

Appendix E-1

Standardized 6-Week Education and Exercise Program with a Physiotherapist

Within 3 days of removal of the splint or cast, all participants attended an individual appointment with 1 of the treating physiotherapists. At this appointment and the 6 subsequent weekly appointments, the following 9 areas were addressed in a standardized format:

1. Information on Surgery, Prognosis, and Expectations

At the first review after splint or cast removal, the therapist and participant discussed the type of surgery, the typical recovery pattern, and the relevance of the exercise program. The therapist discussed the wrist radiographs and the position of the fixation (i.e., explained that the volar plate does not cross the wrist joint and does not restrict movement at the joints). The participant was asked to explain his or her usual daily activities, and discussion focused on appropriate use of the injured upper limb for these activities.

2. Patient-Specific Functional Scale (PSFS) (Chatman et al.¹⁷)

At the first review after splint or cast removal, the therapist introduced the participant to the PSFS, and the reasons for assessing with this scale. Once the participants demonstrated an understanding of the PSFS, they were asked to specify a minimum of 3 activities of importance to them that they were unable to perform adequately following the injury to their upper limb. The PSFS involved giving each activity listed by the participant a score, with 0 indicating inability to perform and 10 indicating an ability to perform the activity at the same level as before the injury to the upper limb. The therapist discussed the tasks listed by the participant and reached consensus on an appropriate way of breaking down the tasks and how scores were awarded on the path to achieving competence in the target task. The tasks and the allocation of scores for components of tasks were recorded. Scores for each task, participant progress, and exercises and/or activities that would assist in achieving the best possible score for tasks were discussed at each weekly therapist and participant review session. Participants were responsible for nominating tasks and monitoring progress toward performing the task at the target level of ability. Participants were asked to add a further task to the PSFS once a score of 10 had been achieved or if both the participant and therapist agreed that progress on a task has plateaued and further progress would be slow. At the final therapist and participant review (6 weeks following cast removal), the PSFS was reviewed and the participant was asked to specify at least 1 short-term and 1 long-term activity that he or she would continue to independently work toward. Appropriate activities and/or exercises to assist in achieving the best possible score for these task(s) were designed and discussed in addition to methods for participants to monitor their own progression following discharge. Barriers to and/or enablers of progress were discussed, and a plan for the participant's ongoing independent action plan was developed.

3. Recording of Wrist and Forearm Active Range of Motion, Grip Strength, and Pain on the Visual Analog Scale

In addition to the information gained from reviewing tasks in the PSFS, participants were able to track their progress with standardized measurements that were recorded at each review session. Following a standardized protocol, wrist flexion and extension, wrist ulnar and radial deviation, forearm supination and pronation, and grip strength were recorded for the participant's injured and uninjured upper limbs. Henna was applied to the participant's injured upper limb on the standardized landmarks for measurement of wrist and forearm

active range of motion. The therapist reapplied the henna as required to the injured upper limb in the weekly sessions. Grip strength was measured following a standardized protocol. Participants were asked to complete a visual analog scale for worst pain and usual pain during the past week.

4. Discussion and Therapist Demonstration of Weekly Exercises from the Standardized Exercise Program

The nature and purpose of the exercise program were discussed. The exercise program was adapted from that described by Krischak et al.¹⁸. The expected level of discomfort during the exercise program was discussed. Indications that the participant was pushing too hard or not pushing hard enough with exercises were clarified. The therapist demonstrated each of the exercises scheduled for practice in the week ahead, wherever possible linking these to the performance of daily activities.

5. Participant Demonstration of Weekly Exercises from the Standardized Exercise Program

Following the therapist demonstration, the participant was asked to demonstrate each exercise, and errors in technique were adjusted. Discomfort with the exercises was assessed so that an appropriate level of discomfort and exertion could be determined for each exercise. Previous investigations have revealed that motivated people who enact behavior generally have detailed plans regarding the how, when, and where components for their exercise completion (Rhodes et al.¹⁹). To enhance compliance with the exercise program, therapists assisted participants in planning appropriate times for exercise and discussed barriers to exercise completion and methods of enhancing exercise enjoyment.

