Complete Summary

GUIDELINE TITLE

Evidence-based care guideline for loss of elbow motion following surgery or trauma in children aged 4 to 18.

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Evidence-based care guideline for loss of elbow motion following surgery or trauma in children aged 4 to 18. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2007 Dec 21. 9 p. [26 references]

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE
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SCOPE

DISEASE/CONDITION(S)

Loss of elbow motion following surgery or trauma, including:

- Fracture of distal humerus
- Supracondylar humeral fracture
- Condyle and epicondyle fracture
- Elbow dislocations
- Olecranon fracture

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Prevention
Rehabilitation
Treatment

CLINICAL SPECIALTY

Orthopedic Surgery
Pediatrics
Physical Medicine and Rehabilitation

INTENDED USERS

Occupational Therapists
Patients
Physical Therapists
Physicians

GUIDELINE OBJECTIVE(S)

- To optimize elbow function through long term maintenance of increased active elbow range of motion
- To increase elbow strength in children who have been immobilized after elbow surgery or trauma
- To minimize time spent in therapy
- To increase coordination and consistency of care provided by therapists
- To maintain and improve family satisfaction

TARGET POPULATION

These guidelines are intended for the use in patients aged 4 through 18 years of age who present with loss of elbow motion following surgery or trauma including the following:

- Fracture of distal humerus
- Supracondylar humeral fracture
- Condyle and epicondyle fracture
- Elbow dislocations
- Olecranon fracture

These guidelines are not intended for use in patients with the following:

- Radial head fracture
- Radial neck fracture
- Nerve damage associated with injury

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis and Evaluation

1. History and physical exam
2. Clinical assessment

Management/Treatment

1. Occupational and physical therapy:
    - Inflammatory/acute phase: range of motion, strengthening, superficial cold
    - Fibroplastic/subacute phase: range of motion, strengthening, superficial heat, ultrasound, superficial cold
    - Remodeling/return to activity phase: range of motion, strengthening, superficial heat, ultrasound, superficial cold
2. Splinting
    - Timeframe for splinting
    - Types of splints
        - Static progressive
        - Serial static
        - Dynamic

3. Discharge criteria
4. Follow up consultation
5. Patient and family education

MAJOR OUTCOMES CONSIDERED

- Range of motion (ROM)
- Equal strength between extremities
- Functional ability
- Patient and family satisfaction

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

To select evidence for critical appraisal by the group for the development of this guideline, Pubmed, OVID (Medline, Cinahl, All EBM Reviews - Cochrane DSR, ACP Journal Club, DARE and CCTR), Pedro, OT Seeker and OT CATS databases were searched to generate an unrefined, "combined evidence" database using a search strategy focused on answering clinical questions relevant to this Loss of Elbow Motion Following Surgery or Trauma (see Appendix 'Initial Clinical Questions used to guide search and selection of evidence' in the original guideline document) and employing a combination of Boolean searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on words in the title, abstract, and indexing terms. Additionally a search was done on the on the web including the website www.googlescholar.com. Many search terms were used as

seven therapists did the searching. The search was done from February to May of 2006. Terms that were used to search relating to the anatomy of the elbow were as follows: elbow, distal humerus, supracondylar, radial head, olecranon, upper extremity. These terms were combined with terms describing the pathology: injury, fracture, dislocation, trauma, adhesions, contracture. Other terms used include: immobilization, complications, therapy, splint, pediatric, rehabilitation, range of motion, stretching, goniometer, modalities, reliability and validity. The citations were reduced by eliminating duplicates, non-English articles, and articles deemed inappropriate for the purpose of this project. Various combinations of these terms were used of the above named databases and the appropriate articles were retrieved, read, reviewed and appraised by members of the team. There were approximately 55 articles pulled from these searches that were culled by team members to find those that best aligned with this guideline's clinical questions (see Appendix in the original guideline document). After the database search was exhausted, the team found other appropriate articles and book chapters by scanning the reference lists of the reviewed articles. The team decided that all levels of evidence would be appropriate as there was not much evidence relating to the specific population at the time of the search. During the course of the guideline development, additional clinical questions were generated and subjected to the search process, and some relevant review articles and adult literature were utilized.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Recommendations have been formulated by a consensus process directed by best evidence, patient and family preference and clinical expertise. During formulation of these recommendations, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The guidelines have been reviewed and approved by clinical experts not involved in the development process, senior management, other appropriate hospital committees, and other individuals as appropriate to their intended purposes.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Each recommendation is followed by evidence classification (A-X) identifying the type of supporting evidence. Definitions for the types of evidence are presented at the end of the "Major Recommendations" field.

