





# Therapy management of thumb carpometacarpal osteoarthritis: Exploring UK therapists' perceptions of joint instability

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## Abstract

**Introduction:** Carpometacarpal joint osteoarthritis is a common and painful condition associated with ligament laxity, subluxation and joint instability. Therapy management includes several interventions targeting the symptoms associated with instability and subluxation. This study aimed to explore the perceptions of experienced therapists, about their understanding of joint instability in carpometacarpal joint osteoarthritis and its relationship with laxity, subluxation and strength, and the perceived effectiveness of exercise interventions.

**Methods:** A qualitative research design, consisting of individual semi-structured interviews was conducted with nine therapists. Interviews were transcribed and analysed using a thematic analysis.

**Results:** Three themes were identified: (a) Relationships between instability and laxity – the terms laxity and instability were often used interchangeably. Instability was associated with laxity, subluxation and disease progression, and was perceived to be a problem that includes the whole thumb column; (b) clinical reasoning by stage of disease – conflicting opinions were expressed regarding instability being present in: pre-arthritis lax joints, early disease or all stages of disease; (c) the role of exercise in management – there was disagreement as to whether instability could be modified by developing muscle strength, or whether treatment should be focussed on compensating for instability.

**Conclusion:** Different perceptions of instability were reflected in wide-ranging opinions regarding the need to manage instability, and regarding the potential for altering instability. The impact of instability on function, and the concept of instability were not easily identified. A clearer definition of instability would facilitate the development and assessment of interventions for instability.

## Keywords

Osteoarthritis, thumb, joint instability, qualitative research

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## Introduction

Radiographic signs of thumb carpometacarpal osteoarthritis (CMCJOA) are common, being present in 21% of those over 40 years of age.<sup>1</sup> The risk factors for osteoarthritis (OA) in the hand are unclear and complex;<sup>2</sup> however, the narrative literature on the aetiology and pathology of CMCJOA<sup>3,4</sup> does describe excessive ligament laxity in an inherently unstable joint as being a critical mechanism. The natural configuration of the carpometacarpal joint (CMCJ) is considered to be unstable because of its shallow and incongruous joint geometry;<sup>5</sup> therefore, the role of ligaments as primary stabilisers is important to stability.<sup>6,7</sup> Ligament laxity and reduced ligament tensile strength have been

associated with CMCJOA.<sup>8–12</sup> If ligament mechanical efficiency is compromised, it is believed that with loading there will be greater shearing forces, impingement of the joint surfaces and translation or subluxation of the base of the first metacarpal.<sup>3,4</sup> Yet a recent study found no differences in first metacarpal translation between patients with early symptomatic CMCJOA

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and healthy individuals<sup>13</sup> (when applying static grips). These unexpected results may indicate a need to reassess the perceived role of laxity, subluxation and joint instability in the pathogenesis of CMCJOA.

Ligament laxity, joint subluxation and instability are common terms in the literature on CMCJOA and seem to be used interchangeably, but definitions of these terms are rarely given. Laxity can be described as the amplitude of joint movement possible within the constraints of the ligaments, and excess laxity can result in excessive or abnormal movement between the joint surfaces.<sup>14</sup> Subluxation is described as an incomplete dislocation, where the joint surfaces are misaligned but nevertheless remain in contact.<sup>15</sup> The term instability is more problematic, as there has been little work done to define what it means and how it presents in the CMCJ. Some descriptions focus on symptoms with function,<sup>16</sup> others on alignment and mobility.<sup>16,17</sup> Understanding instability, and its role in the aetiology and pathology of CMCJOA, may guide clinicians' diagnosis and clinical reasoning in managing instability.

Therapy is a recommended first management option for hand OA,<sup>18</sup> and the recommended modalities for the CMCJ include education, exercise and splinting.<sup>19,20</sup> Therapy interventions aim to specifically address perceived instability by the use of joint protection techniques, stabilising or immobilising splints and dynamic stability exercises. Dynamic stability exercise targets strength, speed and synchronous activation of specific muscles, aiming to reinforce passive ligament tension by providing joint compression and rotation, and reducing subluxation,<sup>21,22</sup> and to restore muscle imbalance.<sup>16,23</sup> Such interventions in theory reduce the impact of joint subluxation, and progression towards severe joint damage. Meta-analysis of multimodal therapy programmes for CMCJOA indicates pain reduction,<sup>24</sup> but no trials have assessed the impact on disease progression. There is evidence that increased grip strength in hand OA correlates with improved self-reported function ( $r = -0.29$  pinch and  $0.4$  for grip,  $p \leq 0.01$ ),<sup>25,26</sup> but there are no data on specific muscle strength and function in CMCJOA. Surveys have demonstrated variations in clinical use and perceived efficacy of exercise for CMCJ pain and OA,<sup>27,28</sup> which may indicate differing opinions on the role of muscles in providing dynamic stability, and improving symptoms and function in this condition.

