BMJ Open

LIMPER trials: immediate mobilisation versus 2-week cast immobilisation after distal radius fracture treated with volar locking plate – a study protocol for a prospective, randomised, controlled trial

Laura Kärnä [1], Antti P Launonen [1], Teemu Karjalainen,[2] Toni Luokkala,[2] Ville Ponkilainen [2], Lauri Halonen,[3] Mika Helminen,[4,5] Ville M Mattila,[1] Aleksi Reito [1]

To cite: Kärnä L, Launonen AP, Karjalainen T, *et al*. LIMPER trials: immediate mobilisation versus 2-week cast immobilisation after distal radius fracture treated with volar locking plate – a study protocol for a prospective, randomised, controlled trial. *BMJ Open* 2022;**12**:e064440. doi:10.1136/bmjopen-2022-064440

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2022-064440).

Received 06 May 2022
Accepted 18 October 2022

[1]Tampere University Hospital, Tampere, Finland
[2]Central Finland Central Hospital, Jyvaskyla, Finland
[3]South Karelia Central Hospital, Lappeenranta, Finland
[4]Health Sciences, Research Services, Tampere, Finland
[5]Health Sciences, Tampere University, Tampere, Finland

Correspondence to
Dr Laura Kärnä;
laura.karna@pshp.fi

ABSTRACT

Introduction Open reduction and internal fixation with volar locking plate has become the most common fixation method in the treatment of unstable distal radius fracture (DRF). There is, however, no consensus as to whether or for how long a wrist should be immobilised after operative treatment. To date, there have been relatively few studies that have evaluated the effect of immediate postoperative mobilisation on functional outcomes. The aim of postoperative rehabilitation is to obtain a good function and to reduce impairment, recovery time, socioeconomical costs and absence from work. Therefore, there is a need for studies that evaluate the optimal method of postoperative rehabilitation to optimise wrist function and return to work.

Methods and analysis This study is a prospective, randomised, controlled trial in which a total of 240 working-age patients who undergo volar plating for DRF will be randomly assigned to either an early mobilisation group or a postoperative 2-week casting group. The aim of the study will be to compare early postoperative outcomes between the study groups. The primary outcome will be patient-rated wrist evaluation at 2 months after operation. A coprimary outcome will be the total length of sick leave. Our follow-up period will be 1 year, and secondary outcomes will include pain, patient satisfaction, perceived ability to work and complications identified at different time points. We expect those patients who undergo immediate mobilisation will have at least as rapid a return to work and function as those patients who undergo postoperative immobilisation, indicating/meaning that there will be no need for postoperative casting.

Ethics and dissemination This study will be conducted according to the Standard Protocol Items: Recommendations for Interventional Trials statement. The Ethics committee of Tampere University Hospital has approved the protocol. Ethics committee approval number is R21111, and it is accepted on 7 September 2021. The results of this study will be submitted for publication in peer-reviewed journals.

Trial registration number NCT05150925.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ As our multicentre study will recruit 240 patients, it will be the largest Randomized controlled trial (RCT) to date that compares immediate postoperative mobilisation to postoperative casting in working-age patients with distal radius fracture treated with volar locking plate.
⇒ The co-primary outcome will be the total length of sick leave which has not been previously used as a main outcome.
⇒ The functional results of this study are applicable only to patients in working-age, since we excluded patients who are over 65 years old.

INTRODUCTION

Distal radius fractures (DRFs) are one of the most common fractures in adults. The incidence of DRFs is increasing in the older population, but also among individuals of a working age (18–65 years).[1–3] In young adults with good bone quality, these injuries typically occur from high-energy trauma, whereas older patients more commonly have low-energy accidents, such as falls from standing height. Displaced DRFs have been considered fractures with a dorsal tilt of more than 15°, radial shortening or an intra-articular step of more than 2 mm after closed reduction.[4–7] If any of the above criteria are met after closed reduction and casting, primary open reduction internal fixation with volar locking plate is usually performed in working-age patients with the aim of avoiding malunion and thereby decreasing disability.

A volar locking plate provides enough stability to allow early mobilisation, thereby avoiding the need for prolonged cast immobilisation. While postoperative

immobilisation is standard practice, there is no consensus on whether how long, if at all, a wrist should be immobilised after operatively treated DRF.[8 9] Previous studies have reported that postoperative immobilisation varies widely from 0 to 6 weeks after the volar plating of DRF.[8 10–13] However, relatively few studies specifically evaluate the impact of postoperative splinting/casting versus immediate mobilisation. The main problem with previous studies has been the relatively small sample sizes, which makes the comparison of these studies difficult.[10 11 14] Moreover, the literature does not provide evidence from controlled datasets of the differences in functional outcomes after 3 months from DRF operation with volar locking plate between the varying postoperative immobilisation periods.[12 13] Moreover systematic reviews on rehabilitation efforts after DRF in adults have shown that the effectiveness in various rehabilitation protocols is not sufficiently evidence based.[15 16]

Since DRF can potentially lead to impaired physical function, rehabilitation can play a vital role in reducing deterioration and recovery time as well as socioeconomical costs, such as limiting the time off work.[17] Any permanent loss of function can even lead to the inability to work, affecting personal coping. After primary intervention, DRFs are associated with the use of multiple resources, including operative interventions, outpatient visits and rehabilitation. Postoperative casting also uses expensive resources, such as time spent in the OR and visits to outpatient clinics for cast fixing or removal.[18] Moreover, the restoration of wrist function and the reduction of impairment is important considering that more than 50% of DRF patients are still of working age. A mean sick leave duration of 4–12 weeks has been reported, which means sick leave after DRF has an important socioeconomical role.[19–22] Further, a recent study has suggested that self-reported disability, pain, and disabilities of the arm, shoulder and hand outcome measure as early as 1-week postfracture are the strongest predictors of length of sick leave, regardless of whether the treatment is operative or non-operative.[21]

To our knowledge, only a few studies exist that have compared standard postoperative casting with immediate mobilisation.[8 10–12] The aim of this trial is to compare outcomes between working-age patients allocated to either immediate postoperative mobilisation or 2-week postoperative cast immobilisation after volar locking plate fixation of DRF. We expect patients in the immediate mobilisation group will have at least as rapid a return to work and function as those patients in the postoperative immobilisation group, meaning that there will be no need for postoperative casting. Immediate mobilisation will allow the effective use of scarce resources without compromising the results of volar plating in DRF with no differences in the numbers of complications 1 year after surgery.

OBJECTIVES

Coprimary objectives

This trial compares the patient-related wrist evaluation (PRWE) at the 2-month time point and the total postoperative length of sick leave between early mobilisation and 2-week casting after volar plating of DRF.

Secondary objectives

Secondary objectives are to compare pain, perceived ability to work, patient satisfaction and complications within a total of 1-year follow-up. We will also investigate the objectively measured physical upper extremity activity level from baseline to 4 weeks in patients in the immediate mobilisation group and from 2 to 4 weeks in patients in the casting group using the tri-axial (Axivity Ltd, Newcastle upon Tyne, UK) accelerometer.

Trial design

This ongoing trial is a prospective, 1:1 equivalence study. This study is a randomised, controlled, multicentre trial comparing immediate mobilisation versus 2-week cast immobilisation in working-age patients after DRF treated with open reduction and volar locking plate fixation.

METHODS

Study setting

The eligible study population will comprise patients aged 18–65 (<65th birthday) who are treated operatively with volar locking plate for DRF at the participating study centres. The participating study centres are Tampere University Hospital, Finland; Central Finland Central Hospital, Finland and South Carelia Central Hospital, Finland. We aim to have more centres participating this study. Patient recruitment started on 1 December 2021. The results of the study will be analysed after the last participating patient has reached 1-year follow-up period, which is expected to be at the end of 2025. This trial is a part of LIMPER (lower and upper limb injuries, diseases and postinjury rehabilitation and treatment) trials.

Eligibility criteria

Inclusion criteria

Patients eligible for the trial must comply with the following criteria at randomisation: intra-articular or extra-articular DRF, including Smith's and volar Barton's fracture with or without accompanying fractures of the processus styloideus ulnae, and who have been pragmatically chosen for operative treatment.

Exclusion criteria

- Refusal to participate in the study.
- Open fracture with a severity greater than Gustilo grade 1.
- Patients aged less than 18 or more than 65 years.
- Patient does not understand written or spoken guidance in local languages.
- Pathological fracture.

- Fractures that are operated on 3 weeks or more after the injury.
- Fracture assessed to need casting after operation: for example, severely comminuted fracture where the fracture morphology is assessed to need both the volar locking plate and postoperative casting.
- Previous fracture in the same wrist or forearm in the last 10 years that has led to impairment of function
- Ipsilateral fracture in upper extremity.
- Polytrauma.

Recruitment

Working-age patients with DRF who are scheduled for volar plating will be asked to participate in the study. Patients will be recruited at either preoperative visits to the outpatient clinic before surgery or on the ambulatory surgery ward the same day the surgery will be performed. The study participants will provide signed informed consent before the operation. Randomisation will be performed intraoperatively after the wound is sutured. Patients that refuse to participate, will be collected in screening log. Participants that are recruited, but are intraoperatively excluded for randomisation will be followed via questionnaires during the 1-year follow-up.