6. Training Diary

The concept and relevance of an exercise diary were discussed with the participant. All participants were asked to complete a daily training diary from the time of splint or cast removal to ascertain compliance with the home exercise program. At each review appointment, the exercise program and diary were discussed. Discussion of the barriers to and facilitators of daily exercise was encouraged.

7. Complications Following Surgery

Participants were advised about possible complications including delayed wound-healing, infection, and fixation position loss or concerns. The importance of prompt attention to complications was discussed. The participant was instructed on how to care for the wound and the importance of scar massage. The therapist demonstrated appropriate scar massage (providing adequate wound closure had occurred).

8. Questions

Treating physiotherapists were asked to create interactive sessions that focused on participant empowerment in the rehabilitation process. Therapists were advised to facilitate a frank and comfortable discussion and avoid didactic instruction. Activities that promoted the use of the injured arm were designed to be as enjoyable as possible. Participants were encouraged to ask questions at any time during the session.

9. Soft-Tissue Work

Treating therapists performed the following soft-tissue work on participants during each session:

- (1) 3 minutes of retrograde massage of wrist extensors muscle body with the wrist in flexion,
- (2) 3 minutes of retrograde massage of wrist flexors muscle body with the wrist in extension,
- and (3) 3 minutes of scar massage (providing adequate wound closure had occurred).

Description of Measurement Techniques

Patient-Rated Wrist Evaluation (PRWE)

The PRWE is a 15-item health-related quality-of-life questionnaire that measures wrist pain and disability in activities of daily living; 5 items assess symptoms and 10 assess disability²⁰. Scale width is 0 to 100 points, with higher scores reflecting greater pain and disability. PRWE raw scores were adjusted for missing data by replacing individual missing item scores with the mean score for the subscale.

Visual Analog Scale (VAS) for Pain

The 10-cm VAS is a single-item measure of pain. The current investigation involved asking participants to specify the VAS for worst (VAS-W) and usual (VAS-U) pain over the past week.

Active Range of Motion (ROM)

Accuracy with locating anatomical landmarks was identified in a pilot investigation as a potential source of intrarater and interrater error in measuring wrist and forearm active range of motion. We used henna, a natural plant extract, to provide a skin mark lasting up to 2 weeks and to standardize anatomical landmarks for goniometer and inclinometer placement. Bilateral measurement enabled comparison with the uninjured side and single measurements of active range of motion using the goniometer or inclinometer were performed on each measurement occasion. To counter the potential for creep in range associated with repeated measurements, participants were shown, and asked to repeat, the target movement several times before they were measured. The current investigation reported absolute measures of wrist and forearm active range of motion in preference to movement arcs (e.g., wrist flexion-extension arc). The basis for this decision was that reduction in range of motion at the wrist and forearm following a distal radial fracture is not uniform for all planes and/or directions of movement and is linked with the type of residual deformity at the distal aspect of the radius²¹.

Forearm Active Range of Motion

A liquid pendulum inclinometer was used to quantify pronation and supination active range of motion. Previously reported positioning was followed, with the elbow held in 90° of flexion and the wrist in neutral²². Positioning, technique, and anatomical landmarks were standardized.

Wrist Active Range of Motion

A standard manual goniometer was used to quantify active range of motion of the wrist, according to a previously reported technique, in which the participants were in the sitting position, with the arm pressed against the torso and the elbow held in 90° of flexion, and standardized anatomical landmarks used²³.

Grip Strength Measurement

Grip strength was recorded bilaterally using the Jamar hand dynamometer. Previously reported standardized positioning and instructions were adopted²⁴. One measurement of grip strength was used for this investigation, given that it has been reported to be comparable with the average of 3 grip strength trials²⁵.