The concept of joint instability in CMCJOA remains a theoretical one, in that it is ill defined with no validated methods to assess instability. Measuring the components of instability (subluxation and laxity)<sup>22,29</sup> rely on radiographic imaging. However, radiographs are not considered essential for a diagnosis<sup>30</sup> and may not be available to many therapists treating this condition.

No previous research has explored practitioners' understanding of instability in this condition. Knowledge gained from clinical experience could guide future research by identifying different opinions; providing an understanding of therapists' views of the role of instability in the aetiology and progression of this condition; and specifically, how these views might influence how exercise is used in the management of CMCJOA.

The purpose of this study was to explore how therapists understand joint instability in CMCJOA, and what are their perceptions of the role of exercise to manage CMCJOA?

## Methods

Based on the research question above, qualitative research was a pragmatic choice for the study methodology. Qualitative research uses the human as the research instrument in order to capture the complexity and subtlety needed for description, understanding and meaning.<sup>31</sup> The epistemological basis for much qualitative research is interpretivism, which holds that knowledge results not just from experience, but also from the interpretation and understanding of experience.<sup>32</sup> Semi-structured interviews were used to explore and describe an area of clinical practice that is not well understood,<sup>33</sup> as well as to gather rich data on a focussed topic. In this case, to understand how the theories on instability in the literature relate to the clinical practice of therapists.

### Sampling and recruitment

Physiotherapists (PT) and occupational therapists (OT) were approached via the following professional organisations: the British Association of Hand Therapists (BAHT); the Chartered Society of Physiotherapy and the British Association of Occupational Therapists. Information on the research and the researcher's contact details were posted on web bulletin boards, or sent out via email updates. Participants were also identified by their peers through snowballing and professional networks. Purposive sampling was used to recruit therapists with a special interest in, and a current caseload of CMCJOA from these organisations. These criteria were confirmed at the start of the interview. The sample size (5–10) was selected in order to provide diversity of opinions, aim for representation from both professions and be achievable within the time constraints imposed as the research was conducted as part of a Master's degree.

### Ethical considerations and data storage

All participants received a detailed explanation of the study in the participant information sheet.

Participation was voluntary, and prior to the interview written informed consent was obtained, and then confirmed verbally at the interview. Those who expressed an interest by email but then did not reply to a subsequent email were not contacted again.

The recorded interview data and contact details collected were stored securely on the Nottingham University server and accessed only by the researcher. Transcripts were anonymised using ID numbers, ordered by recruitment. Ethical permission was granted by the University of Nottingham Faculty of Health Sciences and Medicine Research and Ethics Committee.

### Data collection

All participants were interviewed individually by the researcher during non-work hours – either by telephone or recorded Skype calls. Skype has been used in previous interview studies,<sup>34</sup> and allows the reading of non-verbal cues,<sup>35</sup> and the demonstration of posture or exercise relevant to this study. A semi-structured interview schedule was used (Appendix 1). The content was informed by a structured literature review, discussion with research team and feedback from the BAHT education committee. The topics covered were:

1. The perception of instability and its importance in managing CMCJOA
2. Clinical assessment and relationships between instability, laxity and subluxation
3. Participant perception of the effectiveness of therapy; and factors which might influence effectiveness.