Intervention

All participants in this trial will be treated with open reduction and internal fixation using the volar locking plate system. The decision to operate will be at the discretion of the treating surgeon and the patient and will not be related to the trial. A standard technique with volar modified Henry approach will be used. Wounds will be sutured with absorbable intracutaneous sutures, and an adhesive tape will be placed over the sutured wound.

After the wound is closed, the participants will be randomised to either the immediate mobilisation group or the 2-week cast group. Participants allocated to the 2-week cast group will have a dorsal functional position plaster cast fitted in the operating room after surgery. The cast will be removed in a primary healthcare centre after 2 weeks. After cast removal, participants will be advised to perform a full range of active motion exercises without resistance for the following 2 weeks.

Participants allocated to the immediate mobilisation group will have a padded dressing that may be removed the next day. The participants in the immediate mobilisation group will be advised to perform a full range of active motion exercises without resistance starting from the first postoperative day.

Both groups will receive written aftercare and rehabilitation instructions. The detailed rehabilitation programme for both groups is presented in additional online supplemental materials 1 and 2 in Finnish, and online supplemental materials 3 and 4 in English. After 4 weeks, participants in both groups will meet a physiotherapist in a public health centre or an occupational health centre. The physiotherapist will supervise a full range of motion exercises with progressive weight bearing. After the first follow-up at 4 weeks, the exercise protocol will be the same in both groups. All participants will receive 4 weeks of sick leave from the operating unit after surgery. They will be advised to contact their occupational health centre if the sick leave needs extending or they are willing to return to work earlier.

The upper-limb physical activity of the participants will be measured using a tri-axial (Axivity Ltd) accelerometer. The participants will have an accelerometer sensor mounted on both upper arms with a wrist band. Patients in the immediate immobilisation group will be asked to wear the sensor immediately after surgery, whereas patients in the casting group will wear the sensor after cast removal at 2 weeks after surgery. The sensors will be given to patients in the 2-week casting group after surgery and told to wear them on their upper arms after removal of the cast. Notification will also be sent via Research Electronic Data Capture (REDCap) to ensure application of the Axivity sensors. All patients will return the sensors via post 4 weeks after surgery.

Patient and public involvement

Patients were not involved in the design, recruitment or conduct of this study. Patients will be informed by the results of the study after completion.

Outcomes

We chose the patient-reported outcome measure PRWE as the coprimary outcome since it is widely used and validated in upper extremity studies. Our coprimary outcome is total length of sick leave.

Baseline data

After enrolment, the following baseline data will be collected from the participants: date of birth, age, weight, height, handedness, relevant comorbidities, date of injury, mechanism of injury and fracture characteristics. Participant will be also asked to complete baseline questionnaires on their work status, education level, smoking, physical work exertion and perceived work capacity. Physical work exertion levels are measured on a scale of 1–5.[23] The exertion levels are presented in table 1. Wrist pain prior to injury will be assessed on a numerical rating scale. Participants will complete the PRWE questionnaire describing their wrist function prior to sustaining the fracture.

Primary outcome measures

The coprimary outcome measures of this study will be PRWE score and total length of the sick leave. The primary time point with PRWE will be at 2 months.

Patient-rated wrist evaluation

PRWE is a 15-item questionnaire designed to measure wrist pain and disability in activities of daily living. It is a reliable upper extremity outcome instrument, and has passed to several validation tests. The questionnaire consists of two subscales (pain and function) and the score ranges from 0 (no disability) to 100 (severe disability).[24–26]

Table 1 Physical work exertion level

Physical work exertion level		
1	Sedentary	Work mainly involves sitting, and the occasional lifting of objects weighing a maximum of 5 kg. From time to time might carry, for example, a paper folder or small tools. Walking can be part of the job but work mainly involves sitting
2	Light	Work may occasionally require the lifting of objects weighing a maximum of 10 kg and may require the regular lifting or carrying of objects weighing a maximum of 5 kg. Work can involve a lot of movement, such as walking or using limbs
3	Medium	Work occasionally requires lifting objects weighing a maximum of 25 kg and regularly carrying or lifting objects weighing a maximum of 12 kg
4	Heavy	Work occasionally requires lifting objects weighing a maximum of 50 kg and regularly carrying or lifting objects weighing a maximum of 25 kg
5	Very heavy	Work occasionally requires lifting objects weighing more than 50 kg or regularly carrying or lifting objects weighing more than 25 kg

Moreover, in 2015, Walenkamp *et al* reported that the minimal clinically important difference in the PRWE is 11 points.[25] The validity and reliability of the Finnish PRWE has been shown to be acceptable in patients with DRF.[26] The PRWE is measured at the 4-week, 2-month, 6-month and 12-month time points.

Total length of sick leave

The coprimary outcome of the study is the total length of the sick leave. The day of the return to work is included in the questionnaires sent to participants at different time points. Return to work will be measured as a yes/no question, and the exact date of the return to work is asked by electronic follow-up questionnaire in the follow-ups at the 4-week, 2-month, 6-month and 12-month time points. Patients are also asked, if they have been returned to work at part time or modified work. At 1-year follow-up, the full length of the sick leave for each participant will assessed using data from the Social Insurance Institution of Finland.

Secondary outcomes

Work capacity

Perceived working capacity will be assessed using electronic follow-up questionnaires at all follow-up time points: 4 weeks, 2 months, 6 months and 12 months. The participants will be asked to rate their working capacity on a numerical scale from 0 to 10, with '0' being not able to work at all and '10' being the ability to work at its best.

Pain

The Visual Analogue Scale (VAS) is a validated subjective measure for acute and chronic pain. VAS scores will be recorded by making a mark on an electronic 100 mm line that represents a continuum between 'no pain' and 'worst pain'. Patients will be asked to evaluate the perceived pain during last 7 days. VAS score will be measured at 4 weeks, 2 months, 6 months and 12 months.

Patient-acceptable symptom state

Patient satisfaction will be measured using the patient-acceptable symptom state. Patients will be asked to answer questions via electronic questionnaire at 2 months, 6 months and 12 months. The questionnaires will include the following questions: would you be willing to take the same treatment again if the treatment result was as it is now? (Yes/No). Considering all the different ways your injury is affecting you, if you would remain in this state, do you feel that your current state is satisfactory? (Yes/No).

Complications

At 1-year follow-up, patient data will be reviewed to detect any complications. Complications are defined as problems with wound healing, deep infections, hardware failure (loss of reduction, malunion), tendon complications (both extensor and flexor irritations or ruptures), nerve-related problems (paresthesia, Complex Regional Pain Syndrome (CRPS)) or reoperation (for any reason). Complications are divided into major and minor complications. Problems with wound healing are categorised as minor complications and will be assessed via electronic questionnaires. Major complications include loss of reduction and hardware failure during follow-up resulting in reoperation, permanent nerve damage and CRPS.

Activity level

We will also investigate objectively the physical upper extremity activity level measured from baseline to 4 weeks in patients in the immediate mobilisation group and from 2 to 4 weeks in patients in the 2-week casting group using the tri-axial accelerometer. The sensors will measure 24/7 activity and degree of movement. With this data, we will be able to compare activity levels between the two study groups and against healthy population.

Participant timeline

The time schedule for enrolment, interventions, and visits is presented in table 2. After written informed consent, study personnel will complete case report forms for baseline. Standard radiological parameters will be defined from baseline X-rays. These parameters include volar-dorsal angulation angle, radioulnar inclination angle, intra-articular step-off and intra-articular diastasis. According to normal follow-up procedure, all patients will

Table 2 Schedule of enrolment, interventions and assessments

	Enrolment	Allocation	Follow-up				
Timepoint	**Baseline**	**Operation**	**2 weeks**	**4 weeks**	**2 months**	**6 months**	**12 months**
Enrolment							
Eligibility screen	X						
Informed consent	X						
Randomisation		At the end of the operation					
Interventions							
Immediate immobilisation							
Postoperative casting			Cast removal				
Assessments							
Outpatient visit	X			Remote clinic			
Physiotherapist visit		X		X			
X-ray	X	X		X			
PRWE, return to work	X			X	X	X	X
Pain, complications	X			X	X	X	X
Tri-axial accelerometry	Immediate mobilisation group	—	—	—			
Tri-axial accelerometry	Casting group		—	—			

PRWE, patient-rated wrist evaluation.

undergo a follow-up at a virtual clinic 4 weeks after surgery. Before the visit, direct lateral and AP radiographs will be taken at local health centres and an orthopaedic surgeon will evaluate the X-rays and a virtual clinic appointment will then be carried out over the telephone electronical questionnaires, including PRWE and VAS, will be sent via REDCap before the follow-up appointment at the virtual clinic at 4 weeks.

