2012 Combined Meeting of
The Canadian Society for Surgery of the Hand &
The Canadian Society of Hand Therapists

Scientific Program

Abstract Submissions

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It is an honour to serve as the Scientific Chair for this the 5th Annual Meeting of the Canadian Society of Hand Therapists. The scope of clinical expertise, clinical and graduate education, research work, and innovative collaborations in the arena of hand therapy in Canada is showcased by the peer-reviewed scientific and clinical presenters who will share both posters and oral presentations. We are excited to again enjoy a joint session of scientific presentations with our surgical colleagues from the Canadian Society for Surgery of the Hand (MANUS).

I believe that as CSHT members, we are forging an international identity as passionate leaders in evidence-informed practice within the global hand therapy community. Just imagine what the next five years will look like!

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Tara Packham is an Occupational Therapist with over 20 years of clinical experience in hand therapy. She divides her time between clinical practice with the dedicated team in the Hand Therapy Program at Hamilton Health Sciences and PhD studies at McMaster University under Dr. Joy MacDermid. Clinical and research interests include outcome measurement, complex regional pain syndrome, and the role of the brain in pain, sensation and movement. Tara also serves as an international associate editor for a multi-lingual e-newsletter on Somatosensory Rehabilitation.
A Scoping Review of Motor Imagery in Adult Upper Extremity Rehabilitation
Hebert A & Harris J

Significance:
In the past decade there has been increasing interest in the use of motor imagery i.e. the mental rehearsal of movement, to improve motor function, or to reduce neglect and pain. Motor imagery is being used for conditions such as stroke and complex regional pain syndrome (CRPS). To increase the utility of this treatment and improve the ability to replicate studies, it is important to have consistency in definitions, understand the proposed mechanisms of action and to understand how treatment is delivered.

Objective:
The three objectives of this review are to; 1) examine and summarize the definitions of motor imagery, 2) explore the theories being used to explain MI treatment effects and 3) examine how motor imagery is being used as a treatment technique by identifying common and irregular elements and by summarizing variations in duration, dosage, and frequency.

Method:
A scoping review was used as this form of literature review allows a broad evaluation of an emerging topic. Studies from all levels of evidence were included if motor imagery was used as a treatment technique with any adult clinical population. Studies were excluded if the focus was on imagery assessment, brain computer interfaces or other forms of imagery. Multiple online databases were searched from 1987 to Sept 2011. Data extracted included study type, population demographics, definitions, theories, imagery delivery elements, duration, dosage, and frequency of treatment.

Results:
41 studies met the inclusion criteria consisting of 21 randomized controlled trials, 4 controlled clinical trials, 12 case series and 4 case studies. Most of the motor function studies and all the neglect studies were post stroke. Most of the pain studies were for CRPS. Definitions were provided in 63% of the studies. Simulation theory and neuroplasticity were the most common theories discussed. Treatment delivery varied depending on the population. 23 studies included both motor imagery and physical practice of the same tasks. 24 studies used motor imagery of activities of daily living or simple tasks. Imagery was sometimes combined with other therapies such as with relaxation in 14 studies. Motor function and neglect studies tended to use longer imagery sessions (average 27 minutes) compared to pain studies (average 10 minutes). Not all studies reported on all the data being extracted.

Clinical considerations:
Motor imagery is an emerging treatment being used to promote recovery in orthopaedic and neurological populations for upper extremity motor function, neglect and pain. Common treatment elements were combining imagery with physical practice and / or with relaxation, and of imagining functional tasks. Hopefully this review will help clinicians better understand the current state of research and motor imagery treatment design for various populations.
A Closer Look at the Complications of Zone III Flexor Tendon Repairs – An Analytical Cadaveric Study

Chinchalkar SJ, Pipicelli JG, Agur A, Athwal G

Presented by: Joey G. Pipicelli, Joey.Pipicelli@hotmail.com; Joey.Pipicelli@sjhc.london.on.ca

Purpose:
Zone III flexor tendon repairs managed by traditional post-operative protocols may produce limitations in composite digital motion, limited independent digital flexion and/or extension. The purpose of this clinical paper is to: 1) describe our clinical observations and 2) simulate adhesion in a cadaveric dissection to replicate our clinical observations 3) based on the above, propose modifications are made to post-operative rehabilitation to enhance patient outcomes.

Background:
According to the International Federation of Societies for Surgery of the Hand, flexor tendon injuries are divided into 5 zones. According this classification system, tendon injuries within zone III are between the distal border of the transverse carpal ligament (TCL) and the proximal edge of the fibrooseus sheath. Injuries to this zone have received little attention in the literature.

Methods
To simulate proximal and distal zone III adhesions a fresh cadaver was dissected. The experiment was completed in two phases. **Phase 1** - The first phase consisted of simulating adhesions by suturing the flexor tendons (FDS and FDP) of the middle finger to the lumbrical muscle proximal to the A-1 pulley. After this, passive finger extension of the digit was performed. **Phase 2** - The second phase of this experiment consisted of: 1) simulating adhesions by suturing the flexor tendons of the middle, ring, and small fingers together just distal to the TCL. This was followed by pulling on these digital flexor tendons proximally from the forearm level; FDS and FDP of the ringer finger was pulled proximally from the level of the forearm simulating independent digital flexion; 3) while pulling on the long finger flexor tendons in the forearm we attempted to passively extend the ring finger simulating independent extension.

