

Work-related risk factors in thumb carpometacarpal arthrosis – a systematic review

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This review – the process

March 2017: Invited by "Arbete och Hälsa"

July - August 2017: Literature search

September 2017 – February 2018: Study assessment and writing

February – April 2018: Review by Mikael Forsman and Martin Englund

May – June 2018: Corrections

6th September 2018: Presentation

Thumb carpometacarpal (CMC-1) arthrosis

Radiological signs:

- Joint space narrowing
- Osteophytes
- Cysts

Thumb Arthritis



Symptoms:

- Pain
- Decreased strength
- Decreased range of motion

Clinical findings:

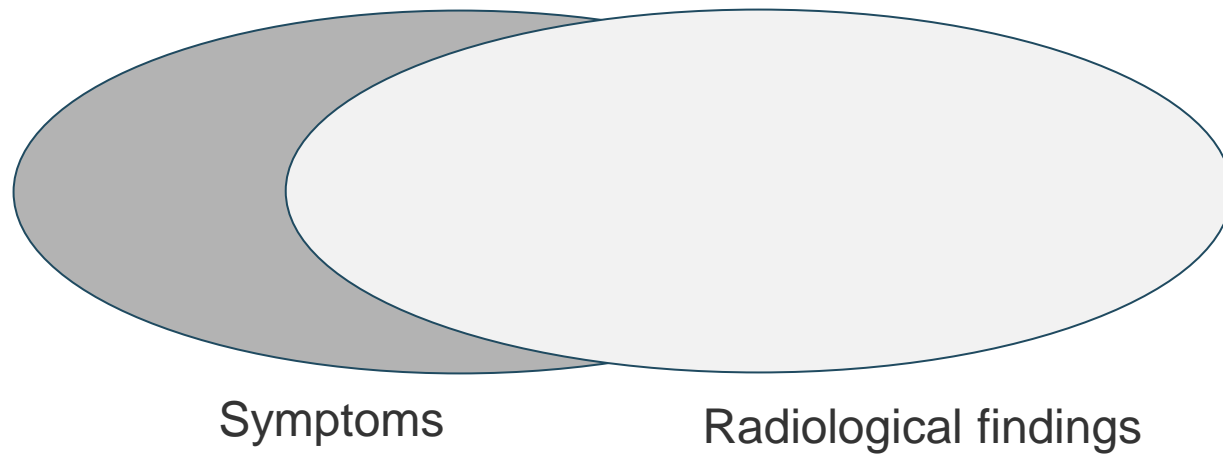
- Swelling
- Stiffness
- Tenderness

Pain when:

- Pinching
- Gripping



Symptoms versus radiological findings



Prevalence

Diagnosis based on doctor diagnosed cases

	Age 20-25	Age 80-85
Men	0.6 %	1.9 %
Women	2.2 %	4.0 %

Moriatis Wolf J, Turkiewicz A, Atroshi I, Englund M. Prevalence of doctor-diagnosed thumb carpometacarpal joint osteoarthritis: an analysis of Swedish health care. *Arthritis Care Res (Hoboken)*. 2014;66(6):961-5.

Diagnosis based on radiographs

	Age 28-92
Men	30.3 %
Women	32.9 %

Haugen IK, Englund M, Aliabadi P, Niu J, Clancy M, Kvien TK, et al. Prevalence, incidence and progression of hand osteoarthritis in the general population: the Framingham Osteoarthritis Study. *Ann Rheum Dis*. 2011;70(9):1581-6.

Treatment



- Splints



- Operation

Well known individual risk factors

- Age
- Sex

- Others?

Pathophysiology – hypotheses

Experimental studies:

Biomechanical stress



Changes in bone and cartilage

Epidemiological studies:

Hand-arm vibrations



Arthrosis of the hand

Potential work-related risk factors

- Repetition
- Position
- Force
 - Pinch grip
 - Hand grip
- Hand-arm vibrations

Previous review

A meta-analyses by Hammer et al. 2014 found:

Pinch grip and CMC-1 arthrosis: OR(95% CI) = 2.04 (1.40-2.97)

”..limited support to the hypothesis that work activities requiring repeated and/or sustained pinch grip contribute to the occurrence of finger or wrist osteoarthritis.”

”Regarding the association of occupational exposure to force grip and hand-arm vibration with finger or wrist osteoarthritis, the current evidence is insufficient...”

- Major limitations of the included studies

Hammer PE, Shiri R, Kryger AI, Kirkeskov L, Bonde JP. Associations of work activities requiring pinch or hand grip or exposure to hand-arm vibration with finger and wrist osteoarthritis: a meta-analysis. Scand J Work Environ Health. 2014;40(2):133-45.

Research questions to be answered in the review

What do we know about work-related risk factors in
CMC-1 arthrosis?

AND

What do we know about other risk factors?