Randomisation

The randomisation procedure will be set up in the REDCap randomisation tool. After recruitment and baseline measurements, a site principal investigator from each hospital will administer the online allocation procedure by entering patient data into the REDCap system, which will enable the randomisation tool. Allocation concealment will be ensured, as randomisation will not be performed and revealed before the patient has been included in the trial.

Randomisation will be performed by the researchers. Randomisation will be performed after the wound has been sutured, because earlier randomisation might influence the surgeons judgement, for example, in longer operating time. Thereafter, the allocation group will be revealed to the patient and the operating surgeon. Participants will be included in the immediate mobilisation group or the 2-week cast group in a 1:1 allocation as per computer-generated randomisation matrix with randomised block size and stratified by work physical exertion level (sedentary/light vs medium/heavy/very heavy), fracture articulateness (intra-articular or extra-articular) and age (older or younger than 55 years).

Blinding

Due to the nature of the intervention, patients cannot be blinded from the treatment allocation. After the first 4-week sick leave period, subsequent sick leaves will be issued by health professionals working outside our institution and not related to the study.

Data management and analysis

Data management

Each patient will be assigned a unique trial identification number (TIN) matched with the patient's personal identification number (ID). This is assigned when patient has signed informed consent, and TINs are consecutive and never reused. The research data will only be handled with a TIN throughout the trial. The research data will be saved on a database with an online patient management programme REDCap (https://www.project-redcap.org/), and secured by password. Only trial researchers will have access to the REDCap data located on a secure study server at Tampere University Hospital. The research data saved to the server will contain only pseudonymous TINs with a set of numbers acquired from the questionnaires, that is, each question will be answered with a number. This will ensure the pseudonymity of each patient and that the patient's identity will remain secret should server data be revealed to third parties.

All primary and secondary data will be acquired and stored on the study server. Data will be entered by the patient during the first visit via a tablet or by a researcher or study nurse when the questionnaires are returned by mail. During the follow-ups, patients will receive a link via email to the questionnaires. Patient-reported outcome data will be entered directly into the REDCap system by the patients using the 'required fields' option activated to ensure there are no missing items from the completed questionnaires. Researchers from each participating hospital will have access to the secure study server where the trial research data is stored. An information security committee has approved the server at Tampere University Hospital. At the end of the trial, each researcher will have access to the data for further analyses.

The copyright of the trial research data will be owned and created by the collaboration parties. The data will be shared freely among the collaboration parties. All participating researchers will have access to the data after the trial. Due to confidentiality and legal agreements, public data sharing will be restricted until primary analysis and publication have been completed. Under certain circumstances, for example, when a new member joins the collaboration, we will grant access to the data. All data will be stored for 5 years after the end of the trial.

Power analysis

The coprimary outcomes in our study are the PRWE, and the total length of sick leave. We set our sample size to 120 patients per group. First, in a Finnish study, the SD of the PRWE in working-age patients was reported to be 14.8 points. Assuming 90% power and a true mean difference of 0 points between groups, 120 patients per group means an equivalence margin of 6.3 points, which is well below the previously established minimal clinical important difference. The previous literature regarding sick leave after DRF is variable. Moreover, the SD for sick leave after DRF is rarely reported. One study reported SD of 9.7 weeks. This means that we would have 90% power for a 4.1-week equivalence margin. Sick leave is, however, very dispersed. In our pilot study, the IQR for sick leave was 42–76 days, which translates to an SD of only 3.6 weeks, assuming a normal distribution. This would mean higher precision in the estimates. Adjustment will be used in all analyses, thus increasing the efficiency of our analyses.

Statistical analysis

Primary analysis of the PRWE will be conducted using a repeated measures (linear) mixed model. Group allocation is the main exposure and age, gender, fracture articularity, and physical work exertion and study centre will be used as covariates. The patient will be used as a random factor. Score at time of assessment (primary outcome at 2 months) for continuous outcome variables, that is, PRWE, length of sick leave, will be included as a fixed factor. Treatment effect will be interpreted as the interaction between group allocation and the score at time of assessment. Analysis for sick leave will be conducted with linear regression, including the same covariates. Regression coefficient for group allocation is interpreted as the treatment effect. This will be done with estimated marginal means and reported with 95% CI. Binary outcomes will be analysed with logistic regression. Group allocation is the main exposure and above-mentioned covariates will be included in the model for adjustment. The main result will be the adjusted marginal proportion between the groups from this model. All analyses with the activity data will be exploratory and hypothesis-generating. R statistical software (The R Foundation for Statistical Computing, Vienna, Austria) will be used in the statistical analyses. We will have an exploratory analysis, where the result is adjusted with the delay from time from of the injury to the time to the operation.

ETHICS AND DISSEMINATION

Ethical approval

The Ethics Committee of Tampere University Hospital has approved the protocol. Ethics committee approval number is R21111, and it is accepted on 7 September 2021. Each recruiting centre will apply for local ethical approval. This study will be conducted according to the World Medical Association Declaration of Helsinki.

Consent

Informed consent will be obtained by the local recruiting study personnel in each participating centre. The consent form is written in Finnish. It is available in additional online supplemental material 5.

Confidentiality

The electronic databases will be maintained in secure storage at the coordinating centre for 5 years after completion of the study (after the last patient has reached the 1year follow-up time point).

Access to data

The primary investigator and study nurse hold the register of patients within the trial. At follow-ups, all patient data will be analysed by a statistician and the authors of the manuscript.

Dissemination policy

The results of this study will be submitted for publication in peer-reviewed journals.

Monitoring

Data monitoring

We will conduct the study without a data monitoring committee.

Harms

All the medical records of the participating patients will be carefully assessed, and all complications in both groups

will be reported when reporting the results of this trial. The harms will be divided into major and minor complications, as described in the Outcomes section.

Auditing

We will not conduct auditing between the participating centres during the trial.

DISCUSSION

During recent decades, there has been a trend towards operative fixation using volar plating in the treatment of displaced DRFs. However, no consensus exists regarding optimal postoperative casting to expedite return to function following the volar plate fixation of DRF. Moreover, there is insufficient evidence on the effectiveness of various rehabilitation protocols.

We assume high adherence to the allocated intervention. As patients have undergone a surgical operation and are of working age, it is unlikely that the patient would remove the cast postoperatively or acquire external support elsewhere. Adherence to accelerometer use may be inferior to that of the allocated intervention. Patients may feel the accelerometer unpleasant to wear and decide to remove it. However, this poses no threat to the validity of the study since accelerometer data are a secondary measurement. Thus, even with lower adherence to accelerometer use, we can still estimate activity differences reliably.

There will be an analysis of the functional outcome, PRWE, and we expect equally good function in both study groups. Further, we expect patients who underwent early mobilisation after volar plating for DRF to return to work as quickly as those patients who wore a cast. We also expect immediate mobilisation to be a safe method for the postoperative care of patients who undergo volar plating for DRF. Considering the number of operated DRFs annually, it is essential to use postoperative interventions that have proven efficacy and are cost-effective.

Twitter Teemu Karjalainen @TeemuVKarjalain

Contributors LK, APL and AR developed the trial, LK being the principal investigator. LK drafted the manuscript and all the members (LK, APL, AR, TK, TL, VP, VMM, LH and MH) contributed to the writing of the protocol.

Funding This study is supported by the Finnish state funding (grant number 9AC079).

Disclaimer Finnish state funding has no role in study designing, management, analysis or interpretation of data when writing the protocol or on decision to submit the report for publication.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iDs

Laura Kärnä http://orcid.org/0000-0003-3417-3420
Antti P Launonen http://orcid.org/0000-0002-3125-0171
Ville Ponkilainen http://orcid.org/0000-0002-5026-4560
Aleksi Reito http://orcid.org/0000-0002-6903-6461

