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A scoping review of applications and outcomes of traction orthoses and constructs for the management of intra-articular fractures and fracture dislocations in the hand



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ABSTRACT

Introduction: Intra-articular hand fractures can have devastating consequences for movement and function. The unique nature of the injury and diverse management strategies are a challenge for conducting trials.

Purpose of the Study: To conduct a scoping review of traction constructs for the management of intra-articular hand fractures.

Methods: We conducted a systematic search of the literature, extracting data on the scope and nature of the evidence for traction constructs.

Results: Our search yielded 87 articles addressing 3 traction constructs: (1) static traction ($n = 17$), (2) dynamic external fixation ($n = 53$), and (3) dynamic orthoses ($n = 17$). Active range of motion of the target joint was the most frequently reported outcome. Study designs included 36 cohorts, 21 case series, and 9 case studies: 24% contained only technical information.

Conclusions: The current literature addressing traction constructs consists primarily of small and low-quality studies. Evidence synthesis could improve the estimation of range of motion outcomes but would not be able to identify the best treatment. Consensus on classification of fracture patterns, routine use of outcome measures, and randomized trials are needed to compare different traction constructs and inform evidence-based care.

Study design: Scoping review.

Level of evidence: N/A.

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Introduction

Intra-articular fracture dislocations in the fingers and hand are often the result of axial load associated with high-velocity impact such as being hit by a baseball or a cricket ball.^{1–3} These injuries may involve damage to the entire joint complex, including bone, cartilage, ligament, and/or tendon insertions with potentially devastating consequences for movement and function.^{4,5} This injury

occurs most commonly at proximal interphalangeal joints (PIPJs) of the fingers but has also been described at the carpometacarpal joint of the thumb,^{6,7} interphalangeal joint of the thumb,^{8,9} and metacarpophalangeal joints of the fingers^{10–12} and thumb.^{13,14}

A variety of acute management options have been developed and applied to this class of injury with the goal of maintaining reduction of the fragments, preserving joint alignment, restoring range of motion (ROM), and minimizing the risk of post-traumatic arthritis or autofusion. Although extension block orthoses are generally the treatment of choice when the joint is stable,⁴ and a variety of traction constructs have been proposed^{15–18} for unstable intra-articular fractures and fracture dislocations, it is unclear what management should be considered optimal.

Although there are no formal estimates of the incidence of these injuries, they are described as common sequelae of sports.^{2,5,19,20}

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However, they have also been called rare.²¹ Many of the foundational articles on this topic, such as Schenk's arcuate traction orthosis¹⁷ and Suzuki's pins and rubbers traction system (PRTS),¹⁸ are based on small cohort studies from a single center. Given these factors, it would be useful to consider some form of synthesis to evaluate the body of literature describing the use of traction and distraction methods for the management of intra-articular hand fractures.

Scoping reviews are a form of knowledge synthesis that seek to be inclusive for maximum breadth of understanding of a topic and can include research from both quantitative and qualitative traditions.^{22,23} They are used to chart the literature and describe the methods and content of a specific field of research or practice^{24,25} and can provide an initial evaluation of whether a critical mass of literature exists on which to base a systematic review. Although scoping reviews may not evaluate the quality of the evidence,^{23,25} they still use methods common to a systematic review in establishing clear objectives, reproducible search strategies, a priori inclusion and exclusion criteria, standardized data extraction, and summary of key findings. They also add a unique element of consultation with experts and stakeholders to review the interpretation of the aggregated findings and support knowledge translation.²⁵

Purpose of the study

Given a wide range of surgical and conservative management options for intra-articular fractures in the hand, we elected to undertake a scoping review to critically examine the scope of research supporting the use of traction or distraction methods to inform evidence-based management by both surgeons and hand therapists. Accordingly, this scoping review will address the following question.

What is the scope and nature of evidence and reported outcomes in the current literature for using traction or distraction constructs for persons with acute intra-articular fracture or fracture dislocation of the metacarpal or interphalangeal joints?