### Data analysis

The interviews were transcribed verbatim. Thematic data analysis was then undertaken using a framework method,<sup>32</sup> where data management is structured in five stages (Table 1). The researcher re-read the data to become familiar with the transcripts, and assessed for her influence on the data. An initial thematic framework was constructed which included both topics covered in the questions and the key themes that emerged from each interview. Data were indexed and sorted and the thematic framework reviewed to ensure it covered all the data. Data were then displayed in thematic charts to allow comparison across individuals for each theme. Themes were described by searching for patterns across cases, as well as linkage between phenomena within each case. Themes were then interpreted for patterns of meaning. Each thematic chart was reviewed and the key themes chosen based on both the similarities, and variance in opinions and their resonance with the original aims of the study. Finally, the

**Table 1.** The five stages of data analysis – Framework approach.

Stage	Description
1	Familiarization with the range and diversity of data.
2	Identification of a thematic framework which reflects a priori, the aims of the study, as well as inductively reflecting on themes emerging from the data.
3	Index and sort data according to thematic framework, review coherence and completeness of thematic framework.
4	Data summary and display to compare themes across cases.
5	Abstraction and interpretation – identification of patterns, typologies, associations across the data.

findings were reviewed in the context of the existing literature. The framework approach is more informed by a priori reasoning than traditional thematic analysis,<sup>36</sup> but a priori concepts are only retained if the data supports their adoption.

### Study credibility

Honest appraisal of contradictory evidence is good research practice, as is transparency in analysis.<sup>33</sup> Considering prior knowledge as a source of potential bias, the researcher set out to be empathetic and neutral in the interviews and reflected on each interview as she transcribed it, and searched for her influence on the data. During the process of thematic analysis, the researcher reviewed the decisions made and considered alternatives based on the data. The research team reviewed the thematic framework constructed, to manage ambiguity or inconsistency in coding decisions,<sup>37</sup> and to ensure comprehensive coverage of all the data.

### Researcher position

As a PT interviewing OTs and PTs, the researcher could benefit from a ‘conscious partiality’,<sup>38</sup> which is known to encourage professional co-operation, solidarity, trust and openness. However, the researcher was also aware of the potential for ‘impression management’, where participants act to protect their own professional identity.<sup>33</sup> Efforts were therefore made to build rapport while setting up the interviews, and to emphasise the knowledge-generating aim of the research.

### Results

A total of 17 PTs and OTs expressed an interest in the study, four of which made contact after the deadline for

**Table 2.** Participant details.

ID	PT or OT	Discipline	Post graduate education	Work location	Case load	Hands experience
1	OT	Rheumatology	Nil	NHS Trust secondary care	Mixed rheumatology, CMCJOA 16% of caseload	18 years
2	OT	Rheumatology	Nil	NHS Trust secondary care	Mixed rheumatology, chronic pain, 1–2 CMCJOA PW	12 years
3	OT	Rheumatology	Nil	NHS Trust secondary care	Rheumatology, 20 CMCJOA PW	18 months
4	OT	Rheumatology	ESP management of rheumatological conditions	NHS Trust secondary care	Mixed rheumatology, 7 CMCJOA PW	20 years
5	OT	Hand Therapy	MA advanced clinical practice	Private Hospital	Hand therapy, treats 2–3 CMCJOA PW	9 years
6	OT	Hand Therapy	Accredited Hand Therapist	NHS Trust secondary care	2 CMCJOA PW in a previous primary care role far more	15 years
7	OT	Hand Rehab	nil	NHS Trust secondary care	50% trauma, sees less CMCJOA now, has seen many over the years and set up care pathways	36 years
8	PT	MSK	Enrolled in MSc Hand Therapy	Community hospital	MSK and hands, 1–2 CMCJOA PW	10 years
9	OT	Rheumatology	Nil	NHS Trust secondary care	Mixed rheumatology, fibromyalgia, hypermobility, 1 CMCJOA PW	10 years

ID: Study participant identification number; PT: Physiotherapist; OT: Occupational therapist; PW: per week; ESP: extended scope practitioner; MSK: musculoskeletal outpatients; NHS: National Health Service; CMCJOA: carpometacarpal joint osteoarthritis; MSc: Master of Science degree; MA: Master of Arts degree.

interviews had passed, and three expressed an interest after reading the participant information sheet but failed to respond to emails during the process of arranging an interview. Two respondents who worked together confirmed that they had developed their concepts and practice together; it was therefore decided to interview just one of them. This left a total of nine participants identified as having clinical experience, a current clinical caseload, and a special interest in CMCJOA.

The participants (Table 2) represented a wide range of clinical experience, working environments and specialities. However, only three PTs made contact and only one responded to follow up emails and was interviewed.

The themes identified from the interview data were:

1. Relationships between instability and laxity;
2. Clinical reasoning by stage of disease; and
3. The role of exercise in management.