Other individual risk factors

Recent reviews by Kalichman et al. 2010 and Hammer et al. 2014:

- Age (age ≥ 45)
- Sex (women)
- Hysterectomy (contradictory results)
- Obesity (hand arthrosis)
- Hypermobility (contradictory results)
- High individual grip force (only 1 study)

Hammer PE, Shiri R, Kryger AI, Kirkeskov L, Bonde JP. Associations of work activities requiring pinch or hand grip or exposure to hand-arm vibration with finger and wrist osteoarthritis: a meta-analysis. *Scand J Work Environ Health*. 2014;40(2):133-45.

Kalichman L, Hernandez-Molina G. Hand osteoarthritis: an epidemiological perspective. *Semin Arthritis Rheum*. 2010;39(6):465-76.

A systematic review – methods

- Search in PubMed and Embase:

*arthrosis or osteoarthrosis or arthritis or osteoarthritis or thumb or
Hand or finger or hand bone or hand joint or finger bone or finger joint
or carpometacarpal joint or trapeziometacarpal joint*

AND

*occupational or environmental or industry or repetition or force or
posture or vibration or risk factors*

- Search in the Cochrane Library (RCTs)
- Comparison with previous reviews and reference lists

A systematic review – methods

Inclusion criteria:

- CMC-1 arthrosis diagnosed by either clinical examination and/or radiographs
- Exposure based on job title or information on specific exposures
- Inclusion of a control group with little or no exposure
- Risk estimate

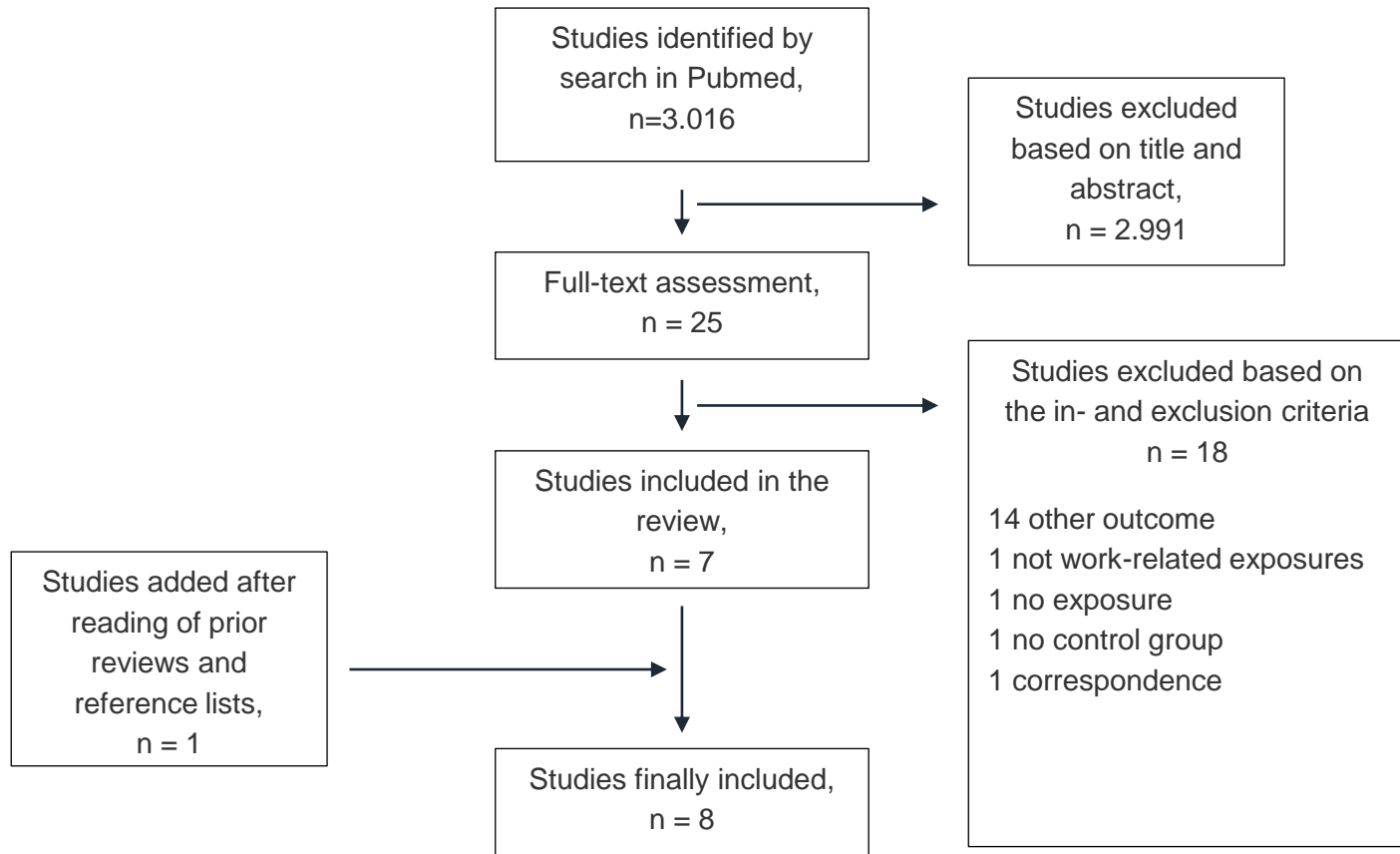
- All methods of exposure assessment were included