REFERENCES

1 Flinkkilä T, Sirniö K, Hippi M, *et al*. Epidemiology and seasonal variation of distal radius fractures in Oulu, Finland. *Osteoporos Int* 2011;22:2307–12.
2 Jerrhag D, Englund M, Karlsson MK, *et al*. Epidemiology and time trends of distal forearm fractures in adults - a study of 11.2 million person-years in Sweden. *BMC Musculoskelet Disord* 2017;18.
3 Rundgren J, Bojan A, Mellstrand Navarro C, *et al*. Epidemiology, classification, treatment and mortality of distal radius fractures in adults: an observational study of 23,394 fractures from the National Swedish fracture register. *BMC Musculoskelet Disord* 2020;21:88.
4 Tahririan MA, Javdan M, Nouraei MH, *et al*. Evaluation of instability factors in distal radius fractures. *J Res Med Sci* 2013;18:892–6.
5 Makhni EC, Ewald TJ, Kelly S, *et al*. Effect of patient age on the radiographic outcomes of distal radius fractures subject to nonoperative treatment. *J Hand Surg Am* 2008;33:1301–8.
6 Nesbitt KS, Failla JM, Les C. Assessment of instability factors in adult distal radius fractures. *J Hand Surg Am* 2004;29:1128–38.
7 Mackenney PJ, McQueen MM, Elton R. Prediction of instability in distal radial fractures. *J Bone Joint Surg Am* 2006;88:1944–51.
8 Quadlbauer S, Pezzei C, Jurkowitsch J, *et al*. Early rehabilitation of distal radius fractures stabilized by Volar locking plate: a prospective randomized pilot study. *J Wrist Surg* 2017;6:102–12.
9 Schnetzke M, Fuchs J, Vetter SY, *et al*. Intraoperative three-dimensional imaging in the treatment of distal radius fractures. *Arch Orthop Trauma Surg* 2018;138:487–93.
10 Andrade-Silva FB, Rocha JP, Carvalho A, *et al*. Influence of postoperative immobilization on pain control of patients with distal radius fracture treated with volar locked plating: a prospective, randomized clinical trial. *Injury* 2019;50:386–91.
11 Clementsen Ståle Ørstavik, Hammer O-L, Šaltytė Benth J, *et al*. Early mobilization and physiotherapy vs. late mobilization and home exercises after ORIF of distal radial fractures: a randomized controlled trial. *JB JS Open Access* 2019;4:e0012.
12 Duprat A, Diaz JJH, Vernet P, *et al*. Volar locking plate fixation of distal radius fractures: splint versus immediate mobilization. *J Wrist Surg* 2018;7:237–42.
13 Watson N, Haines T, Tran P, *et al*. A comparison of the effect of one, three, or six weeks of immobilization on function and pain after open reduction and internal fixation of distal radial fractures in adults. *J Bone Joint Surg* 2018;100:1118–25.
14 Brehmer JL, Husband JB. Accelerated rehabilitation compared with a standard protocol after distal radial fractures treated with volar open reduction and internal fixation: a prospective, randomized, controlled study. *J Bone Joint Surg Am* 2014;96:1621–30.
15 Handoll HHG, Elliott J. Rehabilitation for distal radial fractures in adults. *Cochrane Database Syst Rev* 2015:CD003324.
16 Østergaard HK, Mechlenburg I, Launonen AP, *et al*. The benefits and harms of early mobilization and supervised exercise therapy after Non-surgically treated proximal humerus or distal radius fracture: a systematic review and meta-analysis. *Curr Rev Musculoskelet Med* 2021;14:107–29.
17 de Putter CE, Selles RW, Polinder S, *et al*. Economic impact of hand and wrist injuries: health-care costs and productivity costs in a population-based study. *J Bone Joint Surg Am* 2012;94:e56(1):e56.
18 Saving J, Heintz E, Pettersson H, *et al*. Volar locking plate versus external fixation for unstable dorsally displaced distal radius fractures-A 3-year cost-utility analysis. *PLoS One* 2020;15:e0240377.

19 Kakarlapudi TK, Santini A, Shahane SA, *et al*. The cost of treatment of distal radial fractures. *Injury* 2000;31:229–32.
20 Wong JYP. Time off work in hand injury patients. *J Hand Surg Am* 2008;33:718–25.
21 Egund L, Önnby K, Mcguigan F, *et al*. Disability and pain are the best predictors of sick leave after a distal radius fracture in men. *J Occup Rehabil* 2020;30:656–64.
22 MacDermid JC, Roth JH, McMurtry R. Predictors of time lost from work following a distal radius fracture. *J Occup Rehabil* 2007;17:47–62.
23 Code of federal regulations. Available: https://www.ssa.gov/OP_Home/cfr20/404/404-1567.htm
24 MacDermid JC, Turgeon T, Richards RS, *et al*. Patient rating of wrist pain and disability: a reliable and valid measurement tool. *J Orthop Trauma* 1998;12:577–86.
25 Walenkamp MMJ, de Muinck Keizer R-J, Goslings JC, *et al*. The minimum clinically important difference of the Patient-rated wrist evaluation score for patients with distal radius fractures. *Clinical Orthopaedics and Related Research®* 2015;473:3235–41.
26 Sandelin H, Jalanko T, Huhtala H, *et al*. Translation and validation of the Finnish version of the Patient-Rated wrist evaluation questionnaire (PRWE) in patients with acute distal radius fracture. *Scand J Surg* 2016;105:204–10.

Rannemurtumaleikkauksen jälkeinen kipsihoito verrattuna välittömään liikeharjoitteluun

Potilasohje- kotiharjoitteluohjeet Kipsihoitoryhmässä

Tämä potilasohje on koottu tukemaan värttinäluun murtumasta eli rannemurtumasta kuntoutumista. Ohje on tarkoitettu niille, joiden murtuma on hoidettu leikkauksella, ja joiden jatkohoidoksi on tutkimuksessa randomoitu kahden viikon kipsihoito.

Omatoimisen harjoittelun tärkeys

Ensisijaisena tavoitteena leikkauksen jälkeen on palauttaa ranteen normaali liikkuvuus. Edellytyksenä tavoitteen saavuttamiseksi on ohjeen mukainen **säännöllinen** harjoittelu, joka on ranteen toimintakyvyn kannalta hyvin tärkeää. Harjoitteiden aloittamista ei tule missään nimessä viivästyttää eikä kipsihoidon jälkeistä ranteen liikuttelua tule turhaan pelätä. Tämän ohjevihkon harjoitteet on suunniteltu paranemisaikataulua kunnioittaen ja ovat siksi turvallisia toteuttaa.

Ahkera ja pitkäjänteinen omatoiminen harjoittelu näkyy parhaimmillaan ranteen palautuneena toimintakykynä. Harjoittelematta jättäminen tai harjoitusten viivästyttäminen voi pahimmillaan johtaa jäykkään ja toimintakyvyltään heikkoon ranteeseen.

- Aloita rohkeasti ohjeen mukainen harjoittelu.
- Ahkera harjoittelu mahdollistaa hyvän lopputuloksen.
- Leikattua kättä kannattaa käyttää alusta saakka kevyissä arkiaskareissa, kuten ruokaillessa ja hampaiden pesussa.
- Harjoittele kärsivällisesti. Ranteen toimintakyvyn palautuminen ei tapahdu hetkessä.
- Noudata harjoitusaikataulua, mutta kunnioita epämiellyttäviä tuntemuksiasi!

Kipsihoidon aikaiset harjoitteet

Leikkauksen jälkeen rannetta on suojaamassa kipsi kahden viikon ajan. Toimenpiteen jälkeen on normaalia, että ranne on kipeä ja siinä esiintyy turvotusta. Tavoitteet heti leikkauksen jälkeen keskittyvätkin turvotuksen lievitykseen ja kivun hoitoon.

Kohoasento

Niin kauan kuin turvotusta ilmenee, kannattaa kättä pitää paljon kohoasennossa sydämen tason yläpuolella. Kohoasento helpottaa sekä kipua että turvotusta. Kantosidettä ei leikkauksen jälkeisessä hoidossa käytetä.

Tue levätessäsi käsi kohoasentoon tyynyillä ja liikkuessasi pidä kättä rintakehän päällä. Kun turvotus ei enää ole häiritsevää, on tärkeää, että annat käden olla vapaana ja vältät sen turhaa kannattelua.

Kylmähoito

Kylmähoito rauhoittaa kudoksia leikkauksen jälkeen ja on tehokas kivun hoidossa. Toteuta säännöllistä kylmähoitoa kotona kylmäpakkauksin. Aloita kylmähoito välittömästi leikkauksen jälkeen. Pidä kylmäpakkausta ranteen kämmenen puolella lyhyitä aikoja useasti päivässä. Varo palelluttamasta ihoa. Kylmäpakkausta ei tule koskaan pitää paljasta ihoa vasten.

Sormien harjoitukset

Aloita sormien liikeharjoitukset heti leikkauksen jälkeen. Tee seuraavia harjoituksia hereillä ollessasi noin **tunnin välein. Sormien liikuttelua et voi tehdä liikaa**. Liikkeet vähentävät käden turvotusta ja kipua.

a) Vie sormet täysin nyrkkiin niin, että peukalo jää päällimmäiseksi. Ojenna sormet sen jälkeen aivan suoriksi ja erilleen toisistaan niin leveälle kuin mahdollista. Jos et pysty tekemään liikettä alkuun täydellä aktiivisella liikeradalla, voit avustaa kevyesti toisella kädellä niin kauan, että täysi aktiivinen liike onnistuu. Toista liike 10 kertaa

b) Kosketa peukalolla vuorotellen jokaista sormenpäätä. Jokaisen kosketuksen jälkeen ojenna sormet suoraksi, aivan kuten nyrkistyksen jälkeen. Toista liikettä niin, että kosketat vuoronperää jokaista sormea 10 kertaa.

c) Pyöritä peukalolla suurta ympyrää. Tee liikettä 10 kierrosta kumpaankin suuntaan.

Koko yläraajan liikeharjoitukset

Ranteen ollessa kipsissä on vaarana, että koko yläraaja jää käyttämättömäksi. Olkanivelesi ja kyynärnivelesi tarvitsevat kipsistä huolimatta liikettä. Tee siis seuraavia harjoitteita useasti päivässä.

a) Pidä käsi vartalon vieressä. Ojenna kyynärnivel täysin suoraksi ja ojenna samalla myös sormet. Pidä käsivartta hetki aivan suorana. Koukista sitten kyynärnivel niin koukkuun kuin saat ja koukista samalla myös sormet. Kipsin ei tulisi estää koukistusta. Tee liikettä 10 kertaa ja toista useita kertoja päivässä.

b) Nosta käsi kohti kattoa. Muista hyvä ryhti liikettä tehdessäsi. Tee liikettä 10 kertaa ja toista useita kertoja päivässä.

