and joint range of motion, which provides an objective analysis of the disease status⁷⁰.

Radiographs are reviewed to determine the stage of osteoarthritis in the affected joint and comorbidities of other joints which might influence the patient's complaints²². The Kellgren-Lawrence score, a grading system for OA of any joint, is widely used for staging hand OA⁷¹. Eaton and Littler developed a specific staging system for TMC OA²⁷. While the Kellgren-Lawrence score shows good reliability^{72,73}, the inter-rater reliability of the Eaton classification remains questionable²⁸.

Performance tests ask the patient to carry out standardised tasks similar to those of everyday daily life. Most tests use the time taken to complete the task as an outcome measure. Examples include the Arthritis Hand Function Test⁷⁴, the Jebsen Hand Function Test⁷⁵, and the Purdue Pegboard Test⁷⁶. However, there is a lack of evidence with respect to the extent to which these tests provide methodologically sound measurement properties⁶⁴.

The methods mentioned above do not take into account any subjective evaluation based on the patient's self-assessment of pain, activities of daily living (ADLs), and the ability to return to a previous occupation. In recent years, therefore, subjective evaluations have emerged as increasingly important outcome measures in hand surgery⁷⁰.

PROMs comprise single questions or questionnaires, in which patients rate their pain, hand function, limitations in ADLs and participation, as well as their quality of life. Different PROMs for patients with hand disorders have been reviewed in the literature^{13, 64, 70, 77-82}. However, there is no consensus on tools most appropriate for assessing activity limitations and participation restrictions from the patient's perspective⁶⁴.

For TMC OA, Angst et al. proposed a core set to assess outcomes after resection interposition arthroplasty⁸³. It consists of the Short Form 36 (SF-36), the Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) or the Patient-Rated Wrist Evaluation (PRWE), and a customised form including assessment of range of motion, strength, and other clinical tests. Although showing good construct validity in this particular study, the reliability of the customised form and the responsiveness of the whole set have not been investigated. An overview of the PROMs validated for patients with either hand OA or TMC OA is given in table 1.

Table 1 Overview of patient-reported outcome measures (PROMs) used for assessing patients with hand OA and TMC OA

Questionnaire	Specific for	Content	Validation studies available for hand OA	Validation studies available for TMC OA
AUSCAN ⁸⁴	Hand OA	15 items divided into 3 subscales: pain, stiffness, and hand function	✓ 85-88	✓ 89
Australian / Canadian Osteoarthritis Hand Index				
FIHOA ⁹⁰	Hand OA	10 items about ADLs	✓ 88, 90, 91	✓ 90*
Functional Index for Hand Osteoarthritis				
MHQ ⁹²	Hand disorders	37 items divided into 6 subscales: hand function, ADLs, pain, work performance, aesthetics, and satisfaction with hand function; gives scores for each hand separately	✓ 93-95*	
Michigan Hand Outcomes Questionnaire				
Brief MHQ ⁹⁶	Hand disorders	12 items including pain, function, ADLs, work, aesthetics, and satisfaction	✓ 94*	✓ 96*
Brief Michigan Hand Outcomes Questionnaire				
PEM ⁸⁰	Hand disorders	18 items divided into 3 parts: Process of treatment, hand function and pain, and overall assessment	✓ 97-99	
Patient Evaluation Measure				
SACRAH ⁹⁷	Rheumatic hand disorders	23 items divided into 3 subscales: hand function, stiffness, and pain	✓ 101	
Score for the Assessment and Quantification of Chronic Rheumatic Affections of the Hand				
Rheumatic Affections of the Hand				
Cochin scale ¹⁰⁰	Rheumatic hand disorders	18 items about ADLs	✓ 89, 103, 104	✓ 83, 89, 105
PRWE ¹⁰²	Hand / wrist disorders	15 items divided into 2 parts: pain and hand function	✓ 94, 103, 104*	✓ 83, 89, 107
Patient-Rated Wrist Evaluation				
DASH ¹⁰⁶	Upper extremity disorders	30 items including pain and hand function	✓ 104, 109*	✓ 110
Disabilities of the Arm, Shoulder and Hand Questionnaire				
quickDASH ¹⁰⁸	Upper extremity disorders	11 items including pain and hand function		
quick Disabilities of the Arm, Shoulder and Hand Questionnaire				

* Only part of the study population consists of patients with hand OA or TMC OA

THE CONCEPT OF PATIENT SATISFACTION

The evaluation of patient satisfaction is becoming more and more important in the assessment of treatment outcome. Satisfied patients show increased treatment compliance and are more likely to return to the same healthcare provider^{80,111}.