A systematic review - methods

Exclusion criteria:

- Case studies
- Experimental studies

A systematic review - results



A systematic review - results

Kellgren et al. 1958:

- Cross-sectional study
- 271 cotton workers and mine workers
- Job title
- Radiographic diagnosis

A systematic review - results

Cotton workers, men and women:
OR (95 % CI) = 3.05 (1.53-6.04)

Cotton workers, men:
OR (95 % CI) = 4.60 (1.51-14.01)

Cotton workers, women:
OR (95 % CI) = 1.50 (0.55-4.11)

Mine workers, men:
OR (95 % CI) = 1.23 (0.52-2.89)

A systematic review - results

Limitations:

- Lower age in exposed group compared with the control group
- No adjustment for potential confounders reported
- No clinical parameters used when diagnosing CMC-1 arthrosis
- No blinding when diagnosing CMC-1 arthrosis

A systematic review - results

Lawrence et al. 1961:

- Cross-sectional study
- 340 cotton workers
- Job title
- Radiographic diagnosis

A systematic review - results

Cotton workers, men and women:
OR (95 % CI) = 1.72 (1.17-2.54)

Cotton workers, men:
OR (95 % CI) = 2.48 (1.23-4.99)

Cotton workers, women:
OR (95 % CI) = 1.45 (0.91-2.32)

A systematic review - results

Strengths:

- Control group matched by age and sex
- Blinding when diagnosing CMC-1 arthrosis

Limitations:

- No clinical parameters used when diagnosing CMC-1 arthrosis

A systematic review - results

Kellgren et al. and Lawrence et al.:

- Partly overlapping study populations
- Control group, the same in both studies
- Inconsistent terminology regarding CMC-1

A systematic review - results

Kessler et al. 2003:

- Cross-sectional study
- 639 patients admitted to knee or hip replacement
- Self-reported "heavy physical exertion"
- Radiographic diagnosis
- "Heavy physical load" vs. "moderate, light or no physical activity":

OR (95 % CI) = 0.7 (0.5-1.1)

Kessler S, Stove J, Puhl W, Sturmer T. First carpometacarpal and interphalangeal osteoarthritis of the hand in patients with advanced hip or knee OA. Are there differences in the aetiology? Clin Rheumatol. 2003;22(6):409-13.

A systematic review - results

Strengths:

- Adjusted for age, sex, hip- and knee arthrosis, BMI, hypertension, DM

Limitations:

- Control group might be exposed
- No detailed information on exposure, especially hand exposures
- Blinded regarding name, sex and age (exposure?)
- No clinical parameters used when diagnosing CMC-1 arthrosis

A systematic review - results

Marshall et al. 2013:

- Cross-sectional study
- 1,076 persons, age ≥ 50 , with symptoms of the hands (pain/stiffness)
- Self-reported "excessive use of hands in employment or pastimes"
- Diagnosis based on symptoms and radiographs
- "Excessive use of hands in employment or pastimes":

RRR (95 % CI) = 1.2 (0.8-2.0)

Marshall M, Peat G, Nicholls E, van der Windt D, Myers H, Dziedzic K. Subsets of symptomatic hand osteoarthritis in community-dwelling older adults in the United Kingdom: prevalence, inter-relationships, risk factor profiles and clinical characteristics at baseline and 3-years. *Osteoarthritis Cartilage*. 2013;21(11):1674-84.

A systematic review - results

Strengths:

- Intra- and inter-rater reliability assessed as "excellent" and "moderate"
- Adjusted for age and sex

Limitations:

- Exposure including both work-related and private risk factors
- No information on blinding

A systematic review - results

Haara et al. 2004:

- Cross-sectional study
- 3,597 persons, age ≥ 30 years
- Self-reported work-related risk factors, sum score 0-5:
Lifting/carrying, awkward postures, full-body vibrations/work with vibrating tools, repetitive work, work with machines
- Diagnosis based on radiographs

Haara MM, Heliovaara M, Kroger H, Arokoski JP, Manninen P, Karkkainen A, et al. Osteoarthritis in the carpometacarpal joint of the thumb. Prevalence and associations with disability and mortality. J Bone Joint Surg Am. 2004;86-A(7):1452-7.