The overarching purpose of this review is to synthesize the available evidence that addresses traction as a construct in the management of intra-articular fractures and fracture dislocations in the hand and answer the following questions.

1. What orthotic designs have been proposed?
2. What is the breadth and nature of the evidence comparing the various designs of orthoses?
3. What evidence exists to guide selection of traction forces applied and the duration of traction across constructs?
4. What is the extent of information available to describe the role of hand therapy cointervention?
5. What are the surgical traction options?

Refer to [Table 1](#) for a summary of the parameters of the scoping review.

Methods

Six iterative steps have been recommended^{24,25} for the conduct of scoping reviews: (1) identification of the research question, (2) identification of the relevant studies, (3) study selection, (4) charting the data, (5) collating, summarizing, and reporting the results, and (6) consultation. We used this framework to guide our review: refer to [Figure 1](#) for a flow diagram of the scoping review (see [Appendix A](#)).

Identification of the relevant studies

In January 2013, an initial systematic search was performed using OVID EMBASE, MEDLINE, Cumulative Index to Nursing and

Table 1
Scoping review parameters

Parameter	Description
Participants	Adults with acute intra-articular fracture or fracture dislocation of a metacarpophalangeal joint or interphalangeal joint where a traction construct was used as an intervention and outcomes were reported
Exclusion criteria	<ul style="list-style-type: none"> • Narrative reviews or other review articles that do not contain any data/results not reported elsewhere • Use of traction orthoses for injuries occurring more than 4 wk previous to the surgical intervention, chronic joint instability, or arthroplasty • Neither abstract nor article is available in English OR unable to obtain article in full form
Interventions	Any intervention or combination of interventions involving application of sustained traction to an unhealed fracture in the finger or hand
Outcomes	<ul style="list-style-type: none"> • Fracture healing • Change in fracture position/joint alignment • Adverse events (ie, pin tract infection) • AROM and PROM of the affected joint • TAM of the finger • Grip and/or pinch strength • Hand function and/or dexterity • Pain and/or self-reported disability, return to work status, and other participation indicators
Search terms used	Intra-articular AND fracture AND (finger OR hand) AND (splints OR traction OR equipment design OR rehabilitation OR therapy OR comminuted OR fixation) NOT cancer NOT wrist NOT mallet

AROM = active range of motion; PROM = passive range of motion; TAM = total active movement.

Allied Health Literature, PubMed, Web of Science, and Google Scholar. See [Figure 1](#) for the search keywords, which were defined *a priori*. In addition to the automated search strategies, reference lists of related journal articles and existing reviews were hand searched for additional articles. Articles on all formats of traction orthoses for acute intra-articular fractures of the fingers and hand were included for examination, including all levels of evidence in the surgical and rehabilitation literature. Further searches of the terms “traction + splinting” were undertaken on the Google search engine to provide an overview of the so-called gray literature, in hopes of including any relevant published material from non-peer-reviewed sources. Citations and abstracts (where available) were downloaded into an Excel database. Automated updates of the core searches were also implemented, and all articles meeting the inclusion criteria published during the data extraction and manuscript preparation period (ending May 15, 2015) were also included in the review.

Study selection

All references in the Excel database were independently reviewed for inclusion by 2 reviewers (TLP and PDB). In all instances, differences of opinion were resolved by discussion among the 2 reviewers. Inclusion criteria consisted of all articles containing qualitative or quantitative data related to the use of traction orthoses or traction-based external fixation for acute management of traumatic injuries to the joints of the fingers and hand (interphalangeal or metacarpophalangeal joint) in adult humans. Articles exclusively describing fractures to the central shaft of the metacarpals or phalanges were excluded, as were mallet-type injuries to the distal phalanx, and injuries to the thumb carpometacarpal joint, as these may be associated with carpal injuries.^{6,7} In addition, the search was limited to articles with an abstract available in English; Google Translate was then used to translate the body of the article from the source language, with the content checked against the abstract. Commentaries and other descriptive articles or narrative reviews that did not contain any new information not covered by source articles were excluded.

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