Results:
Phase one of this cadaveric experiment revealed that by simulating adhesions of FDS and FDP tendons to the lumbral muscle, proximal to the A-1 pulley caused reduced distal gliding of the tendons limiting extension of the digit. Phase two revealed that the simulated adhesions of the tendons distal to the TCL reduced full composite flexion of the digits. Besides this, a loss of independent digital flexion and extension was noted when a single digit was either pulled in extension or when the flexor tendons were pulled proximally. In both of these situations, differential tendon gliding of the FDS and FDP was limited due to the location of tendon adhesion.

Conclusion:
The occurrence on zone III flexor tendon injuries is common, however, the literature is limited describing optimal operative management, post-operative rehabilitation, and complications following such injuries. This paper reviews postoperative complications observed in our clinical practice managed by traditional regimes. The complications observed were further studied through cadaveric simulation. We suggest zone III injuries be divided into proximal and distal regions as these injuries have different rehabilitative approaches in order to minimize secondary complications. Although no clinical data is currently available on the use of this post-operative rehabilitative approach, this article does present treatment methods that are based on sound clinical reasoning. A randomized clinical trial of this rehabilitation approach following proximal and distal zone III flexor tendon injuries may provide evidence that it is beneficial in the prevention of secondary complications which are associated with such injuries.
Orthotic Considerations for Dense Connective Tissue and Articular Cartilage – the Need for Optimal Movement and Stress

McKee P, Hannah S, & Priganc V

Orthotic intervention is an essential component of hand rehabilitation, addressing biological factors that affect activity and participation. This paper addresses basic science underlying clinical reasoning when considering orthoses to maintain or restore structural integrity, mobility and function of dense connective tissue (DCT) structures and articular cartilage. Functional, pain-free joint mobility requires skeletal stability, healthy articular cartilage and appropriate extensibility of periarticular DCT. However these tissues often have different and sometimes conflicting requirements for the maintenance and restoration of integrity and health. The duration of immobilization, especially at end range, should be carefully considered, as it impairs nutrition of tissues and adversely compresses articular cartilage, causing injury that may not be reversible. Immobilization also reduces extensibility of DCT. Thus, an intermittent orthotic wearing schedule is suggested, allowing movement wherever possible to promote tissue health. To optimize benefits and minimize harmful effects of orthotic intervention, further research on physiological responses of tissues to immobilization and tension is needed.

Reliability of Electro-Goniometric ROM Measurements in Patients with Hand and Wrist Limitations

Tajali SB, MacDermid JC, Grewal R, Houghton P, Young C

**Purpose:**
To determine Intrarater, Interrater and Inter instrument reliabilities of two digital electro goniometry (NK and J-Tech) to measure active wrist/finger range of motion (ROM) in patients with hand movement limitations.
**Background:**
Measurements of wrist and/or finger ROMs are frequently performed after wrist or hand disorders. Joint ROM measurements are used to assess patients’ status and progress. Goniometric measurements must be reliable because the results can be used to determine impairment ratings and functional progress. The electrogoniometer measurements may be a viable alternative for traditional goniometry.

**Methods:**
The study was performed in a randomized block design on 44 patients (20 men, 24 women, 21-68 years old) with wrist and/or hand movement limitations. Two experienced raters (one physical therapist and one kinesiologist) measured active wrist ROMs (flexion & extension, radial & ulnar deviations, pronation & supination), active and passive PIP index flexion using two digital electrogoniometer. The raters were blinded to the clinical information. The ROMs evaluation was repeated by one rater (physical therapist) 2-5 days after the initial measurements. Testing was performed with standardized consistent landmarks taken from previous research.

**Results:**
Intraclass reliability analysis (ICCs) was used to assess reliability. The intrarater, interrater and inter instrument reliabilities was high in most of the ROM measurements (ICCs ranged from 0.64 to 0.97, single measure ICC). The ICCs were high for both types of electro-goniometers.

**Conclusion:**
Digital goniometric devices (NK and J-Tech) can be used to reliably measure active wrist ROMs and active or passive PIP flexion in patients with wrist and/or hand limitations.

**Prior Presentation:** Part of this project was presented at the American Society of Hand Therapist (ASHT) Conference held in Nashville-TN, Sep 22-25th 2011.

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**Practice Patterns for Rehabilitation Post Elbow Fracture – a Survey**
MacDermid JC, Vincent JI, Kieffer L, Kieffer A, Demaiter J, MacIntosh S.

Presented by: Joshua Israel Vincent, joshuaisrael1985@gmail.com

**Background and Purpose:**
Elbow fractures amount to 4.3% of all the fractures. The elbow is prone to stiffness after injury and fractures can often lead to significant functional impairment. Physiotherapy plays a major role in restoring range of motion (ROM) and function. There is not much literature available on the practice patterns of hand therapists following elbow fracture. The purpose of this study is to describe the current elbow fracture rehabilitation practice.

**Methods:**
Hand therapists (n=315) from the USA and Canada completed a web-based survey on their practice patterns and clinical opinions related to acute (0-6 weeks) and functional rehabilitation (6-12 weeks) phases of elbow fracture.

**Results:**
Greater than 99% of respondents found fracture severity, co-morbidities, time since fracture, and compliance with an exercise program, psychological factors, and occupational demands to be important prognostic indicators for optimal
function. The majority used education (95%) and active ROM (86%) in the acute stage while, home exercise programs (99%), active ROM (99%), stretching (97%), strengthening (97%), functional activities (97%), passive ROM (95%), and active assisted ROM (95%) were generally used in the functional stage. The most common outcome measures used were goniometry (99%), jamar dynamometry (97%), and hand held dynamometry (97%).