### *Theme 1: Relationships between instability and laxity*

Participants' concepts of instability were that the joint had inadequate or imbalanced support structures (Table 3) and this was associated with ligament laxity and subluxation. The terms instability and laxity were often used interchangeably, and for three participants, the described assessment of instability was the same as the assessment of laxity of the individual thumb joints, or hypermobility in the hand.

Assessments for instability and laxity were repeatedly labelled as subjective due to either the presence of bilateral disease preventing comparisons, or due to a large variance in accepted 'normal' motion for the thumb.

ID 3: *It's difficult to measure [instability] because everyone is different and with CM CJ you often cannot measure against the other hand as it often affects both hands.*

**Table 3.** Participants' definition of stability.

Participant ID	Question: How do you understand the term instability when used for CMCJ OA?
1	'The joint can be mal-aligned . . . doesn't provide support required, it's not a thing I associate with the CMCJ I might expect it more with the MCPJ'.
2	'If the joint is moving out of place and if they can't do the things they should be able to . . . that's not a great description is it?'
3	'I suppose my opinion is the control that the ligaments have or give to particular a joint and whether the ligaments are balanced'.
4	'Instability I would interpret that as an imbalance in the forces, and whether that is because of persistent inflammation or swelling that has stretched joint capsules, or the mechanics of the bony changes affecting the soft tissues. But the opposing forces are not equal – they weren't in the first place but with OA changes they are exaggerated – that's how I would describe it'.
5	'So it's about ligament integrity how tight or lax they are – joint instability and then the muscle structure and role on top'.
6	'Instability is when the laxity is worse, so the joint has more of a collapsing type feel to it, where it gives way, there's a lot less control of the joint'.
7	'I think I understand it in terms of ligament laxity, or ligament lengthening, or rupture that then leads to an unstable thumb column. Going from the CMC to the MCP to the IPJ. Lack of which you would see on loading'.
8	'If it is not stable when you are functioning . . . I don't know – it's not maintaining a normal alignment when it is loaded'.
9	'For instability when the muscles around the joint are weak and can't support the joint for movement, so the joint is at risk of subluxation and shearing'.

Laxity was described as ligamentous or joint structures being weakened or damaged, resulting in excessive joint movement or subluxation.

*ID 7: I see laxity as a concept around ligament lengthening, weakening and possibly rupture.*

Subluxation was described as a clear and distinct concept of joint malalignment.

*ID5: Subluxation is the movement of the joint out of its normal position of sitting in whatever direction.*

Participants who emphasised the importance of dynamic stability – in addition to static ligamentous stability – tended to separate instability from laxity, and as a result differentiate their assessment stressing that laxity could be present without instability. This relationship between instability and laxity was perceived to be modified by muscles, and the role of muscles was to limit subluxation.

*ID 5: I think you can have a really lax joint without it being an unstable joint . . . if you have strong muscle structures actually having a lax joint is ok . . .*

The relationship between instability, laxity and subluxation was a progression. The outcomes of instability

were reported as deformity, malalignment or abnormal motion (matching the outcomes for disease progression). There were differing opinions as to the sequence of disease (whether joint laxity is a cause of, or a result of, disease). Additionally, the role of muscles as a modifier in the relationship between laxity and instability could also be negative, i.e. with the potential to increase as well as to decrease instability.

*ID 4: This unstable joint, when you start getting joint space narrowing or swelling that might stretch the joint capsule, because of the imbalance in the flexors and extensors and the adductors and abductors – it reinforces that instability.*

*ID 8: If they [a person with CMCJOA] are lax, they could have the chance of developing instability, laxity isn't always pathological . . . Eventually, they could develop slight subluxation, so I would say it is a progression.*

The participants considered the whole thumb column when assessing stability, and there was agreement that instability is more obvious and more easily assessed at the MCPJ, but the CMCJ is seen as the starting point for thumb instability.

*ID 1: It depends, many of our patients whilst they may have a primary problem at the CMCJ it is the MCPJ*

that is more unstable as a compensation so we tend to stabilize both, [with splints] majority of patients I see will probably hyperextend at the MCPJ and at the IPJ which presents more problems.

### Theme 2: Clinical reasoning by stage of disease

Stability of the thumb, rather than of the CMCJ, was considered by all but one of the participants. Consideration of stability was generally linked to disease severity (see *CMCJOA stages of disease*, Table 4), but in different ways. Some participants used interventions targeted at stability with all patients with CMCJOA – but with less certain expectations of outcome in later stages of the disease.