A systematic review - results

“Sum of physical stress at work”, OR (95 % CI):

Exp. group 0 = 1.00 (ref)

Exp. group 1 = 1.02 (0.72-1.43)

Exp. group 2 = 0.84 (0.62-1.13)

Exp. group 3 = 0.77 (0.50-1.18)

Exp. group 4 = 0.78 (0.41-1.48)

Exp. group 5 = 0.13 (0.02-0.99)

A systematic review - results

Strengths:

- Blinded regarding exposure status
- Adjusted for age, sex, BMI, smoking and educational level

Limitations:

- Exposure not specific for the hands
- No clinical parameters used when diagnosing CMC-1 arthrosis

A systematic review - results

Caspi et al. 2001:

- Cross-sectional study
- 253 geriatric patients
- Combination of self-reported and expert-rated degree of lifelong "hand strain" and "hand requirements"
- Radiographic diagnosis
- No significant association (data not shown in the article)

Caspi D, Flusser G, Farber I, Ribak J, Leibovitz A, Habot B, et al. Clinical, radiologic, demographic, and occupational aspects of hand osteoarthritis in the elderly. *Semin Arthritis Rheum.* 2001;30(5):321-31.

A systematic review - results

Strengths:

- Blinded regarding exposure

Limitations:

- No information on adjustments for potential confounders

A systematic review - results

Jones et al. 2002:

- Cross-sectional study
- 522 persons with ≥ 1 living relative with arthrosis of the hand
- Combination and self-reported job title and expert-rated degree of work with "mechanical stress" to the hand
- Radiographic diagnosis
- "High degree of mechanical stress " to the hands:

OR (95 % CI) = 0.73 (0.40-1.33)

Jones G, Cooley HM, Stankovich JM. A cross sectional study of the association between sex, smoking, and other lifestyle factors and osteoarthritis of the hand. J Rheumatol. 2002;29(8):1719-24.

A systematic review - results

Strengths:

- Intra-observer variation was assessed and found good
- Adjusted for age, sex, age*sex-interaction, BMI, family status

Limitations:

- Selected study population with a possible different risk

A systematic review - results

Fontana et al. 2007:

- Case-referent study
- 61 women admitted to surgery because of CMC-1 arthrosis
- 120 controls, other orthopedic patients, matched by sex and age
- Expert-rated exposure to "manual job" and/or "job with possible higher risk of CMC-1 arthrosis"
- Self-reported exposure to specific risk factors

Fontana L, Neel S, Claise JM, Ughetto S, Catilina P. Osteoarthritis of the thumb carpometacarpal joint in women and occupational risk factors: a case-control study. J Hand Surg Am. 2007;32(4):459-65.

A systematic review - results

“Jobs with possible increased risk of CMC-1 arthrosis (e.g. secretaries, tailors, hat makers, sewing machinists, broiders and cleaning assistants)”:

OR (95 % CI) = 3.78 (1.20-11.92)

Repetitive work with the thumb:

OR (95 % CI) = 11.91 (3.65-38.86)

”Jobs, where the patients thought they had too few breaks”:

OR (95 % CI) = 5.95 (1.66-21.28)

A systematic review - results

Strengths:

- Adjusted for age, smoking, obesity, familiar disposition, hysterectomy, parity and temporary jobs

Limitations:

- Selected population
- No blinding during interview of the patients

	Design	Study population	Specific exp.	Reporting Exposure	Blinding	Outcome	Conf. control
Kellgren et al.	CS	Overlapping	Job title	Self	No	Radiographs	No
Lawrence et al.	CS	Overlapping	Job title	Self	Yes	Radiographs	Unclear
Kessler et al.	CS	Exposed control group	No	Self	Unclear	Radiographs	Yes
Marshall et al.	CS	-	No	Self	Unclear	Radiographs/ symptoms	Yes
Haara et al.	CS	-	No	Self	Yes	Radiographs	Yes
Caspi et al.	CS	-	Yes	Self/exp	Yes	Radiographs	Unclear
Jones et al.	CS	Selected	Yes	Self/exp	Unclear	Radiographs	Yes
Fontana et al.	CR	Selection	Yes/No	Self/exp	Unclear	Surgery	Yes

Summarizes

- Three (two) studies found a positive association between repetitive work of the thumb or jobs, characterized by repetitive work tasks for the hands and CMC-1 arthrosis
- Five studies found no association
- All studies had limitations

Conclusion

- *The evidence is assessed as insufficient to establish an association between work-related risk factors of the thumb and the development of CMC-1 arthrosis*
- Emphasis is put on:
 - In reality only two studies had a positive association
 - Both studies limited by reporting bias, lack of blinding, lack of confounder control and poorly defined exposure

Perspectives

- Precise exposure definition
 - Preferably electronic measurements
 - Expert-based job exposure matrix
- Prospective design (causality)

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