**Conclusions:**
Exercise, education, and functional activity are primary components of elbow fracture rehabilitation. Future research should focus on defining the optimal dosage and type of exercise/activity, as well as core measures to monitor outcomes of these interventions.

**Implications for Practice:**
This study has the potential to aid in the development of CPG’s pertaining to elbow fracture rehabilitation. As a result, all therapists will be able to benefit from a standardized treatment regime for a condition that has shown limited research to date.

**KEY WORDS:** elbow fracture; hand therapist; intervention; rehabilitation; survey

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**Intolerance after Median, Ulnar or Radial Nerve Injury**
Novak C, Anastakis DJ, Beaton BE, Mackinnon SE, & Katz J

**Purpose:**
Cold intolerance following nerve injury may contribute to poor outcome. This study evaluated the factors associated with cold intolerance in upper extremity nerve injuries.

**Methods:**
Following REB approval, adults more than six months after a median, ulnar or radial nerve injury were completed these questionnaires: Cold Intolerance Severity Scale (CISS), DASH, SF-36, McGill Pain Questionnaire (MPQ), Pain Catastrophizing Scale (PCS) and Post-traumatic Stress Disorder Checklist (PCL-C). Statistical analyses evaluated the relationships among the dependent and independent variables. Linear regression evaluated the variables that predicted CISS scores.

**Results:**
There were 46 men and 26 women with a median time from injury of 15 months. There were high levels of cold intolerance, disability and pain reported. CISS scores were significantly correlated with the MPQ pain rating index (r = .71), pain intensity (r = .56), DASH (r = .49), PCS (r = .49), PCL-C (r = .40), SF-36 physical (r = -.37) and mental composite scores (r = -.32) and time since injury (r = .29). CISS scores were significantly higher in patients with complex nerve injuries (p = .02) and no difference in work status. The final regression model explained 53% of the variance and the only significant variable was the MPQ pain rating index (Beta = .677, p < .001).

**Conclusions:**
High levels of cold intolerance were reported by these patients with median, ulnar or radial nerve injuries and the significant factor that was associated with cold intolerance was the MPQ pain rating index.
A Risk Score to Predict the Probability of Poor Functional Outcome at 2 years Following Radial Head Arthroplasty
Kaur M, MacDermid J, & Grewal R

Background
The aim of this study was to identify if baseline pain was a significant factor for poor functional outcome (PFO) at 2 years post-RHAP and to develop a risk score to predict the probability of PFO.

Methods
Adult inpatients posted for RHAP were invited to participate in the study. Data regarding pain and function at baseline, 3, 6, 12 and 24 months were collected. 129 patients (mean age 46) were evaluated. The data was subjected to logistic regression to quantify the relative impact of baseline pain on PFO and develop a baseline score at 24 months.

Results
The probability of PFO could be estimated from the equation CFO=1/ (1+exp(-z)) where z= (-2.85) + 0.819*pain score + (-0.066)*sex + 0.048*age. In validation, this achieved an area of 0.72 (R²=0.262, p<0.001) under ROC curve and the actual incidence of PFO correlated with the predicted risk.

Conclusion
The results suggest that the probability of PFO following RHAP can be predicted by a score mainly based on baseline pain.

(Please note: The results are obtained from pre-elementary analysis and expected to be refined by the time of presentation)

Collagenase Injection for Severe Dupuytren’s Contracture of the PIP joint: the Role of Therapy and Splinting
Skirven T, DeTullio L, Osterman AL, Jacoby S, Bachoura A

Presented by: Lauren DeTullio, ldetullio@handcenters.com

Background:
After treatment with injectable collagenase clostridium histolyticum (Xiaflex®), proximal interphalangeal joint (PIP) contractures in Dupuytren’s disease have worse outcomes when compared to metacarpophalangeal contractures. Longstanding and severe Dupuytren’s contracture of the PIPJ can cause secondary changes and contractures to the
surrounding periarticular joint structures and attenuation of the central slip of the extensor mechanism, which may explain suboptimal outcomes.

**Purpose:**
To determine if the results of Xiaflex injection of severe PIPJ contractures can be improved with therapy and splinting. The therapy and splinting study protocol addressed the residual contracture and the attenuated central slip and shortened oblique retinacular ligament (ORL).

**Methods:**
Patient with a Dupuytren’s PIPJ contracture scheduled for a collagenase injection were invited to participate in the study. Following injection and cord rupture by a hand surgeon, a hand therapist evaluated and treated each patient based on a treatment protocol, which involved: splinting and/or serial casting to address residual PIPJ contracture and attenuated central slip; and home exercises emphasizing reverse blocking for PIPJ extension and DIPJ flexion exercises to lengthen the ORL. A paired sample t-test was used to compare 2 means and a p-value less than 0.05 was considered statistically significant.

**Results:**
There were fourteen patients: 13 males and 1 female. The ring finger was involved in 3 cases and the small finger in 11 cases. The mean age was 61.6 years (range 37-79). The baseline PIPJ contracture was 53.1° (range 25-80). Following one Xiaflex injection, therapy and home exercises, the mean contracture at 30 days after injection became 4.3° (range 0-20), p = 0.000. The results represent a 92.8% improvement of the contracture.