History and Physical Exam

It is recommended that a thorough history will be taken from the patient and/or parent regarding:

- Mechanism of injury
- Type of injury
- Any surgery-type of procedure
- Immobilization (duration, date removed)
- Functional goals of patient and family (Local Consensus [**E**])

Clinical Assessment

Recommended assessment of the following:

- Active (AROM) and passive range of motion (PROM) of shoulders, elbows, forearms and wrists
- Joint end feel
- Sensation
- Visual inspection of surgical site
- Girth measurements (if appropriate)
- Strength of shoulders, elbows (if appropriate), forearms, wrists and grip (Davila & Johnston-Jones, 2006 [**S**], Local Consensus [**E**])

Recommended Outpatient Occupational and Physical Therapy Interventions

It is the recommendation of these therapists that the patient with a post-traumatic immobilized elbow with impaired motion and/or strength be referred for outpatient occupational or physical therapy interventions as soon as possible after the immobilization period. It has been shown that patients who have been allowed early mobilization or referred to physical therapy sooner have gone onto have, fewer complications, fewer residual symptoms, and faster gains in range of motion and strength than those who have delayed motion and/or therapy (Nash et al., 2004 [**M**]; Keppler et al., 2005 [**C**]; Dias et al., 1987 [**C**]). The following clinical guidelines are based upon the best research available at this time related to the basic science of healing and principles of rehabilitation. It is recommended that this will be utilized from day one when a patient comes out of their cast and incorporated into their plan of care.

It is recommended that a clinic based physical therapy plan be initiated, as indicated by the patient's current impairments. It is recommended that the patient and family are instructed in a home program of range of motion and strengthening and that they will be followed at least once weekly by physical therapy for progression of program until goals are met or patient's progress has plateaued (Friedrich, Cermack, & Maderbacher, 1996 [**C**], Griffith, 2002 [**E**]).

1. **Inflammatory/Acute Phase (0 to 2 weeks after injury)**
    - **Recommended Goals**: Control pain, minimize and prevent edema, protect healing structures, maintain stability, maintain and progress (gently) range of motion (ROM).
    - **Recommended ROM Interventions**: Begin active range of motion (AROM) and active assisted range of motion (AAROM) at the elbow when stability has been achieved; begin AROM of all non-involved joints; AROM and AAROM will promote healing of bone and articular cartilage, it will also help increase the tensile strength of soft tissues and minimize intra-articular adhesions (Davila & Johnston-Jones, 2006 [**S**]).
    - **Recommended Strengthening Interventions**: Isometrics at the elbow musculature (only if not contraindicated); grip strengthening exercises (Davila & Johnston-Jones, 2006 [**S**]).
    - **Recommended Modalities**: Superficial cold modalities to help reduce the acute inflammation (Nadler, Weingand & Kruse, 2004 [**S**]).
    - **Recommended Precautions**: It is recommended to avoid pronation/supination with collateral ligament involvement and avoid excessive pain and stress with AROM and AAROM (Davila & Johnston-Jones, 2006 [**S**], Local Consensus [**E**]).

2. **Fibroplastic/Subacute Phase (2 to 8 weeks after injury)**
    - **Recommended Goals**: Continue to decrease edema, increase ROM, increase function, increase strength
    - **Recommended ROM Interventions**: Continue with AROM and AAROM with increased force of contraction; recommended to begin gentle passive range of motion (PROM) at 6 weeks postop/injury (Local Consensus [**E**]); recommended technique for PROM is be slow prolonged stretching with at least a 30 second hold, doing 4 to 5 repetitions (Bandy & Irion, 1994 [**D**]).
    - **Recommended Strengthening Interventions**: Progression to isotonic strengthening exercises (Davila & Johnston-Jones, 2002 [**E**]) for healing fractures, weight-bearing exercises will help increase bone mineral density with healing bone (MacKelvie, Khan & McKay, 2002 [**M**]).
    - **Recommended Modalities**: Superficial heat (20 minutes) or ultrasound may be used immediately prior to stretching to increase tissue extensibility (Draper et al., 1998 [**B**]; Draper & Ricard, 1995 [**C**]; Taylor, Waring, & Brashear, 1995 [**C**]); superficial cold at end of session to reduce any acute inflammation of tissue (Nadler, Weingand & Kruse, 2004 [**S**]).
    - **Precautions**: It is recommended that the therapist take caution with amount of force applied to target tissue; PROM force will be within tissue tolerance (comfortable, short of pain) so as to lengthen and remodel the tissue, not cause inflammatory response (Bandy & Irion, 1994 [**D**]; Davila & Johnston-Jones, 2006 [**S**]).