Voit tehdä olkanivelen liikeharjoitetta myös makuuasennossa nostamalla kättä pääsi yläpuolelle tyynylle.

Kipsin poiston jälkeen

Kipsi poistetaan kahden viikon kuluttua leikkauksesta ja tällöin on aika aloittaa ranteen ahkera liikeharjoittelu. Säännöllisen harjoittelun avulla voidaan palauttaa ranteen toimintakyky mahdollisimman hyväksi. Ranne voi olla alkuun hyvin jäykkä ja ensisijainen tavoite välittömästi kipsin poiston jälkeen onkin liikkuvuuden lisääminen. Tee harjoitteita useita kertoja päivän aikana.

Ranteen ja kyynärvarren liikeharjoitteet

Liikkuvuuden lisäämisen lisäksi liikkeet aktivoivat ranteen lihastoimintaa. Jos liikkeet a ja b tuntuvat alkuun liian raskailta, voit tehdä liikkeen pöydän tasossa painovoima eliminoituna kuten ohjeessa c, mutta peukalo ylöspäin.

a) Pidä ranteesi pöydän reunalla kämmenselkä kattoa kohti niin, että kätesi voi liikkua

vapaasti. Sormet saavat olla kevyesti koukussa. Liikuta kättä hitaasti itseäsi kohden kämmenselkä edellä. Palauta liike hitaasti alas. Toista harjoitus 10 kertaa.

b) Käännä kämmen kohti kattoa. Sormet saavat olla kevyesti koukussa. Käännä kämmentä itseäsi kohti. Palauta käsi hitaasti takaisin alas. Toista harjoitus 10 kertaa.
c) Käännä kämmen pöytää vasten ja pidä toisen käden tuki kyynärvarressasi. Sormet saavat olla rentoina. Tee sivusuuntaista hidasta liikettä (ikään kuin pyyhkisit pöydän pintaa) niin suurena kuin mahdollista. Edistymisen myötä voit tehdä harjoituksen pöydän reunan yli peukalo ylöspäin. Tee liikettä 10 kertaa molempiin suuntiin.
d) Istu ryhdikkäässä asennossa olkavarsi vartalosi vieressä ja kyynärnivel noin 90 asteen koukussa. Käännä vuorotellen kämmen ja kämmenselkä kohti kattoa. Tee käden kääntö 10 kertaa molempiin suuntiin.

Pehmeän lankarullan/ sideharsorullan puristus

Pidä pehmeää käteen sopivaa lankarullaa tai esimerkiksi sideharsorullaa kevyesti kädessäsi. Purista esinettä viiden sekunnin ajan ja hellitä puristus. Toista harjoitus 10 kertaa.

Neljä viikkoa leikkauksesta

Neljän viikon kuluttua leikkauksesta on leikatun ranteen röntgenkuvaus ja lääkärikontrolli. Kontrollissa varmistetaan, että murtuma on luutunut odotetusti. Jos kaikki on kunnossa, voit aloittaa leikatun käden normaalin käytön. Käden ja ranteen käyttö arjen normaaleissa toiminnoissa on tärkeää, sillä se edesauttaa toimintakyvyn palautumista.

Ranteen toimintakyvyn palautuminen on aina yksilöllistä. Ranne on pääosin palautunut kuormituskyvyn ja liikeratojen osalta noin kolmen kuukauden kuluttua leikkauksesta. Täydellinen palautuminen voi kestää vuoden tai pidempään. Palautumiseen kuluva aika riippuu vamman vakavuudesta ja harjoitteluaktiivisuudesta. Varhain aloitettu ja aktiviinen ranteen liikeharjoittelu nopeuttaa vammasta kuntoutumista.

Jatka yhä aiempia harjoituksia, sillä säännöllinen liikkuvuusharjoittelu on edelleen tärkeää ranteen toimintakyvyn palauttamiseksi. Nyt harjoituksiin tulee mukaan ranteen venytys, joka edesauttaa liikkuvuuden lisääntymistä sekä vastustettu lihasvoimaharjoitus. Lisäksi edellisiltä viikoilta tuttua puristusliikettä muutetaan hieman.

Pallon puristus

Purista esimerkiksi tennispalloa viiden sekunnin ajan. Pallo saa olla nyt kovempi kuin edellisessä puristusharjoituksessa. Harjoituksesta tulee näin vahvistavampi. Toista puristus 10 kertaa.

Ranteen venytys

a) Ojenna leikattu ranne terveen käden avulla niin, että tunnet venytyksen ranteen kämmenen puolella. Venytä kevyesti 30 sekunnin ajan. Toista venytys.

b) Koukista leikattu ranne terveellä kädellä. Venytys tuntuu nyt ranteen kämmenselän puolella. Venytä kevyesti 30 sekuntia. Toista venytys.

Vastustettu lihasvoimaharjoitus

Omalla kädellä vastustetut lihasvoimaharjoitukset ovat turvallisia tehdä. Seuraavissa harjoituksissa käsiä painetaan toisiaan vasten.

a) Paina terveellä kädellä leikatun käden kämmentä vasten. Vastusta liikettä leikatulla kädellä niin, ettei käsi liiku. Paina käsiä toisiaan vasten viiden sekunnin ajan. Toista harjoitus viisi kertaa.

b) Paina terveellä kädellä leikatun käden kämmenselkää vasten. Vastusta liikettä leikatulla kädellä niin, ettei käsi liiku. Paina käsiä toisiaan vasten viiden sekunnin ajan. Toista harjoitus viisi kertaa.

Lihasvoimaharjoitus kevyellä painolla

Seuraavat liikkeet voit tehdä kevyellä käsipainolla (puoli kilogrammaa) tai käyttäen painona esimerkiksi puolen litran juomapulloa. Liikkeet vahvistavat rannetta.

a) Pidä ranteesi pöydän reunalla kämmenselkä kattoa kohti niin, että kätesi voi liikkua vapaasti. Pidä paino kädessäsi. Nosta painoa kääntäen kämmenselkää itseäsi kohti. Palauta käsi hitaasti alas. Toista liike 10 kertaa.

b) Käännä paino kuvan mukaisesti pystyasentoon. Nosta painoa kääntäen sen yläosaa itseäsi kohti. Muista taas käden hidas palautus takaisin alkuasentoon. Toista 10 kertaa.

c) Käännä paino niin, että kämmenesi on kattoa kohti. Nosta painoa kääntäen kämmentä itseäsi kohti. Palauta käsi hitaasti takaisin alas. Toista 10 kertaa.

Ranteen vähitellen palautuva toimintakyky on palkkio säännöllisesti toteutetusta omatoimisesta harjoittelusta!

Rannemurtumatutkimus- välitön mobilisaatioryhmä

Rannemurtumaleikkauksen jälkeinen kipsihoito verrattuna välittömään liikeharjoitteluun

Potilasohje- kotiharjoitteluohjeet välittömän mobilisaation ryhmässä

Tämä potilasohje on koottu tukemaan värttinäluun murtumasta eli rannemurtumasta kuntoutumista. Ohje on tarkoitettu niille, joiden murtuma on hoidettu leikkauksella, ja joiden jatkohoidoksi on tutkimuksessa randomoitu välitön mobilisaatio.

Omatoimisen harjoittelun tärkeys

Ensisijaisena tavoitteena leikkauksen jälkeen on palauttaa ranteen normaali liikkuvuus. Edellytyksenä tavoitteen saavuttamiseksi on ohjeen mukainen **säännöllinen** harjoittelu, joka on ranteen toimintakyvyn kannalta hyvin tärkeää. Tämän ohjevihkon harjoitteet on suunniteltu paranemisaikataulua kunnioittaen ja ovat siksi turvallisia toteuttaa.

Ahkera ja pitkäjänteinen omatoiminen harjoittelu näkyy parhaimmillaan ranteen palautuneena toimintakykynä. Harjoittelematta jättäminen tai harjoitusten viivästyttäminen voi pahimmillaan johtaa jäykkään ja toimintakyvyltään heikkoon ranteeseen.

- Aloita rohkeasti ohjeen mukainen harjoittelu.
- Ahkera harjoittelu mahdollistaa hyvän lopputuloksen.
- Leikattua kättä kannattaa käyttää alusta saakka kevyissä arkiaskareissa, kuten ruokaillessa ja hampaiden pesussa.
- Harjoittele kärsivällisesti. Ranteen toimintakyvyn palautuminen ei tapahdu hetkessä.
- Noudata harjoitusaikataulua, mutta kunnioita epämiellyttäviä tuntemuksiasi!