**Discussion:**
Central slip attenuation in Dupuytren’s contracture is likely a cause of persistent flexion of the PIPJ. The therapy and splinting study protocol addresses the residual contracture and the attenuated central slip and shortened ORL. The role of therapy and splinting following collagenase injection for Dupuytren’s contractures is not well defined yet. In the short term however, it appears that severe PIPJ contractures benefit significantly from greater attention to post injection splinting and specific exercise. Long-term follow-up is needed to determine maintenance of contracture correction.

**Disclosure:** The Philadelphia Hand Center has received funding from Auxilum Pharmaceuticals.

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**Health-Related Quality of Life in Patients Undergoing Surgery for Dupuytren’s Contracture**

**Thoma A, Ignacy TA, Levis C, Martin S, Duku E**

**Purpose:**
To measure the quality of life (QOL) of patients undergoing palmar fasciectomy for Dupuytren’s contracture (DC) prior to surgery and at 12 months post-operatively using the Health Utilities Index Mark 3 (HUI3) QOL questionnaire.

**Methods:**
From 2007-2010, consecutive patients from the offices of 3 plastic surgeons in Hamilton, Ontario were recruited. Patients were asked to complete the HUI3 before surgery and 12 months postoperatively. The HUI3 assesses 8
attributes of health providing a score between 0 and 1 for each attribute (see Table 1). The HUI3 also provides an overall QOL score on a scale from 0 to 1 where 0 represents the worst possible QOL (death) and 1 represents perfect health.

Results:
Thirty-three patients were recruited and 26 patients had complete data. The patients mean age was 64.2±7.3 (SD). Participants gained a mean increase in health utility 0.0401 from their baseline (0.7851±0.1982) to 12 month postoperatively (0.8252±0.2107), which exceeds the threshold of 0.03 for the minimum clinically important difference (MCID). Of the 8 attributes, dexterity saw a statistically significant and clinically important increase from baseline (0.8642±0.1353) to 12 months postoperatively (0.9573±0.0711), (p-value<0.001).

Table 1. Multi-attribute and single attribute health utility scores for surgical patients undergoing palmar fasciectomy pre-operatively and 12 months post-operatively.

<table>
<thead>
<tr>
<th></th>
<th>Pre-operative (1 week pre-op) (n=26)</th>
<th>Post-operative (12 months) (n=26)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HUI3 Multiattribute Score</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.7851 (0.1982)</td>
<td>0.8252 (0.2107)</td>
<td>0.329</td>
<td></td>
</tr>
<tr>
<td><strong>HUI3 Single Attribute Scores</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vision</td>
<td>0.9558 (0.0163)</td>
<td>0.9438 (0.0745)</td>
<td>0.473</td>
</tr>
<tr>
<td>Hearing</td>
<td>0.9746 (0.1045)</td>
<td>0.9415 (0.2174)</td>
<td>0.241</td>
</tr>
<tr>
<td>Speech</td>
<td>1 (0)</td>
<td>1 (0)</td>
<td>-</td>
</tr>
<tr>
<td>Cognition</td>
<td>0.9942 (0.0286)</td>
<td>0.9938 (0.0217)</td>
<td>0.161</td>
</tr>
<tr>
<td>Dexterity</td>
<td>0.8642 (0.1353)</td>
<td>0.9573 (0.0711)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Ambulation</td>
<td>0.9677 (0.0821)</td>
<td>0.9550 (0.1746)</td>
<td>0.652</td>
</tr>
<tr>
<td>Pain</td>
<td>0.8758 (0.2253)</td>
<td>0.8965 (0.1411)</td>
<td>0.589</td>
</tr>
<tr>
<td>Emotion</td>
<td>0.9654 (0.0628)</td>
<td>0.9827 (0.0570)</td>
<td>0.327</td>
</tr>
</tbody>
</table>

Conclusion:
This is the first study to measure QOL in patients with DC. The overall HUI3 score from pre-op to post-op demonstrated a clinically important difference.
Measurement Properties of the *QuickDASH* (Disabilities of the Arm, Shoulder and Hand) Outcome Measure and Cross-Cultural Adaptations of the *QuickDASH*: a Systematic Review


**Background:**
The ability to measure outcomes related to function in people with upper limb disorders using a short, yet robust instrument has many practical advantages over long form instruments. The DASH (Disabilities of the Arm, Shoulder and Hand), a 30-item self-report measure, is one of the most commonly used measures for the upper limb. The *QuickDASH*, a shortened version (11-items), is becoming more widely used since its development in 2005.

**Methods:**
A systematic review used a best evidence synthesis approach to critically appraise the measurement properties [using CONsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklists] of the *QuickDASH* and cross-cultural adaptations. A standard search strategy was conducted between 2005 (year of first publication of the *QuickDASH*) and March 2011 in MEDLINE, EMBASE and CINAHL.

**Results:**
The search identified 14 studies (15 published articles) to include in the best evidence synthesis of the *QuickDASH*. A further 11 articles were identified to include in the best evidence synthesis on eight cross-cultural adaptation versions of the *QuickDASH*.

**Conclusions:**
The measurement properties of the *QuickDASH* have been evaluated in multiple studies and across most of the measurement properties. The best evidence synthesis of the *QuickDASH* suggests that this tool is performing well with strong positive evidence available for reliability (internal consistency and test-retest reliability) and hypothesis testing, and moderate positive evidence for structural validity testing. Strong negative evidence was found for responsiveness. Information about the measurement properties of the cross-cultural adapted versions is still lacking or of poor overall methodological quality.
Testing the Effectiveness of an Injury Prevention Workshop for National Youth Orchestra Canada

Guptill, C

Playing-related health problems in instrumental musicians are poorly recognized by healthcare practitioners, and ill-defined in the research literature. Recent studies indicate very high prevalence, upwards of 80%. Several injury prevention and education courses for musicians have been developed in the US. Courses in Canada are rare, and if offered, are provided for music students enrolled in post-secondary programs. Currently, only two international studies have measured the efficacy of such a course. Neither of these courses were offered in elite intensive programs, where the practical implications and palatability of taking precious time away from rehearsal must be considered.