*ID 3: I would always try to varying degrees, something within the intervention that is focusing on stability. My opinion is there is not a joint too far down the line to not give a chance to or try to improve... [but later]... In the more advanced CMCJOA I would mostly be hoping to improve function and pain. But in the early to maybe moderate, I would look at hopefully maintaining or improving stability.*

For others, it was clear that instability could be considered in early disease, but could be excluded in late stage disease.

*ID 7: The Eaton 2s are probably the people developing real instabilities... In the classification Eaton 3s and certainly by 4, the patient has become much more stable and some of the 4s are very stable, because the way the thumb has collapsed it has gone into its own stable position, the way the osteophytes are forming around the base of the MC are providing its own stability.*

In one case, instability was only considered in young patients with CMCJ ‘thumb pain’, but not in those with OA.

*ID 8: Only with the younger patients do I consider instability, not with the older patients with early disease... in someone with thumb pain at thirty I would say there is some kind of laxity and some kind of instability and that is why they are getting that pain, because they are loading the joint differently. There is not enough support around the joint.*

The data reveal a lack of agreement on whether CMCJ stability should be considered in all CMCJOA patients, with perceptions differing on the impact of stage of disease.

**Table 4.** Radiographic staging of CMCJOA.<sup>39</sup>

Stage	Signs on lateral X-ray CMCJ
I	Slight joint widening
II	Slight joint narrowing, minimal subchondral sclerosis, joint debris (osteophytes or loose bodies) <2 mm
III	Marked narrowing/obliteration joint space, cystic changes, sclerotic bone, varying degrees of dorsal subluxation, joint debris >2 mm
IV	Stage III deterioration and scaphotrapezial joint narrowed with sclerosis and cystic changes

### Theme 3: The role of exercise in management

The overlap of exercise with other interventions (education and orthotics) meant that patients’ outcomes were attributed to a package of care. Participants’ assessments prioritised individual symptoms and functional problems in accordance with guidelines,<sup>20</sup> and symptoms and functional problems were not differentiated into those from disease or those from instability. The impact of instability on function was hard for participants to determine. The aim of therapy management for some participants was to reduce instability and slow disease progression, and they perceived their interventions to be effective.

*ID 4: I'm not suggesting for a moment we cure this (instability and degeneration) but it is about slowing it down, with stretches and exercises and strengthening to try and slow down that process.*

However, for some participants’ joint stability could not be modified by exercise. However, other interventions could counteract instability – whatever the stage of disease. For example, in answer to the question do you think therapy can improve stability in the joint?

*ID 1: My impression is once the damage has occurred then probably not; they need compensation by equipment or orthotics.*

And further, as well as being perceived as ineffective, exercise aimed at reducing instability could be detrimental, and was therefore avoided. A few participants suggested that patients found exercise painful, and felt they did not get good results.

*ID 7: I think if the ligament structures are weakening and lengthening, I struggle to believe that strengthening the thumb muscles can change much... They don't necessarily have weak muscles but they are still developing subluxation and patterns of deformity in their*

*CMCJ... I worry that I am going to be applying deforming forces to the thumb....*

Those participants advocating exercise described five pre-conditions for effective exercise: motivated patients, well-controlled pain, absence of significant subluxation, absence of adduction contracture and absence of muscle wasting.

## Discussion

The aim of this research was to explore therapists' views on the role of stability in the management of CMCJOA, and explore the conceptual models of instability that guide practice. The first theme describes the relationships between laxity and instability and reveals that ligament laxity was associated with instability and the terminology used was interchangeable for some participants. Some authors have also suggested that laxity equates to instability,<sup>40</sup> or interpreted assessments that demonstrate laxity as equating to instability.<sup>41,42</sup> This excludes consideration of neuromuscular control (the role of dynamic stability), an important component of stability to other participants. Participants struggled to articulate a definition for instability that allowed them to feel confident in the assessment of instability. This problem has been encountered in other qualitative work on clinicians' perceptions of phenomena that are difficult to measure, e.g. psychosocial status.<sup>43</sup> Articulating a clear definition could be a limitation of the interview method because participants require time to reflect before providing complex answers. However, it may also be because the published definitions specific to CMCJOA are either open to interpretation (e.g. 'an inability to bear physiologic loads during function without symptoms'<sup>16</sup>), or are too conceptual ('stability: the force couple between active muscle and static ligament tension'<sup>44</sup>).