3. **Remodeling/Return to Activity Phase (2 to 6 months after injury)**
    - **Recommended Goals**: To continue to increase ROM, strength and function; progress to sport specific exercises as indicated
    - **Recommended ROM**: Continue with above interventions of AROM, AAROM and PROM; may introduce joint mobilization techniques if loss of motion can be attributed to joint stiffness (Michlovitz, Harris, & Watkins, 2004 [**M**]; Davila & Evelyn, 2002 [**E**])
    - **Recommended Strengthening**: Progressive resistive strengthening with weights and bands are appropriate
    - **Recommended Modalities**: Superficial heat (20 minutes) or ultrasound (3MHz, 1.5 W/cm^2 for 7 minutes) can be used immediately prior to stretching to increase tissue extensibility (Draper et al., 1998 [**B**]; Draper & Ricard, 1995 [**C**], Taylor Waring & Brashear, 1995 [**C**]); superficial cold at end of session to reduce any acute inflammation of tissue (Nadler, Weingand & Kruse, 2004 [**S**]).
    - **Precautions**: It is recommended that joint mobilization techniques be delayed until 6 to 8 weeks after injury or fracture union is evident (be in close contact with referring physician regarding implementation of this intervention) (Local Consensus [**E**]).

4. **Splinting**

    It is recommended to wait until sufficient healing and fracture stability has occurred prior to initiating splinting to regain ROM in order to avoid pain, inflammation, ligamentous insufficiency, and heterotropic ossification (Szekeres, 2006 [**O**], Chinchalkar & Szekeres, 2004 [**S**]). Splinting is most

effective if initiated in the first 3 months, moderately effective from 3 to 6 months, and has variable effectiveness when initiated 6 to 12 months post injury (Morrey, 2002 [**E**]).

Contraindications: Poor skin quality, bony blocks, loose bodies, or any other intra-articular restrictions seen on x-ray. Discontinue splint use if sensory or motor changes occur with use (Zander & Healy, 1992 [**C**], Morrey, 2002 [**E**]). Close communication with the referring physician is essential to ensure safe use of splinting and casting.

5. **Recommended Timeframe for Splinting**
   A. Inflammatory Phase (0 to 2 weeks), splinting and casting can be used to protect the joint (Chinchalkar & Szekeres, 2004 [**S**]).
   B. Fibroplastic Phase (2 to 8 weeks) splinting and casting may be used to help restore or gain range of motion.
   C. Remodeling Phase (2 to 6 months) progressively increase ROM with splinting to enhance collagen orientation and plastic elongation of tissues (Davila & Johnston-Jones, 2006 [**S**]; Chinchalkar & Szekeres, 2004 [**S**]).

6. **Types of Splints**
   A. **Static Progressive Splints**: These splints operate on principle of stress relaxation (Gelinas et al., 2000 [**C**]; Bonutti et al., 1994 [**D**]) and are used to regain ROM. Examples: Joint Active Systems (JAS), turnbuckle splints

      Pro: Can be worn for shorter periods of time, worn to patient comfort, adjustable tension. Operating on principle of stress relaxation, there may be less likelihood of irritation and inflammation (Morrey, 2002 [**E**]). This type of brace may be more effective for gaining extension (Davila & Johnston-Jones, 2006 [**S**]). JAS makes one splint for flexion and extension

      Con: Rely on patient to continuously adjust the splint

      <u>Static Progressive Splints Guidelines</u>:

      1. Recommend wear splint 30 minutes to 2 hours 3 to 4 times per day (Bonutti et al., 1994 [**D**]; Chinchalkar & Szekeres, 2004 [**S**]; Davila & Evelyn, 2002 [**E**]).
      2. Recommend 20 hours wear time, including use at night (Gelinas et al., 2000 [**C**]; Morrey, 2002 [**E**]).

   B. **Serial Static Splinting**: (also includes serial casting and night extension splints)

      Pro: night splints are recommended for use in combination with other splinting to help maintain gains made through the day (Davila & Johnston-Jones, 2006 [**S**]; Chinchalkar & Szekeres, 2004 [**S**]).

      <u>Serial Static Splinting Guidelines</u>:

Recommend night splinting to maintain gained motion and compliments use of static progressive stretches (Chinchalkar & Szekeres, 2004 [**S**]). It is also helpful if flexion contracture is less than 30° (Davila & Johnston-Jones, 2006 [**S**]).

C. **Dynamic Splinting**: These splints operate on the principle of creep and usually requires 8 to 12 hours of wear time per session (Bonutti et al., 1994 [**D**]).