Kohoasento

Niin kauan kuin turvotusta ilmenee, kannattaa kättä pitää paljon kohoasennossa sydämen tason yläpuolella. Kohoasento helpottaa sekä kipua että turvotusta. Kantosidettä ei leikkauksen jälkeisessä hoidossa käytetä.

Tue levätessäsi käsi kohoasentoon tyynyillä ja liikkuessasi pidä kättä rintakehän päällä. Kun turvotus ei enää ole häiritsevää, on tärkeää, että annat käden olla vapaana ja vältät sen turhaa kannattelua.

Kylmähoito

Kylmähoito rauhoittaa kudoksia leikkauksen jälkeen ja on tehokas kivun hoidossa. Toteuta säännöllistä kylmähoitoa kotona kylmäpakkauksin. Aloita kylmähoito välittömästi leikkauksen jälkeen. Pidä kylmäpakkausta ranteen kämmenen puolella lyhyitä aikoja useasti päivässä. Varo palelluttamasta ihoa. Kylmäpakkausta ei tule koskaan pitää paljasta ihoa vasten.

Sormien harjoitukset

Aloita sormien liikeharjoitukset heti leikkauksen jälkeen. Tee seuraavia harjoituksia hereillä ollessasi noin **tunnin välein. Sormien liikuttelua et voi tehdä liikaa**. Liikkeet vähentävät käden turvotusta ja kipua.

a) Vie sormet täysin nyrkkiin niin, että peukalo jää päällimmäiseksi. Ojenna sormet sen jälkeen aivan suoriksi ja erilleen toisistaan niin leveälle kuin mahdollista. Jos et pysty

tekemään liikettä alkuun täydellä aktiivisella liikeradalla, voit avustaa kevyesti toisella kädellä niin kauan, että täysi aktiivinen liike onnistuu. Toista liike 10 kertaa

b) Kosketa peukalolla vuorotellen jokaista sormenpäätä. Jokaisen kosketuksen jälkeen ojenna sormet suoraksi, aivan kuten nyrkistyksen jälkeen. Toista liikettä niin, että kosketat vuoronperää jokaista sormea 10 kertaa.

c) Pyöritä peukalolla suurta ympyrää. Tee liikettä 10 kierrosta kumpaankin suuntaan.

Koko yläraajan liikeharjoitukset

Olkanivelesi ja kyynärnivelesi tarvitsevat liikettä. Tee siis seuraavia harjoitteita useasti päivässä.

a) Pidä käsi vartalon vieressä. Ojenna kyynärnivel täysin suoraksi ja ojenna samalla myös sormet. Pidä käsivartta hetki aivan suorana. Koukista sitten kyynärnivel niin koukkuun kuin saat ja koukista samalla myös sormet. Tee liikettä 10 kertaa ja toista useita kertoja päivässä.

b) Nosta käsi kohti kattoa. Muista hyvä ryhti liikettä tehdessäsi. Tee liikettä 10 kertaa ja toista useita kertoja päivässä.

Voit tehdä olkanivelen liikeharjoitetta myös makuuasennossa nostamalla kättä pääsi yläpuolelle tyynylle.

Välittömän mobilisaation ryhmässä ranteen liikeharjoitteet kuormittamatta aloitetaan heti kun kipu ja turvotus antaa myöden. Säännöllisen harjoittelun avulla voidaan palauttaa ranteen toimintakyky mahdollisimman hyväksi. Tee harjoitteita useita kertoja päivän aikana.

Ranteen ja kyynärvarren liikeharjoitteet

Liikkuvuuden lisäämisen lisäksi liikkeet aktivoivat ranteen lihastoimintaa. Jos liikkeet a ja b tuntuvat alkuun liian raskailta, voit tehdä liikkeen pöydän tasossa painovoima eliminoituna kuten kuvassa c, mutta peukalo ylöspäin.

a) Pidä ranteesi pöydän reunalla kämmenselkä kattoa kohti niin, että kätesi voi liikkua vapaasti. Sormet saavat olla kevyesti koukussa. Liikuta kättä hitaasti itseäsi kohden kämmenselkä edellä. Palauta liike hitaasti alas. Toista harjoitus 10 kertaa.
b) Käännä kämmen kohti kattoa. Sormet saavat olla kevyesti koukussa. Käännä kämmentä itseäsi kohti. Palauta käsi hitaasti takaisin alas. Toista harjoitus 10 kertaa.
c) Käännä kämmen pöytää vasten ja pidä toisen käden tuki kyynärvarressasi. Sormet saavat olla rentoina. Tee sivusuuntaista hidasta liikettä (ikään kuin pyyhkisit pöydän pintaa) niin suurena kuin mahdollista. Edistymisen myötä voit tehdä harjoituksen pöydän reunan yli peukalo ylöspäin. Tee liikettä 10 kertaa molempiin suuntiin.
d) Istu ryhdikkäässä asennossa olkavarsi vartalosi vieressä ja kyynärnivel noin 90 asteen koukussa. Käännä vuorotellen kämmen ja kämmenselkä kohti kattoa. Tee käden kääntö 10 kertaa molempiin suuntiin.

Pehmeän lankarullan/ sideharsorullan puristus

Pidä pehmeää käteen sopivaa lankarullaa tai esimerkiksi sideharsorullaa kevyesti kädessäsi. Purista esinettä viiden sekunnin ajan ja hellitä puristus. Toista harjoitus 10 kertaa.

Neljä viikkoa leikkauksesta

Neljän viikon kuluttua leikkauksesta on leikatun ranteen röntgenkuvaus ja lääkärikontrolli. Kontrollissa varmistetaan, että murtuma on luutunut odotetusti. Jos kaikki on kunnossa, voit aloittaa leikatun käden normaalin käytön. Käden ja ranteen käyttö arjen normaaleissa toiminnoissa on tärkeää, sillä se edesauttaa toimintakyvyn palautumista.

Ranteen toimintakyvyn palautuminen on aina yksilöllistä. Ranne on pääosin palautunut kuormituskyvyn ja liikeratojen osalta noin kolmen kuukauden kuluttua leikkauksesta. Täydellinen palautuminen voi kestää vuoden tai pidempään. Palautumiseen kuluva aika riippuu vamman vakavuudesta ja harjoitteluaktiivisuudesta. Varhain aloitettu ja aktiviinen ranteen liikeharjoittelu nopeuttaa vammasta kuntoutumista.

Jatka yhä aiempia harjoituksia, sillä säännöllinen liikkuvuusharjoittelu on edelleen tärkeää ranteen toimintakyvyn palauttamiseksi. Nyt harjoituksiin tulee mukaan ranteen venytys, joka edesauttaa liikkuvuuden lisääntymistä sekä vastustettu lihasvoimaharjoitus. Lisäksi edellisiltä viikoilta tuttua puristusliikettä muutetaan hieman.

Pallon puristus

Purista esimerkiksi tennispalloa viiden sekunnin ajan. Pallo saa olla nyt kovempi kuin edellisessä puristusharjoituksessa. Harjoituksesta tulee näin vahvistavampi. Toista puristus 10 kertaa.

Ranteen venytys

a) Ojenna leikattu ranne terveen käden avulla niin, että tunnet venytyksen ranteen kämmenen puolella. Venytä kevyesti 30 sekunnin ajan. Toista venytys.

b) Koukista leikattu ranne terveellä kädellä. Venytys tuntuu nyt ranteen kämmenselän puolella. Venytä kevyesti 30 sekuntia. Toista venytys.

Vastustettu lihasvoimaharjoitus

Omalla kädellä vastustetut lihasvoimaharjoitukset ovat turvallisia tehdä. Seuraavissa harjoituksissa käsiä painetaan toisiaan vasten.

a) Paina terveellä kädellä leikatun käden kämmentä vasten. Vastusta liikettä leikatulla kädellä niin, ettei käsi liiku. Paina käsiä toisiaan vasten viiden sekunnin ajan. Toista harjoitus viisi kertaa.

b) Paina terveellä kädellä leikatun käden kämmenselkää vasten. Vastusta liikettä leikatulla kädellä niin, ettei käsi liiku. Paina käsiä toisiaan vasten viiden sekunnin ajan. Toista harjoitus viisi kertaa.

Lihasvoimaharjoitus kevyellä painolla

Seuraavat liikkeet voit tehdä kevyellä käsipainolla (puoli kilogrammaa) tai käyttäen painona esimerkiksi puolen litran juomapulloa. Liikkeet vahvistavat rannetta.

a) Pidä ranteesi pöydän reunalla kämmenselkä kattoa kohti niin, että kätesi voi liikkua vapaasti. Pidä paino kädessäsi. Nosta painoa kääntäen kämmenselkää itseäsi kohti. Palauta käsi hitaasti alas. Toista liike 10 kertaa.

b) Käännä paino kuvan mukaisesti pystyasentoon. Nosta painoa kääntäen sen yläosaa itseäsi kohti. Muista taas käden hidas palautus takaisin alkuasentoon. Toista 10 kertaa.

c) Käännä paino niin, että kämmenesi on kattoa kohti. Nosta painoa kääntäen kämmentä itseäsi kohti. Palauta käsi hitaasti takaisin alas. Toista 10 kertaa.