This presentation will present findings of a study examining the effectiveness of an injury prevention workshop for an elite, intensive orchestral training program for young musicians (data collection is complete; analysis is in progress). In summer 2011, National Youth Orchestra Canada (NYOC) received a workshop based on principles of risk reduction, which integrated mental and physical health management from a best-evidence synthesis. The workshop was delivered by the author, who is a registered occupational therapist, musician and researcher in performing arts health. The study consisted of pre- and post-workshop Internet surveys, measuring prevalence of injuries and preventive behaviours in both the NYOC (N=90), and the control group, l’Orchestre de la Francophonie (n=70), which did not receive the workshop. Data were collected at baseline, post-workshop, post-program (end of summer) and 3 months post-program. It is hypothesized that knowledge and attitudes about playing-related health problems will be positively impacted. The findings will be used to improve future delivery of the workshop, and to design multi-centre cluster trials.

Properties of the Patient Rated Wrist and Hand Evaluation: a Rasch analysis

Packham T & MacDermid J

Presented by: Joy MacDermid, macderj@mcmaster.ca

Introduction:
The Patient-Rated Wrist and Hand Evaluation (PRWHE) is a self-reported assessment of pain and disability to evaluate the outcomes after hand injuries. Rasch analysis is an alternative strategy for examining the psychometric properties of a measurement scale based in item response theory, rather than classical test theory. The Rasch model 1) converts
ordinal scale measurements of individual test items into interval level scaling and 2) considers whether different groups systematically provide different answers to questions (and adjusts for this bias).

**Purpose of the Study:**
This study used Rasch analysis to examine the content, scoring and measurement properties of the PRWHE.

**Methods:**
PRWHE scores (n=210) from persons with a traumatic injury or reconstructive surgery to one hand were collected from an outpatient hand rehabilitation facility. Rasch analysis was conducted to assess how the PRWHE fit the Rasch model, confirm the scaling structure of the pain and disability subscales, and identify any areas of bias from differential item functioning.

**Results:**
Rasch analysis of the PRWHE supports internal consistency of the scale (α =0.96) and reliability (as measured by the person separation index) of 0.95, χ² (30)= 47.74, p=0.02. Two PRWHE items showed evidence of bias but this cancelled out when assessment scores were considered as subscale totals rather than an overall score. While gender, age, diagnosis, and duration since injury all influenced how people scored the PRWHE, hand dominance and affected side did not.

**Conclusions:**
Initial examination of the PRWHE suggests the scale structure may be best considered as 3 subscales (pain, specific activities and usual activities) rather than simply pain and disability. The psychometric properties of consistency, reliability and responsiveness previously tested by classical methods are further supported by Rasch analysis.
3D Anatomy Glove Learning System for Teaching and Refreshing Hand Anatomy Knowledge
McKee P & Agur A
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Purpose
Although hand anatomy is an important component of education for occupational and physical therapy students, many programmes are unable to provide optimal learning, or may not even provide a formal anatomy course. Hand therapists often seek opportunities to enhance knowledge of upper extremity anatomy. The purpose of the study was to develop and evaluate an innovative learning system to enhance comprehension of hand anatomy for students and therapists.

Methods
(1) A glove, imprinted on volar and dorsal surfaces with anatomically-correct bones, was designed. (2) Video clips were produced showing anatomy on dissected human specimens, followed by how to draw muscles onto the glove. Video segments also demonstrated function of muscles, surface anatomy and common clinical conditions. Participants - 130 first year OT students and 143 hand therapists - watched the videos and drew muscles on their own gloves with coloured markers, producing a 3D kinesthetic glove. Effectiveness of the learning system was then evaluated with a questionnaire. Descriptive statistics were collected and themes from written comments were identified.

Results
Analysis of the surveys found that confidence in hand anatomy knowledge increased an average of 21% among 414 participants. Overall satisfaction with the learning system was 9/10. Written comments provided insight into the benefits of the learning system for enhancing knowledge of students, therapists and even in client education.

Conclusions
Comprehension of hand muscle function was enhanced by the drawing process as well as by wearing the 3D, kinesthetic gloves during functional movements. It can be used for classroom-based courses, online courses, self-directed learning and client education.

Effect of Butlers Neural Mobilization of the Radial Nerve in Managing Lateral Elbow Pain Secondary to Extensive Computer Usage
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³Professor, Assistant Dean of Rehabilitation Science, McMaster University, School of Rehabilitation Science, Hamilton, Ontario, Canada and Co-Director of Clinical Research, Hand and Upper Limb Center, St. Joseph’s Hospital, London, Ontario, Canada

Background:
Computer users may be at risk of lateral elbow pain. The radial nerve is anatomically predisposed to micro trauma during keyboard use due to static work of the elbow extensor muscles surrounding it resulting in adverse mechanical tension in the radial nerve which is reflected as decreased neural mobility.
Aims:
The purpose of this study was to determine if a single occasion a neural mobilization of the radial nerve was effective in reducing pain or improving in neural extensibility as reflected by shoulder abduction motion measured during an Upper Limb Tension Test (ULTT).