Patient satisfaction is a complex construct. It is a very individual experience and linked to specific personal characteristics and specific situations that makes the rating of each patient unique⁸⁰. Weaver et al. defined treatment satisfaction as “a recipient’s rating of or report on salient aspects of the process and the results of his or her treatment experience according to predetermined criteria”¹¹². It can be regarded as a cognitive evaluation or an emotional response to a given situation⁸⁰.

Quantifying satisfaction is demanding because of the influence of a variety of, so far, poorly defined factors on the patient’s perception of a satisfactory outcome^{80,113}. There are several dimensions which contribute to the individual perception of satisfaction (Figure 5). On the one hand they include aspects such as facilities, service features, continuity of care, humaneness, and competence, and on the other hand, the process and outcome of the treatment^{80,114}. Furthermore, patient satisfaction is influenced by specific personal characteristics comprising expectations, demographics, and personal preferences¹¹⁵.

In the context of quality management, many healthcare institutions have already taken action to monitor patient satisfaction with respect to processes and services^{113,116}. Assessing treatment satisfaction has also become increasingly popular¹¹³. However, clinicians and

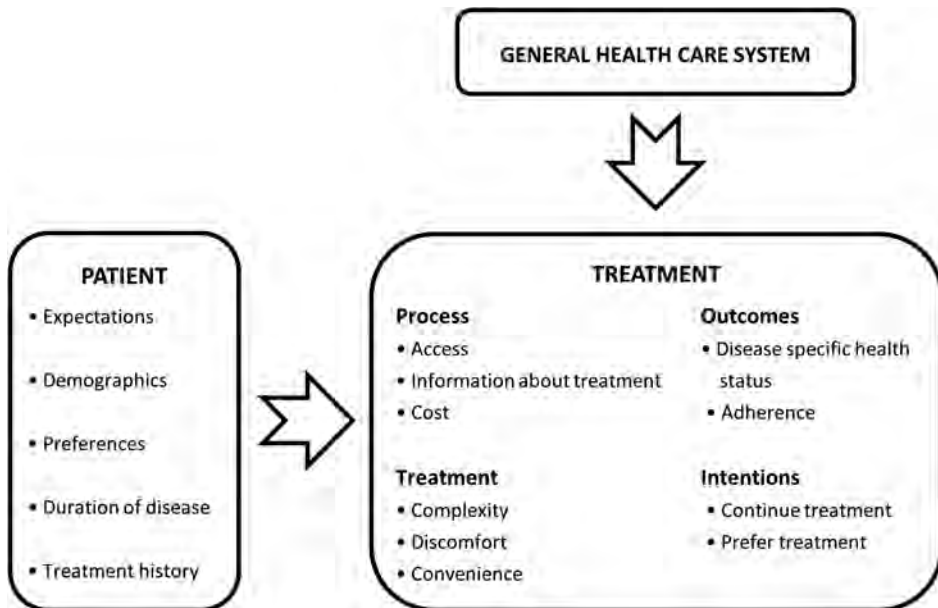


Figure 5 Concept of patient satisfaction (adapted from Revicky¹¹⁵). Satisfaction is determined by various factors pertaining to the patients themselves, the process, outcomes, treatment characteristics and intentions, as well as by the general health care system.

researchers are using several tools to evaluate treatment satisfaction, including various Likert scales and questionnaires of equivocal methodological quality, which precludes statistical comparisons of the different studies¹¹³.

In hand surgery, studies have shown that objective parameters do not necessarily correlate with the patient's perception of treatment success. Several researchers have described the discrepancy between objective and subjective outcome assessments following orthopaedic interventions on the hand¹¹⁷⁻¹¹⁹. For example, Mandl et al. revealed that objectively quantified outcomes following metacarpophalangeal (MCP) arthroplasty are not necessarily associated with the subjective satisfaction of the patient¹¹⁷. In particular, strength as well as range of motion showed only low to moderate, non-significant correlation with patient satisfaction. MacDermid et al. support these results in that they found no significant correlation between strength, range of motion, radiographic findings, and patient satisfaction following joint arthroplasty in patients with TMC OA¹¹⁸. These findings emphasise the importance of assessing patient satisfaction instead of only objective outcomes and should encourage doctors to reconsider their primary outcome measure¹¹³.