Pro: May be more effective for gaining flexion during the Remodeling Phase (Davila & Johnston-Jones, 2006 [**S**])

Con: Operating on principle of creep, this may cause inflammation, which may lead to additional swelling and scarring. Requires longer wear time (Bonutti et al., 1994 [**D**]; Morrey, 2002 [**E**]). Need separate splints for flexion and extension

Dynamic Splinting Guidelines:

No specific recommendations available in the peer reviewed literature. Dynasplint recommends extended wear time of at least 8 to 10 hours (Dynasplint_Systems, 1996 [**E**]).

7. **Cincinnati Children's Hospital Medical Center Occupational Therapist/Physical Therapist (CCHMC OT/PT) Recommendation for Splint and Brace Use**:
   A. It is recommended that night splinting be considered for soft tissue restrictions if there is a lack of progress after 2 weeks of physical therapy.
   B. Also recommended is use of static progressive splint for flexion or extension contractures if there is a soft tissue restriction and there is a lack of sufficient progress after 2 weeks of intervention. One example of this type of brace is the JAS. Static progressive is the splint of choice for this situation; however, dynamic splinting (Dynasplint_Systems, 1996 [**E**]) can be considered if necessary (insurance will not reimburse static progressive splint, or MD will not refer this type of brace, patient/family preference or patient/family will not be able to utilize static progressive splint properly) (Local Consensus [**E**]).

8. **Recommended Discharge Criteria**
   A. Equal ROM of involved and uninvolved elbow
   B. Strength within functional limits or equal to the uninvolved extremity (Local Consensus[**E**]).
   C. Meet patient/family goals for occupational/physical therapy

9. **Consults**
   A. It is recommended that contact with the patient's medical doctor for a referral to OT for evaluation and possible splint fabrication if a patient exhibits significant lack of motion of the hand and/or wrist due to nerve damage (Griffith, 2002 [**E**], Local Consensus [**E**]).

B. It is recommended that if a patient exhibits a hard end feel or has not shown progress for 4 to 6 weeks, they be referred back to their physician (Davila & Johnston-Jones, 2006 [**S**], Local Consensus [**E**]).

10. **Education**

It is recommended that education for the patient and family:

- Begin upon initial evaluation and continue throughout the course of occupational/physical therapy services
- Be geared to the developmental age of the patient and the learning abilities of the family/caregivers
- Address relevant topics such as treatment plan, expected progress and outcomes, recreational and functional activities and selection of splinting/bracing options

Definitions:

Evidence Grading Scale

A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis
E: Expert opinion or consensus
F: Basic laboratory research
S: Review article
M: Meta-analysis or systematic review
Q: Decision analysis
O: Other evidence

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified for each recommendation (see "Major Recommendations").

Evidence Grading Scale

A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample

C: Prospective trial or large case series
D: Retrospective analysis
E: Expert opinion or consensus
F: Basic laboratory research
S: Review article
M: Meta-analysis or systematic review
Q: Decision analysis
O: Other evidence

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate management of loss of elbow motion following surgery or trauma to enable:

- Optimal elbow function
- Increased elbow strength
- Minimization of time spent in therapy
- Increased coordination and consistency of care by therapists
- Improved patient and family satisfaction

POTENTIAL HARMS

Dynamic splinting - Operating on principle of creep, this may cause inflammation, which may lead to additional swelling and scarring.

CONTRAINDICATIONS

CONTRAINDICATIONS

Splinting is contraindicated in the following conditions: poor skin quality, bony blocks, loose bodies, or any other intra-articular restrictions seen on x-ray.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

These recommendations result from review of literature and practices current at the time of their formulations. This Guideline does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the guidelines to meet the specific and unique requirements of individual patients. Adherence to these recommendations is voluntary. The physician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

Appropriate companion documents have been developed to assist in the effective dissemination and implementation of the guideline.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Evidence-based care guideline for loss of elbow motion following surgery or trauma in children aged 4 to 18. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2007 Dec 21. 9 p. [26 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2007 Dec

GUIDELINE DEVELOPER(S)

Cincinnati Children's Hospital Medical Center - Hospital/Medical Center

SOURCE(S) OF FUNDING

Cincinnati Children's Hospital Medical Center

GUIDELINE COMMITTEE

Loss of Elbow Motion OT/PT Guideline Team 2006--2007

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The guideline was developed without external funding. All Team members and Clinical Effectiveness support staff listed have declared whether they have any conflict of interest and none were identified.

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the Cincinnati Children's Hospital Medical Center.

Print copies: For information regarding the full-text guideline, print copies, or evidence-based practice support services contact the Children's Hospital Medical Center Health Policy and Clinical Effectiveness Department at HPCEInfo@chmcc.org.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI Institute on May 12, 2008. The information was verified by the guideline developer on May 21, 2008.

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