Methods:
Forty-one computer professionals (Mean age 46.7; S.D.12.77), who had experienced lateral elbow pain for a mean of 2.87 months were recruited. The subjects rated pain using a verbal numeric rating scale (NRS). Radial nerve tension was tested using the ULTT for radial nerve in both upper extremities. Gleno humeral joint abduction was measured using a universal goniometer. The radial nerve was mobilised using a series of 8 oscillations and repeated 3 times with one minute rest in between. The NRS and ULLT test were repeated after treatment and the scores compared using a paired t-test.

Results:
The mean GH abduction range increased significantly post-treatment from 72.9 (7.7) to 77.4 (6.5) (p<0.000; t value=6.91). While the mean NRS scores decreased significantly from 5.7 (1.1) to 3.8 (1.4) (p<0.000; t value=8.07).

Conclusion:
A single session of 3 neural mobilization resulted in an improved extensibility during a ULTT and less pain in computer users with lateral elbow pain. A longer-term randomized trial is needed to determine if effects are sustained over time.

Key words: lateral elbow pain; neural tension testing; Butler’s technique of neural mobilization; visual analog scale

The Efficacy of Splinting and Home Therapy After Injection of Collagenase Clostridium Histolyticum for Dupuytren’s Contracture
McMahon HA, Jacoby SM, Culp RW, Skirven RM, Osterman AL
Heather.McMahon@Jefferson.edu

Purpose:
The objective was to compare the efficacy of a treatment regimen for Dupuytren’s Contracture consisting of injectable collagenase clostridium histolyticum (Xiaflex®), splinting, and home therapy for metacarpophalangeal contractures (MP) versus proximal interphalangeal (PIP) joint contractures.

Methods:
A retrospective chart review of patients treated with Xiaflex® at one center over one year was conducted to collect pre-injection and post-injection MP and PIP contractures. Minimum follow-up was 30 days. All patients received Xiaflex® injection, cord manipulation, dorsal or volar-based customized thermoplastic splints, and home exercise education. However, splinting and home therapy were not stringently enforced in order to achieve realistic compliance rates.

Results:
There were a total of 27 patients with 63 digits: 20 males and 7 females with a mean duration of follow-up of 5.5 months. The mean baseline MP contracture was 39.8° ± 18.6 and the mean baseline PIP contracture was 47.8° ± 27.9, p=0.229. At latest follow-up, mean post-injection MP contracture was 6.5° ± 12.3, while mean post-injection PIP contracture was 26.5 ° ± 23.4, p=0.001.

Conclusion:
Despite the therapeutic regimen of Xiaflex®, splinting, and home therapy, similar to previous literature, we observed significantly better outcomes in patients treated for MP contractures versus PIP contractures. As a result, we have developed a research protocol that employs a custom fabricated extension splint aimed at correcting residual PIP joint contractures, with exercises addressing oblique retinacular ligament tightness and central slip attenuation, which have been implicated as possible causes of poorer PIP contracture outcomes.
**Novel Hinge Splint Design for Scaphoid Injury**

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Scaphoid fracture is one of the most common injuries to the carpal bones. Ideally, post-fracture treatment would permit controlled motion of the hand, while preventing motion of the healing scaphoid. The “Dart Thrower’s Motion” (DTM) is a motion produced when throwing a ball or hammering during which the hand travels from a position of radial deviation and extension to a position of ulnar deviation and flexion along the DTM plane. Compared to pure radio-ulnar deviation or flexion-extension, the DTM causes relatively little translation or rotation of the scaphoid, thus the stresses on the scaphoid are thought to be minimized. For scaphoid injuries involving fractures and ligament tears, the DTM is an ideal movement of the wrist as it does not further damage the injured scaphoid region. Early controlled motion of the wrist would help to maintain flexibility and mobility during healing and would accelerate post-fracture recovery compared to immobilization. Hinge splints currently on the market, however, only allow flexion-extension of the hand in the sagittal plane; a motion that causes excessive stresses on the healing scaphoid. The purpose of our project was to design and prototype a hinge splint apparatus that can be used to guide hand motion in the DTM plane. The hinge is designed to attach to a typical thermoplastic splint and is adjustable to compensate for variations in patient hand size. Our future work will evaluate the scaphoid hinge splint on a subset of subjects in order to improve the functionality for healthcare providers.

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**Client Centered Rehabilitation Following Avulsion of FDS in a Previously Amputated Digit**

Marie Eason Klatt OT Reg. (Ont.), CHT, MScCH (Candidate)

**Purpose:**  
To present the results of an unusual case of flexor tendon avulsion in a client with a digital amputation where rehabilitation employed early active motion using the place and hold method

**Background:**  
This 54 year old female diabetic client sustained an avulsion of the FDS tendon to her right dominant long finger which had an amputation at the level of the middle phalanx 36 years previously. The injury was the result of a typical jersey tendon avulsion, however, this client lacked a profundus tendon in the affected digit. She underwent primary repair of the FDS tendon which included wire and button fixation.

**Methods:**  
She was treated with an early active motion protocol using the place and hold method which also included protected PROM. A pulley ring was used to protect the repair. Time lines for initiation various stages of the early active motion protocol were modified based on wound healing and clinician judgement. Treatment also included edema control using icing, contrast baths with AROM, and Coban®. Pulsed ultrasound, scar massage and silicone sheeting were employed to manage post operative scarring. Strengthening exercises and activities were initiated at 8 weeks post-repair.