Two Jamar dynamometers were calibrated and aligned prior to commencement of the outcome recording and were recalibrated throughout the investigation. The grip strength assessment procedure was demonstrated by the examiner, and participants were advised to perform their maximum within the limits of pain. Once the participants were positioned, they were instructed “Are you ready? Squeeze as hard as you can. Harder! . . . Harder! . . . Harder! Relax.” These verbal instructions are similar to those adopted previously²⁶.

Disabilities of the Arm, Shoulder and Hand (DASH)

The DASH is a health-related quality-of-life questionnaire that measures disability and symptoms in a single condition or in multiple conditions of the upper limb¹³. The DASH scale ranges from 0 to 100 points, with higher scores reflecting greater disability.

Measurement Techniques for Wrist and Forearm Active Range of Motion

Wrist and Forearm Range of Motion

Two types of goniometers and an inclinometer were used for measurements.

Goniometer 1:

A standard clear plastic 180° goniometer, with 1° increments marked, an axis of rotation, and 2 movable arms of 20 cm.

Goniometer 2:

A standard clear plastic 180° goniometer, with 5° increments marked, an axis of rotation, and 2 movable arms of 15 cm.

Inclinometer:

Liquid pendulum inclinometer, with 2° increments marked, and a dial able to be fully rotated 360° and lockable at 90° intervals.

For consistency in instructions for participants, the therapists were advised to demonstrate the movement they were about to measure and then ask the participant to repeat that movement gently until they thought they had achieved maximum movement. Participants were asked to “warm up” with 2 repeated movements prior to recording of each movement by the therapist. Each movement was recorded once only, and measurements were taken to the nearest degree.

1. Wrist Extension (Fig. E-1)

Technique

- Ulnar technique - using Goniometer 1
- A 0 starting position, with measurements recorded from 0 and progressing to the participant's end of range

Position

- Block or rolled towel under elbow
- Elbow flexed to 90°

- Forearm held in neutral supination and pronation
- Fingers held in relaxed position

Landmarks

- Axis of the goniometer placed over the tip of the ulnar styloid
- Distal arm of the goniometer aligned parallel with the fifth metacarpal
- Proximal arm of the goniometer aligned along the ulnar border of the forearm in line with the midpoint of the distal aspect of the olecranon

2. Wrist Flexion (Fig. E-2)

Technique

- Ulnar technique - using Goniometer 1
- A 0 starting position with measurements recorded from 0 and progressing to the participant's end of range

Position

- Block or rolled towel under elbow
- Elbow flexed to 90°
- Forearm held in neutral supination-pronation
- Fingers together with the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints extended (as able)

Landmarks

- Axis of the goniometer placed over the tip of the ulnar styloid
- Distal arm of the goniometer aligned parallel with the fifth metacarpal
- Proximal arm of the goniometer aligned along the ulnar border of the forearm in line with the midpoint of the distal aspect of the olecranon

3. Wrist Radial Deviation (Fig. E-3)

Technique

- Using Goniometer 2
- A 0 starting position, with measurements recorded from 0 and progressing to the participant's end of range

Position

- Neutral wrist position with no flexion or extension (or as close to this position as possible)
- Palm and forearm flat on table if able. If unable to achieve flat palm and forearm on table, then palm and forearm placed on a flat surface in a comfortable amount of forearm pronation
- Elbow flexed to 90°

Landmarks

- Axis of the goniometer is placed over the center of the capitate on the dorsal aspect of the wrist. Center of capitate is located by finding the midpoint of the line connecting the radial and ulnar styloid tips
- Distal arm of the goniometer is aligned with the third metacarpal head
- Proximal arm of the goniometer is aligned with a point at the midpoint of the dorsal aspect of the forearm located 10 cm from the center of the capitate

4. Wrist Ulnar Deviation (Fig. E-4)

Technique

- Using Goniometer 2
- A 0 starting position, with measurements recorded from 0 and progressing to participant's end of range

Position

- Neutral wrist position with no flexion or extension (or as close to this position as possible)
- Palm and forearm flat on table if able. If unable to achieve flat palm and forearm on table, then palm and forearm are placed on a flat surface in a comfortable amount of forearm pronation
- Elbow flexed to 90°