Ranteen vähitellen palautuva toimintakyky on palkkio säännöllisesti toteutetusta omatoimisesta harjoittelusta!

Immediate mobilization versus 2 weeks cast immobilization after distal radius fracture treated with volar locking plate- rehabilitation program

Rehabilitation program – 2 week cast group

The primary goal after distal radius fracture treated with volar locking plate is to restore normal wrist movement. A prerequisite for achieving this goal is regular training in accordance with the instructions, which is very important for the functioning of the wrist.

The start of the exercises should not be delayed in any way, and there should be no unnecessary fear of moving the wrist after the cast treatment. The exercises in this guide are designed with the healing schedule in mind and are therefore safe to perform.

Hard-working and long-term self-training can be seen at its best as a restored ability to function on the wrist. Failure to do so or delaying training can, at worst, lead to a stiff and poorly functioning wrist.

1) **Feel free to start training as instructed as soon as pain allows**
2) **Diligent training allows good end result.**
3) **Operated hand should be used from the beginning in light everyday tasks, such as eating and brushing your teeth.**
4) **Practice patiently. Restoration of wrist function does not happen in an instant.**
5) **Follow the training schedule, but respect your unpleasant feelings!**

Rehabilitation during the 2 week cast immobilization

A plaster cast will be placed in the operating room after surgery and will be removed in health care center after 2 weeks. After the procedure, it is normal for the wrist to be sore and swollen. Goals immediately after surgery focus on relieving swelling and treating pain.

Elevated position

As long as the swelling occurs, you should keep your hand in elevated position above the level of the heart as much as possible. The elevated position relieves both pain and swelling.

When resting, support your arms for example with pillows and keep your hand on your chest as you move. When the swelling is no longer disturbing, it is important that you allow the hand to be free and avoid unnecessary support.

Cold treatment

Cold therapy soothes tissues after surgery and is effective in treating pain. Carry out regular cold care at home with cold packs. Start cold therapy immediately after surgery. Keep the cold pack on the palm side of your wrist for short periods several

times a day. Be careful not to freeze the skin. The cold pack should never be kept exposed to the skin.

Finger exercises

Start moving your fingers immediately after surgery. Do the following exercises while you are awake about every hour. You can't move your fingers too much. Movements reduce swelling and pain in the hand.

a) Put your fingers fully in your fist so that your thumb is on top. Then extend your fingers quite straight and as far apart as possible. If you are unable to make the move to the top with a full active trajectory, you can gently assist with one hand until the full active movement is successful. Repeat the movement 10 times

b) Touch each fingertip alternately with your thumb. After each touch, extend your fingers straight, just like after punching. Repeat the movement so that you touch each finger 10 times in turn.

c) Rotate your thumb in a large circle. Move 10 turns in each direction.

Full upper limb movement exercises

When the cast is on, there is a risk that the entire upper limb will remain unused. Your shoulder and elbow joints need movement despite the cast. So do the following exercises several times a day.

a) Keep your hand next to your body. Extend your elbows completely straight and at the same time extend your fingers. Keep your arm straight for a moment. Then hook the elbow joint as far as you can and at the same time hook your fingers. Cast should not prevent flexion. Do the exercise 10 times and repeat several times a day.

b) Raise your hand towards the ceiling. Remember good posture when moving. Do the exercise 10 times and repeat several times a day.

You can also do the shoulder joint exercise while lying down, by raising your arm above your head on the pillow.

After cast removal

Cast will be removed after two weeks from operation.Then it is time to start active progressive full range of motion. Regular training can improve to restore the wrist ability to function. The wrist can be very stiff at first, and the primary goal immediately after removing the cast is to increase mobility. Do the exercises several times during the day.

Wrist and forearm movement exercises

In addition to increase mobility, the movements activate the muscular activity of the wrist. If movements a and b feel too heavy at first, you can make the movement in the plane of the table with gravity eliminated as in movement c, but with your thumb up.

a) Hold the back of your palm towards the ceiling at the edge of the table so that your hand can move freely. Fingers should be slightly hooked. Move your hand slowly towards yourself with the back of your palm forward. Restore the motion slowly down. Repeat the exercise 10 times.
b) Turn your palm towards the ceiling. Fingers should be slightly hooked. Turn your palm towards yourself. Slowly bring your hand back down. Repeat the exercise 10 times.
c) Turn your palm against the table and hold the support of your other hand on your forearm. Fingers are allowed to be relaxed. Make the lateral slow motion (as if you were wiping the table surface) as large as possible. As you progress, you can do the exercise over the edge of the table with your thumb up. Move 10 times in both directions.
d) Sit in an upright position with your upper arm next to your body and your elbow hooked about 90 degrees. Alternately turn your palm and back of your palm toward the ceiling. Turn your hand 10 times in both directions.

Lightly hold a soft roll of yarn or a gauze roll, for example, in your hand. Squeeze the object for five seconds and loosen the squeeze. Repeat the exercise 10 times.

4 weeks after operation

All patients will undergo a follow-up at remote clinic 4 weeks after surgery according to the normal follow-up procedure. Before the visit, radiographs will be taken in health centers and orthopedic surgeon will evaluate the x-rays and virtual clinic appointment by phone will be carried out. Patients will visit a physiotherapist in their own health center after 4 weeks from surgery. If everything is okay in the follow-up-Physiotherapist will guide patients in carrying on with full range of motion exercises with progressive weight bearing, exercise protocol being similar in both groups after first follow-up in 4 weeks.

Restoration of wrist function is always individual. The wrist has usually mainly recovered in load capacity and trajectories approximately three months after surgery. A full recovery can take a year or more. The time it takes to recover depends on the severity of the injury and the training activity. Early-onset and active wrist exercise training accelerates injury recovery.

Continue with previous exercises, as regular mobility training is still important to restore wrist function. Now the exercises include wrist stretching, which promotes increased mobility, as well as resisted muscle strength exercise. In addition, the pressing movement familiar from previous weeks will be slightly changed.

Ball compression

For example, squeeze a tennis ball for five seconds. The ball must now be harder than in the previous compression exercise. This makes the exercise more strengthening. Repeat the compression 10 times.

Streching the wrist

a) Using a healthy hand, extend the operated wrist so that you feel a stretch on the palm side of the wrist. Stretch lightly for 30 seconds. Repeat the stretch.
b) Bend the operated wrist with a healthy hand. The stretch is now felt on the back of the wrist. Stretch lightly for 30 seconds. Repeat the stretch.

Resistant muscle strength exercise

Self-opposed muscle strength exercises are safe to do. In the following exercises, the hands are pressed against each other.

a) Press with a healthy hand against the palm of the hand cut. Resist the movement with the cut hand so that the hand does not move. Press your hands against each other for five seconds. Repeat the exercise five times.
b) Press the cut of the hand with the healthy hand against the back of the palm. Resist the movement with the cut hand so that the hand does not move. Press your hands against each other for five seconds. Repeat the exercise five times.

Muscle strength training with light weight

You can do the following movements with a light dumbbell (half a kilogram) or for example using a half-liter drinking bottle. The movements strengthen the wrist.

a) Hold the back of your palm towards the ceiling at the edge of the table so that your hand can move freely. Hold the weight in your hand. Lift the weight by turning the back of your palm towards yourself. Slowly bring your hand down. Repeat the movement 10 times.

b) Turn the weight to the vertical position. Lift the weight by turning the top towards you. Again, remember to slowly return the hand to original position. Repeat 10 times.

c) Turn the weight so that your palm is facing the ceiling. Lift the weight by turning the palm towards you. Slowly bring your hand back down. Repeat 10 times.

The gradually restoring wrist function is a reward for regular self-training!

Immediate mobilization versus 2 weeks cast immobilization after distal radius fracture treated with volar locking plate- rehabilitation program

Rehabilitation program – Immediate mobilization

The primary goal after distal radius fracture treated with volar locking plate is to restore normal wrist movement. A prerequisite for achieving this goal is regular training in accordance with the instructions, which is very important for the functioning of the wrist.

The start of the exercises should not be delayed in any way, and there should be no unnecessary fear of moving the wrist after the cast treatment. The exercises in this guide are designed with the healing schedule in mind and are therefore safe to perform.

Hard-working and long-term self-training can be seen at its best as a restored ability to function on the wrist. Failure to do so or delaying training can, at worst, lead to a stiff and poorly functioning wrist.

1) **Feel free to start training as instructed as soon as pain allows**
2) **Diligent training allows good end result.**
3) **Operated hand should be used from the beginning in light everyday tasks, such as eating and brushing your teeth.**
4) **Practice patiently. Restoration of wrist function does not happen in an instant.**
5) **Follow the training schedule, but respect your unpleasant feelings!**

Rehabilitation program

A dressing will be placed in the operating room after surgery and will be removed in 1-3 days after surgery. After the procedure, it is normal for the wrist to be sore and swollen. Goals immediately after surgery focus on relieving swelling and treating pain.

Elevated position

As long as the swelling occurs, you should keep your hand in elevated position above the level of the heart as much as possible. The elevated position relieves both pain and swelling.