More applicable to CMCJ stability in practice might be to follow the pattern used in the wrist<sup>45</sup> and (quoted for) the knee: 'An inability to maintain a position or control motion under differing external loads'.<sup>46</sup> This definition matches the assessments of motion and pinch posture described by some participants, and includes the role of proprioception and muscular control in providing stability, while not being solely dependent on symptoms. The data from this study suggest a definition for the thumb would need to consider all its joints, as a starting point for discussion, we suggest the following definition: 'the thumb column can be considered stable if smooth, co-ordinated, full range of (available) motion is demonstrated, and can be sustained with loading'.

The second theme was clinical reasoning by stage of disease, opinions ranged from instability being

considered a problem only for disease free lax joints, to generalisations of instability's presence in early disease or specifications of stage two disease, to instability covering all stages. The literature on dynamic stability exercise could have influenced opinions on stage of disease, with exercise only being advised for early disease<sup>23</sup> because biomechanical changes in later disease reduce the ability of muscles to provide stability. However, other authors have not specified disease stage as a restriction to exercise<sup>16</sup> and, consensus guidelines encourage strengthening exercise for the muscles to stabilise the CMCJ – without reference to disease stage.<sup>47</sup> Divergent opinions may also be influenced by organisational factors. Some participants discussed caseloads that included only late stage disease, which resulted in a view of MCPJ instability being the problem in CMCJOA, and in a perception of the CMCJ as a (now) stable joint.

The differing opinions as to when instability exists in CMCJOA reflect different perceptions of instability, for some participants, early disease or pre-arthritis laxity are indicative of instability at the CMCJ. For one participant, a diagnosis of OA, and for others a later stage disease, are what suggest the joint is no longer unstable. Instability is thus a concept for some participants that does not co-exist with significant joint disease. Instability was also conversely, considered by others to be a consequence of disease progression, i.e. OA causing ligaments to weaken and rupture. Researchers suggest ligament pathology also impairs the proprioceptive feedback to muscles,<sup>48</sup> thus reducing both the dynamic and passive stability of the joint. Additional to the ligaments, muscles and neural connections stability requires normal joint surfaces.<sup>45</sup> Perceptions of instability as separate from established disease may arise because the symptoms existing with joint degeneration, could not be attributed (solely) to instability. Further if normal articulating surfaces are essential to stability, once the surfaces are damaged functional stability may be unachievable. The role of symptoms in defining instability in OA needs to be clarified, as does the relationship between joint degeneration and malalignment, and instability. The management approaches taken for an arthritic joint, presenting with a deformity, versus a painful lax joint with normal cartilage and joint geometry may need to differ.

CMCJ laxity and subluxation was perceived to be difficult to assess clinically (unlike the MCPJ/IPJ where hyperextension or deviation can be easily observed and measured), and there are no validated tests for instability reported in the literature. New research methods using CT scans are being developed to assess instability by measuring first metacarpal translation under static load.<sup>13</sup> However as one participant stressed, instability isn't static and should be assessed

through range of motion because joint congruency and ligament tension vary with posture. This illustrates the complexity of assessment and the shortcomings of static measurements.

The final theme was that of the role of exercise in managing instability. There were opposing views on whether instability could be modified, or whether it was always fixed and therefore requiring compensatory strategies. For those who felt instability could be modified, exercise to stretch tight structures and to strengthen weakened muscles was the intervention of choice; the perception being that in the presence of greater instability muscle power has a greater role in providing stability by reducing subluxation or shearing. This was linked to a perceived aim of altering disease progression rather than an expectation of immediate changes in function or pain. This is an interesting finding as therapy research has so far focussed on these outcomes and not on disease progression.

There was broad agreement that in the presence of significant subluxation, muscle wasting and contracture, that strengthening was not feasible. This suggests late stage disease as being an important consideration for exercise interventions, supported by the comments from participants of less certain outcomes in this group. Additional factors considered to preclude attempts to modify instability at any stage were uncontrolled pain and unmotivated patients. The factors above may be indicators of poor prognosis for therapy management but participants were keen to stress they were particularly relevant to exercise. Additionally, all participants agreed that therapy referral early in the disease could achieve optimum outcomes.