Landmarks

- Axis of the goniometer is placed over the center of the capitate on the dorsal aspect of the wrist. Center of capitate is located by finding the midpoint of the line connecting the radial and ulnar styloid tips
- Distal arm of the goniometer is aligned with the third metacarpal head
- Proximal arm of the goniometer is aligned with a point at the midpoint of the dorsal aspect of the forearm located 10 cm from the center of the capitate

5. Forearm Pronation (Fig. E-5)

Technique

- Inclinator should be positioned on the dorsal surface of the forearm and not pushed into skin
- Starting movement from a position of neutral (0°) supination-pronation and moving into maximum pronation

Position

- Sitting away from table
- Elbow against torso
- Elbow flexed to 90°

Landmarks

- Inclinator is placed at a point at the midpoint of the dorsal aspect of the forearm located 5 cm from the center of the capitate
- Inclinator is aligned parallel with the sagittal plane of the forearm

6. Forearm Supination (Fig. E-6)

Technique

- Inclinator should be positioned on volar surface of forearm and not pushed into skin
- Starting movement from a position of neutral (0°) pronation-supination and moving into maximum supination

Position

- Sitting away from table
- Elbow against torso
- Elbow flexed to 90°

Landmarks

- Inclinator is placed at a point at the midpoint of the volar aspect of the forearm located 5 cm from the center of the capitate
- Inclinator is aligned parallel with the sagittal plane of the forearm

References

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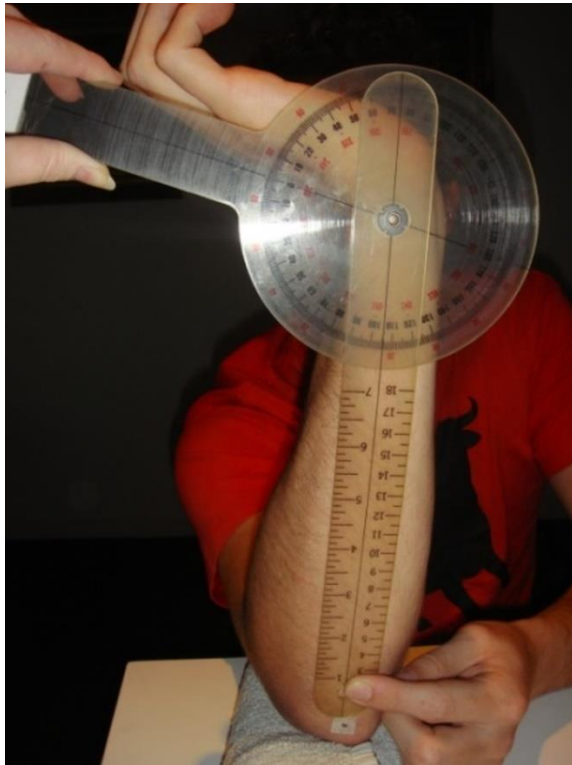


Fig. E-1
Wrist extension measurement.