When resting, support your arms for example with pillows and keep your hand on your chest as you move. When the swelling is no longer disturbing, it is important that you allow the hand to be free and avoid unnecessary support.

Cold treatment

Cold therapy soothes tissues after surgery and is effective in treating pain. Carry out regular cold care at home with cold packs. Start cold therapy immediately after surgery. Keep the cold pack on the palm side of your wrist for short periods several

times a day. Be careful not to freeze the skin. The cold pack should never be kept exposed to the skin.

Finger exercises

Start moving your fingers immediately after surgery. Do the following exercises while you are awake about every hour. You can't move your fingers too much. Movements reduce swelling and pain in the hand.

a) Put your fingers fully in your fist so that your thumb is on top. Then extend your fingers quite straight and as far apart as possible. If you are unable to make the move to the top with a full active trajectory, you can gently assist with one hand until the full active movement is successful. Repeat the movement 10 times

b) Touch each fingertip alternately with your thumb. After each touch, extend your fingers straight, just like after punching. Repeat the movement so that you touch each finger 10 times in turn.

c) Rotate your thumb in a large circle. Move 10 turns in each direction.

Full upper limb movement exercises

When the cast is on, there is a risk that the entire upper limb will remain unused. Your shoulder and elbow joints need movement despite the cast. So do the following exercises several times a day.

a) Keep your hand next to your body. Extend your elbows completely straight and at the same time extend your fingers. Keep your arm straight for a moment. Then hook the elbow joint as far as you can and at the same time hook your fingers. Do the exercise 10 times and repeat several times a day.

b) Raise your hand towards the ceiling. Remember good posture when moving. Do the exercise 10 times and repeat several times a day.

You can also do the shoulder joint exercise while lying down, by raising your arm above your head on the pillow.

In the immediate mobilization group, full range of motion practise starts as soon as pain and swelling allows. Then it is time to start active progressive full range of motion. Regular training can improve to restore the wrist ability to function. The wrist can be very stiff at first, and the primary goal immediately after removing the cast is to increase mobility. Do the exercises several times during the day.

Wrist and forearm movement exercises

In addition to increase mobility, the movements activate the muscular activity of the wrist. If movements a and b feel too heavy at first, you can make the movement in the plane of the table with gravity eliminated as in movement c, but with your thumb up.

a) Hold the back of your palm towards the ceiling at the edge of the table so that your hand can move freely. Fingers should be slightly hooked. Move your hand slowly towards yourself with the back of your palm forward. Restore the motion slowly down. Repeat the exercise 10 times.
b) Turn your palm towards the ceiling. Fingers should be slightly hooked. Turn your palm towards yourself. Slowly bring your hand back down. Repeat the exercise 10 times.
c) Turn your palm against the table and hold the support of your other hand on your forearm. Fingers are allowed to be relaxed. Make the lateral slow motion (as if you were wiping the table surface) as large as possible. As you progress, you can do the exercise over the edge of the table with your thumb up. Move 10 times in both directions.
d) Sit in an upright position with your upper arm next to your body and your elbow hooked about 90 degrees. Alternately turn your palm and back of your palm toward the ceiling. Turn your hand 10 times in both directions.

Lightly hold a soft roll of yarn or a gauze roll, for example, in your hand. Squeeze the object for five seconds and loosen the squeeze. Repeat the exercise 10 times.

4 weeks after operation

All patients will undergo a follow-up at remote clinic 4 weeks after surgery according to the normal follow-up procedure. Before the visit, radiographs will be taken in health centers and orthopedic surgeon will evaluate the x-rays and virtual clinic appointment by phone will be carried out. Patients will visit a physiotherapist in their own health center after 4 weeks from surgery. If everything is okay in the follow-up-Physiotherapist will guide patients in carrying on with full range of motion exercises with progressive weight bearing, exercise protocol being similar in both groups after first follow-up in 4 weeks.

Restoration of wrist function is always individual. The wrist has usually mainly recovered in load capacity and trajectories approximately three months after surgery. A full recovery can take a year or more. The time it takes to recover depends on the severity of the injury and the training activity. Early-onset and active wrist exercise training accelerates injury recovery.

Continue with previous exercises, as regular mobility training is still important to restore wrist function. Now the exercises include wrist stretching, which promotes increased mobility, as well as resisted muscle strength exercise. In addition, the pressing movement familiar from previous weeks will be slightly changed.

Ball compression

For example, squeeze a tennis ball for five seconds. The ball must now be harder than in the previous compression exercise. This makes the exercise more strengthening. Repeat the compression 10 times.

Streching the wrist

a) Using a healthy hand, extend the operated wrist so that you feel a stretch on the palm side of the wrist. Stretch lightly for 30 seconds. Repeat the stretch.
b) Bend the operated wrist with a healthy hand. The stretch is now felt on the back of the wrist. Stretch lightly for 30 seconds. Repeat the stretch.

Resistant muscle strength exercise

Self-opposed muscle strength exercises are safe to do. In the following exercises, the hands are pressed against each other.

a) Press with a healthy hand against the palm of the hand cut. Resist the movement with the cut hand so that the hand does not move. Press your hands against each other for five seconds. Repeat the exercise five times.
b) Press the cut of the hand with the healthy hand against the back of the palm. Resist the movement with the cut hand so that the hand does not move. Press your hands against each other for five seconds. Repeat the exercise five times.

Muscle strength training with light weight

You can do the following movements with a light dumbbell (half a kilogram) or for example using a half-liter drinking bottle. The movements strengthen the wrist.

a) Hold the back of your palm towards the ceiling at the edge of the table so that your hand can move freely. Hold the weight in your hand. Lift the weight by turning the back of your palm towards yourself. Slowly bring your hand down. Repeat the movement 10 times.

b) Turn the weight to the vertical position. Lift the weight by turning the top towards you. Again, remember to slowly return the hand to original position. Repeat 10 times.

c) Turn the weight so that your palm is facing the ceiling. Lift the weight by turning the palm towards you. Slowly bring your hand back down. Repeat 10 times.

The gradually restoring wrist function is a reward for regular self-training!

3.9.2021

TUTKITTAVAN SUOSTUMUS

Rannemurtumaleikkauksen jälkeinen kipsihoito verrattuna välittömään liikeharjoitteluun

Minua on pyydetty osallistumaan yllämainittuun tieteelliseen tutkimukseen.

Olen lukenut ja ymmärtänyt saamani tutkimustiedotteen. Olen saanut riittävän selvityksen tutkimuksesta ja sen yhteydessä suoritettavasta henkilötietojeni keräämisestä, käsittelystä ja luovuttamisesta. Tutkimuksen sisältö on kerrottu minulle myös suullisesti ja olen saanut riittävän vastauksen kaikkiin tutkimusta koskeviin kysymyksiini. Tiedot antoi minulle _____.

Olen saanut riittävät tiedot oikeuksistani tutkittavana, tutkimuksen tarkoituksesta ja sen toteutuksesta sekä tutkimuksen hyödyistä ja riskeistä. Minulla on ollut riittävästi aikaa harkita osallistumistani tutkimukseen.

Ymmärrän, että tähän tutkimukseen osallistuminen on vapaaehtoista. Minulla on oikeus kieltäytyä siitä sekä peruttaa tutkimukseen antamani suostumus milloin tahansa tutkimuksen aikana ilman perusteluita ilmoittamalla siitä tutkimushenkilökunnalle.

Ymmärrän, että tietojani käsitellään luottamuksellisesti. Tutkimuksen yhteydessä henkilötietojani voidaan siirtää tai luovuttaa anonymisoituna, tietoturvallisesti tutkimusryhmän ulkopuolisille tahoille tai EU/ETA-alueen ulkopuolelle tai käyttää tieteellisessä julkaisutoiminnassa tutkimustiedotteessa kuvatulla tavalla.

Tutkimuksesta kieltäytymisestä tai suostumuksen peruuttamista ei aiheudu minulle kielteisiä seurauksia eikä se vaikuta kohteluuni tai saamaani hoitoon millään tavalla. Olen tietoinen siitä, että mikäli peruutan suostumukseni tai osallistumiseni tutkimukseen keskeytyy muusta syystä, siihen mennessä kerättyjä tietojani voidaan edelleen käsitellä tässä tutkimuksessa, mikäli tutkimuksen toteuttaminen sitä vaatii ja lainsäädäntö sallii sen tai edellyttää sitä.

Allekirjoituksellani vahvistan osallistumiseni tähän tutkimukseen ja suostun vapaaehtoisesti tutkittavaksi sekä ymmärrän, että terveydentilaani koskevia ja muita henkilötietojani käsitellään osana tätä tutkimusta.

_____ __.__*20*__ _____ __.__*20*__

Suostun osallistumaan tutkimukseen: **Suostumuksen vastaanottaja:**

_____ _____
Tutkittavan allekirjoitus Tutkijan allekirjoitus

_____ _____
Nimenselvennys Nimenselvennys

_____ _____
Henkilötunnus tai syntymäaika virka/toimi

_____
Osoite