Modification of instability was rejected by other participants who felt interventions should focus on compensating for instability, because muscle strength could not stabilise a joint with lax or damaged ligaments. There was a clear divide between those who felt from experience that exercise had a role in managing instability in CMCJOA, and those who did not find it effective, the lack of research evidence to guide practice was cited by participants as a cause of uncertainty.

This study is limited by only having one PT as a participant, resulting in a bias towards OT opinions. This could have influenced the perceptions on assessment of instability; and on the use of exercise in managing instability. However, the views described on assessment do reflect the lack of any published methods for clinically assessing instability; and as the participants' opinions were divided both for and against the use exercise, it is considered that the sample reflected a broad range of opinion and practice. Respondent validation was not used in this study, and could be considered a limitation, as participants have not been

given the opportunity to review the themes and give feedback. Skype and phone calls enabled recruitment of participants from geographically diverse locations, and interviewing outside of work hours resulted in uninterrupted interviews. Skype video calls were used for several interviews, which enabled demonstrations of hand movements – but given the common clinical language any ambiguities were resolved, by description in the non-video calls. All data were analysed based on the audio transcription, not on any observational data. On reflection, Skype may have proved more useful in a situation of non-peer interviewing. There was no perceived advantage in terms of rapport, or understanding meaning, and for the participant to be on camera could have been more demanding and more invasive to privacy.

## Conclusion

The findings of this study indicate that therapists treating CMCJOA lack a common conceptual model of instability, with differing perceptions of the relationship between instability and laxity, and of instability and disease stage. Instability is described by the participants as being difficult to identify, with current assessments limited by the need for subjective judgment. Differences were also found in the perceived role of exercise as an intervention for instability. This variety in opinion could be because instability can be considered a theoretical concept in CMCJOA without an agreed definition, method of diagnosis or a commonly accepted set of clinical or objective findings.

Future research should focus on achieving an agreed definition of instability in CMCJOA, so that both research and clinical practice is not hampered by different interpretations of instability. An agreed definition would also facilitate the development of assessment methods and interventions. Future research could then seek to improve our understanding of instability (or its measurable components) on pain, function and disease progression. Studies evaluating the effectiveness of exercise interventions in CMCJOA could investigate whether the factors suggested by the participants in this study can predict outcome, and whether therapy management has an impact on disease progression.

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## Informed consent

Written informed consent was obtained from all subjects before the study.

## Ethical approval

The Ethics Committee of University of Nottingham Faculty of Health Sciences and Medicine Research and Ethics approved this study (REC number: D16042015 SoHS MARM).

## Guarantor

VJ.

## Contributorship

VJ researched literature and conceived the study. PH was involved in protocol development, gaining ethical approval. VJ conducted patient recruitment and data collection. VJ conducted the transcription and analysis, JE and PH reviewed the data and analysis. VJ wrote the first draft of the manuscript. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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## Appendix I: Interview guide

### General

Can you tell me a little about the type of caseload you see clinically?

Can you tell me a little about how you became particularly interested/experienced in the management of CMCJ OA?

Do you share the management of these with an OT/Physio? (Generic working or single profession perspective)

### Role of stability (and definitions of terms)

What do you consider the most important things to find out in your initial assessment?

Do you consider stability or instability when managing OA in this joint?

Can you remember what brought the concept of instability to your attention?

How do you understand the term instability when used for CMCJ OA?

How do you understand the term laxity in relation to CMCJ OA?

How do you understand the term subluxation with CMCJ OA?

Do you see a relationship between CMCJ laxity, subluxation and instability?

### Assessment of stability

Do you think you can clinically assess a patient to determine if CMCJ instability is a problem?

If so how do you assess for instability with your patients?

Do you think you can clinically assess for subluxation, if so how?

Do you think you can clinically examine laxity in the CMCJ, if so how?  
If not are there any tests/measurements that you might consider or have seen others use?

***Factors that influence stability***

Do you think therapy can influence CMCJ stability in patients with OA?  
...if so can you describe this sort of case, does it fit a pattern?  
Tell me about the treatment you use to improve stability?

How might treatment help? i.e. Do you have a specific approach, what do you say to patients?  
How do you assess outcome in these patients?  
From your experience are there specific factors you think influence stability in CMCJ OA?  
Are any of those factors key in deciding if improving stability is achievable in a particular case?  
As you examine your patients do you have a way of assessing if you think improving stability is feasible?  
Can you describe the sort of case you have seen where you think it's not achievable?

**Any other comments?**