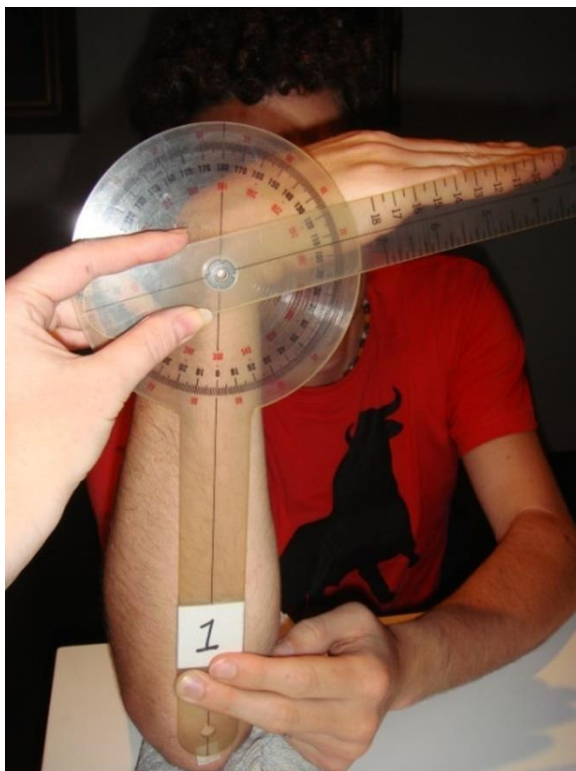


Fig. E-2
Wrist flexion measurement.

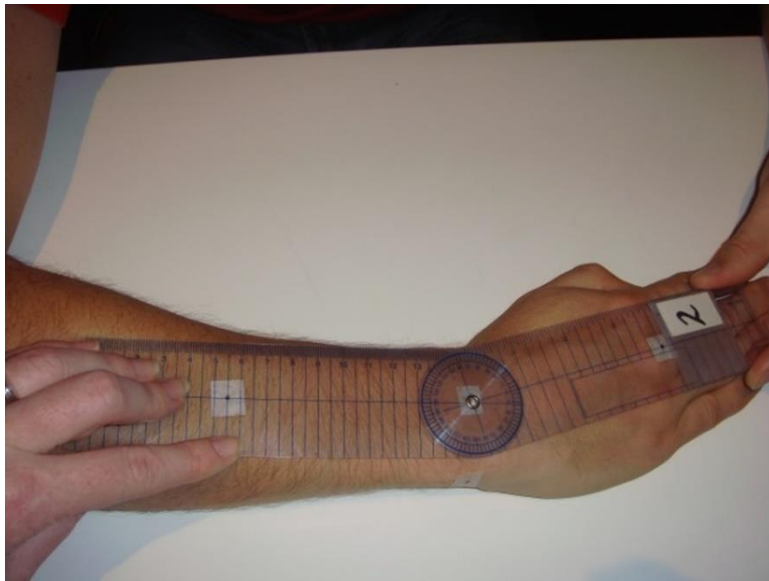


Fig. E-3
Wrist radial deviation measurement.

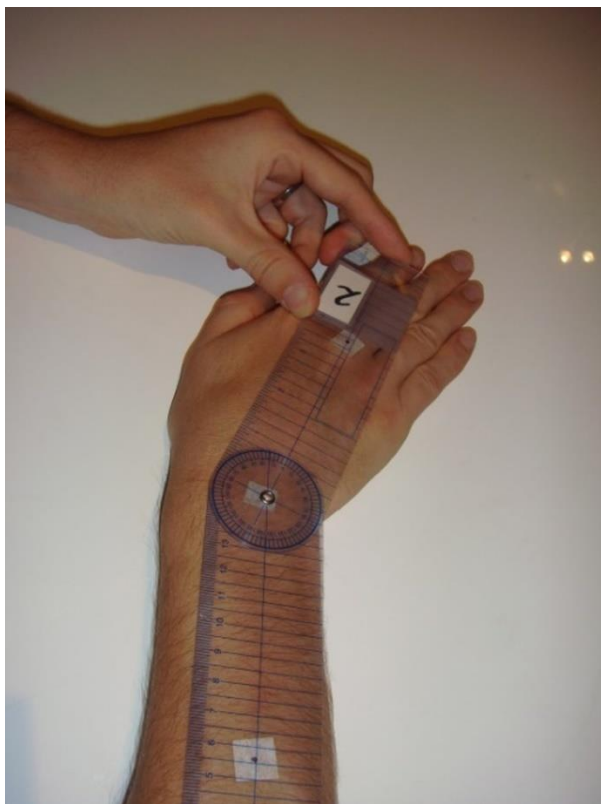


Fig. E-4
Wrist ulnar deviation measurement.



Fig. E-5
Forearm pronation measurement.



Fig. E-6
Forearm supination measurement.