**Results:**  
At the time of discharge, the client’s AROM in the affected digit was 105° flexion at the MCP joint with a 5° extension lag and 70 degrees at the PIP joint with full extension. Grip strength using the JAMAR dynamometer at the middle setting measured 27 kg on the right and 36 kg on the left. The client’s score on the PRWHE steadily improved over the course of
her rehabilitation and at the time of discharge measured 9. She returned to full duty employment at a tertiary care hospital as a clinical assistant responsible for direct patient care on an inpatient cardiology unit where her duties included feeding, toileting, dressing, and transferring. She was independent in all aspects of her ADL and IADL. Moreover, she had resumed her avocational interests of knitting, crocheting and braiding her daughter’s hair.

**Conclusion:**
Careful application of flexor tendon rehabilitation protocols using a client centered approach yielded a return to previous functional status for this client who had sustained a tendon avulsion in a digit with a previous amputation. Problem solving and a comprehensive understanding of human occupation are essential elements of effective rehabilitation. As hand therapists, we base our clinical decision making on a thorough knowledge of biological healing and disease process, comprehensive understanding of rehabilitation protocols and careful assessment of the client’s occupational performance issues.

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**Take a Bite Out of it: Managing Human and Animal Bites to the Upper Extremity**

O'Callaghan, Lynda B.Sc. (PT), BPE, MA  
Krakovsky, Antoinette B.Sc. (OT), OT Reg. (Ont.)  
Eason Klatt, Marie B.Sc. (OT), OT Reg. (Ont.), CHT, MScCH (Candidate)

**Purpose:**
To present evidence based clinical pearls to apply to the assessment and treatment of soft tissue injuries sustained following human or animal bites through case-based presentations.

**Background:**
An interprofessional approach to rehabilitation can significantly improve or alleviate the temporary or permanent dysfunction that may result from soft tissue injury following a bite of any kind. Soft tissue injuries resulting from human or animal bites pose multiple challenges for the therapist. Controlling pain, managing wound healing and edema, addressing the complications of infection and managing scarring require early intervention and an client centered approach to treatment.

**Methods:**
A comprehensive review of the literature was conducted using the following data bases: MEDLINE (2007 to March Week 1, 2011), and CINHL (2007 to March week 1, 2011) with the assistance of a hospital-based medical librarian. Medical subject heading used were bites and stings, wound infection, rehabilitation, and soft tissue injuries and related terms. The search was limited to English language references and human subjects. As the main focus of the search was to determine the impact of rehabilitation interventions on human and animal bites, it was necessary to review titles, abstracts and articles to identify pertinent findings addressing rehabilitation treatment of hand and upper limb injuries following bites. Articles which focused on mammalian rather than other phyla were selected. Hand searching was also conducted by reviewing the references of retrieved articles. Through small, interprofessional focus groups and the results of the literature review, evidence-based pearls were developed for application to a variety of clinical scenarios where the mechanism of injury was a human or animal bite.

**Results:**
Case-based presentations that highlight the impact these injuries have on soft tissue will be used to demonstrate the application of these pearls to the assessment and treatment of this client population.

**Conclusion:** Animal and human bites may result in permanent disability and scarring without timely, appropriate rehabilitation. As clinicians, we should base our treatment decisions on a critical examination of the relevant literature and shape our practice around integration of this evidence with each clinical challenge. Without the benefit of specific rehabilitation research evidence for this patient population, hand therapists are called upon to use their knowledge of
wound healing, hand and upper limb anatomy and biomechanics, and scar management. These pearls assist therapists in the clinical decision making required to meet many of the challenges of client centered treatment following human and mammalian bites.

**The Psychometric Properties of the MacHANd Performance Assessment (MPA)**

Tara Packham, Annemarie Muhic, and Elizabeth Landman

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**Study Design:**
This measurement study examined reliability and validity of the MacHANd Performance Assessment (MPA) with a hand-injured population.

**Introduction:**
Few functional hand assessments have been developed explicitly for traumatic hand injuries and data supporting their use is limited. The MPA is a standardized assessment under development that uses everyday functional tasks to examine the grasp and pinch patterns of the hand.

**Purpose of the Study:**
To determine if the MPA is a reliable and valid measure of function to be used with individuals following hand injury.

**Methods:**
Participants receiving therapy following hand trauma or surgery (n=41) were recruited from hand therapy clinics throughout the Hamilton/Niagara Region. At baseline visit, two raters simultaneously observed and scored the MPA, the Jebsen-Taylor hand assessment, Patient Rated Wrist and Hand Evaluation (PRWHE) and grip and pinch strength dynamometry. Available participants also repeated the assessments again within one week of baseline.

**Results:**
The MPA demonstrates good to high inter-rater reliability and excellent test-retest reliability. Item-total correlations were very strong at $\alpha=0.95$. Preliminary explorations of construct and criterion validity confirmed hypothesized relationships between MPA scores and other measures.

**Conclusions:**
The MPA is an easy to use functional assessment for individuals with hand injuries based on performance of everyday tasks. This study provides initial estimates of the psychometric properties of the MPA in patients with hand injuries.

**Level of Evidence: N/A**
Osteochondral Autograft Transplantation for Articular Defects in the Hand and Wrist

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**Co-authors:** Randall Culp, M.D.; Sidney Jacoby, M.D.

**Location:** Thomas Jefferson University Hospital – The Philadelphia Hand Center, Philadelphia, PA

**Hypothesis:**
The osteochondral autograft transfer system procedure (OATS) has been described for osteochondral defects. We hypothesize that this procedure can be used for articular defects in the hand and wrist, with adequate functional results.