ECONOMIC ASPECTS OF HAND OA

The severe limitations in daily life faced by people with hand OA may also affect their working ability³⁸. On average, employees with OA in any joint are absent from work for 20 days per year¹²⁰. Patients with hand OA sometimes even have to take early retirement due to their hand problems³⁸. With increasing retirement age, the issue of future employment restrictions for people with hand OA is likely to become more pronounced³⁸. The relevance of costs associated with absence from work is substantiated by data from the Netherlands¹²¹. In patients with hand and wrist injuries, the costs of working days lost are considerably higher than the healthcare costs¹²¹.

Patients with TMC OA may be off work due to the condition itself, but surgical intervention may also lead to relatively long sick leave. Following trapezium resection with tendon interposition, patients may be totally unable to work for some eight weeks (median, range 2 - 36), followed by a further eight weeks period with a working ability of only 50%¹²².

Costs associated with loss of productivity and absenteeism, in combination with the direct healthcare expenses, have substantial economic consequences for the patient, the employer, and society^{38, 121}. Direct medical costs for patients with generalised OA account for almost USD 13,000 annually¹²³. It is therefore important to know the actual costs associated with hand OA and its related treatment. However, economic evaluations in orthopaedics and especially in hand surgery are scarce. The few economic studies published cover the treatment of Dupuytren's disease¹²⁴⁻¹²⁶, hand and wrist injuries^{121, 127}, ganglia and trigger digits^{126, 128}. Knowledge about the cost-utility of different treatment options for hand and TMC OA would assist the surgeon in choosing the best treatment for the patient, bearing in mind the economic consequences^{129, 130}.

Different methods are available to evaluate the economic effect of interventions. Cost-effectiveness analyses relate the costs of two (or more) interventions to the outcomes, such as death, complication rates, or a questionnaire score. They give a ratio of the difference in costs of the interventions divided by the difference in outcomes¹³¹. The cost-effectiveness analysis can be extended to a cost-utility analysis, where the costs are related to utility outcomes. The

result is usually expressed as quality-adjusted life-years (QALYs). The utilities are derived from quality of life questionnaires, such as the SF-36¹³² or the EuroQol-5D (EQ-5D)¹³³. The area under the curve with time leads to the number of QALYs^{130, 131, 134}.

Additionally, the incremental cost-utility ratio (ICER) is usually given as an outcome parameter in the comparison of two treatment strategies. It estimates the additional costs that must be invested to achieve one additional clinical benefit of the new treatment over the standard treatment^{129, 131}.

THE AIM OF THE THESIS

The aim of this thesis is to investigate patients' limitations in daily life, outcome measures, clinical outcomes emphasising patient satisfaction, and economic aspects of the treatment of patients with hand OA, focussing on patients suffering from TMC OA.

This thesis is divided into two parts, each of three chapters.

Part ONE, comprising chapters two, three, and four, aims to describe patients' limitations in daily life in individuals with various hand disorders and relevant outcome measures for patients with TMC OA. **Chapter two** focuses on the particular problem of opening food containers and aims to develop guidelines for the industry on how to produce easy-to-open packaging. The objective of **chapter three** is to identify and compare the outcome measures that are currently used for patients with TMC OA. In **chapter four**, the measurement properties of a particular questionnaire, the MHQ, for the assessment of patients with TMC OA are evaluated.

Part TWO contains chapters five, six, and seven and describes the outcomes of surgical and non-surgical management in patients with TMC OA with respect to patient satisfaction and economic aspects. In order to gain knowledge about factors determining patient satisfaction, **chapter five** reviews such factors for patients after orthopaedic surgery on the hand. **Chapter six** analyses the outcome of surgical and conservative treatment of TMC OA with a focus on patient satisfaction. **Chapter seven** completes this thesis with an economic analysis of the conservative and surgical treatment of TMC OA with respect to healthcare costs and loss of productivity.

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