**Methods:**
We performed a retrospective chart review of four male patients who had an OATS procedure for an articular defect of their hand or wrist. The average age was 30 years old. The patients' injuries consisted of osteochondral defects in two proximal lunates, a proximal scaphoid, and a metacarpal head. Outcome variables consisted of four month postoperative grip strength, range of motion, time to return to normal activity, and radiographic evidence of osteochondral plug in-growth.

**Results:**
The average time from injury to surgery was 29 months, with an average follow-up of 5 months. Using our technique, we had no significant complications. The average gain of wrist motion was 6°, with wrist strength gaining an average of 18 PSI. Radiographic evidence of graft position and an improved articular surface was seen in all the cases by final follow-up. Every patient was happy with their result and would do it over again. All patients returned to their daily activities, including minor league baseball, golfing, and ice hockey.

**Summary:**
The OATS is a technically demanding procedure, but is a good option for focal osteochondral defects in higher demand individuals. It incorporates hyaline cartilage into the defect, with capabilities for re-growth and regeneration. One can expect a successful outcome after a congruent articular surface is maintained and an adequate rehabilitation regimen is applied.

**Level of Evidence:** Level IV (case series)

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A Systematic Review of Outcome Assessments for Complex Regional Pain Syndrome: Describing the Elephant

**Tara Packham OT(Reg)Ont, MSc(RS); Joy MacDermid PT, PhD; James Henry PhD; Dr. James Bain FRCPS**

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MacHANd Research Network

Presented by: Tara Packham, MSc, OT (Reg.) Ont; Hamilton Health Sciences, Hamilton, Ontario; packhamt@hhsc.ca

**Study Design:**
Systematic review.

**Introduction:**
Complex regional pain syndrome (CRPS) is a neurological disorder characterized by a variable collection of signs and symptoms for which there is no accepted diagnostic test. Despite the lack of established diagnostic tools, there is a need to evaluate these patients and monitor response to interventions.

Purpose of the Study: To conduct a systematic review of the scope and quality of psychometric examinations of disease-specific outcome measures for CRPS.
**Methods:**
Health database searches yielded 23 papers in English covering 19 assessment instruments that included at least 20% or n=50 persons with CRPS in the test population. Each article was scored for quality by 2 raters using a 12-item structured tool; data was also extracted for comparison of tool content.

**Results:**
Article quality ratings ranged from 25% to 88%, with higher scores indicating higher quality. Six of the tools were specific to the upper extremity. Many ‘general’ tools were for single construct, such as pain, skin temperature or allodynia. This could be compared to describing an elephant by only looking at the tusk, ear or tail. Most psychometric data was based on small studies (mean n=33); only one study addressed all relevant issues of reliability, validity and responsiveness.

**Conclusions:**
Despite the variety of outcome measurement tools reported for CRPS rehabilitation, large gaps remain in both comprehensiveness and supporting psychometric evidence. Comprehensive, relevant and psychometrically sound tools for monitoring treatment outcomes are needed to address the pain and functional limitations experienced by this population.

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**Muscle Fatigue in Patients with Rotator Cuff Pathology**

Jayaprakash Raman, MPT, (PhD); Joy MacDermid, PT, PhD, Dave Walton, PT, PhD, FCAMT

Presented by: Jayaprakash Raman, MPT, (PhD), Health and Rehabilitation Sciences Program, Faculty of Health Sciences, University of Western Ontario; jraman3@uwo.ca

**Purpose:**
The purpose of this prospective study is to analyse muscle endurance in patients with rotator cuff tear posted for surgery and compare it to patients with rotator cuff pathology but not torn, and age matched controls.

**Study Design:**
Prospective cross-sectional study.

**Background:**
In about one-third of patients undergoing uncomplicated major surgery, a pronounced increase in fatigue extends throughout the first month. A postoperative decrease in muscle force and endurance is related to postoperative fatigue. Postoperative fatigue correlates with the degree of surgical trauma but is not related to duration of general anesthesia and surgery or to preoperative nutritional status, age, or sex. There has been no study to analyze the effect of rotator cuff repair on fatigue of the shoulder muscles. This study aims to study the effect of rotator cuff repair on muscle performances and compare it with that of patients with rotator cuff pathology who do not undergo surgery.

**Methods:**
Twenty subjects with rotator cuff tear posted for surgical repair of the rotator cuff, twenty subjects with rotator cuff pathology but intact and twenty age matched controls were chosen for the study. The subjects were measured for pain, function and general health status using DASH (Disabilities of arm, shoulder and hand), Western Ontario Rotator cuff index (WORC), SF-12 and FIT-HaNSA outcome measure.

Muscle performances are measured using the **Biodex system 3** which is a muscle strength testing and rehabilitation instrument used in the testing and rehabilitation services for shoulder, elbow, wrist, hip, knee and ankle. Modes of operation for exercise and testing include isokinetic, passive, isometric, isotonic, and reactive eccentric. Patients are
tested for their muscle performance using the endurance protocol developed by Jean-Sébastien Roy et al. The endurance protocol was performed in isotonic mode with the resistance set at 50% of each subject’s peak torque as measured for shoulder external (ER) and internal rotation (IR). Each subject performed 60 continuous repetitions of IR/ER rotation. The muscle performance is measured by calculating the average peak torque (in Nm) and analyzed across the group of patients and controls.

**Level of Evidence:** 2b.

**Keywords:** Muscle endurance, fatigue, Biodex.
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