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### Management of lateral ankle injuries

*A multidimensional approach*

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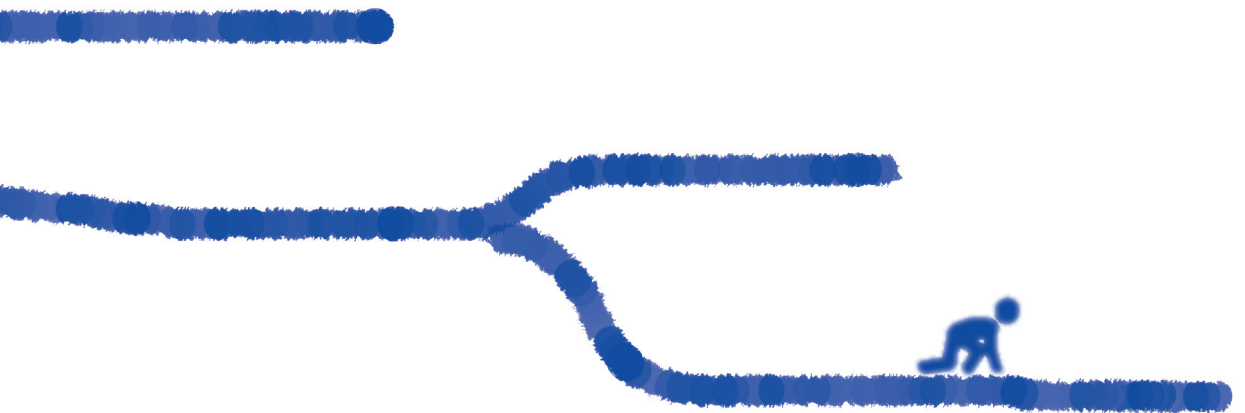
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# Summary

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**Management of lateral ankle injuries:  
a multidimensional approach**



## General introduction

Lateral ankle sprains are the most commonly seen musculoskeletal injury. As such, an increasing number of studies report high numbers of patients that experience posttraumatic ankle instability and limitations in activities of daily living (ADL), work and sports. It is currently unclear which determinants are associated with either a positive or negative (treatment) outcome in patients who sustained a lateral ankle sprain. Therefore the main focus of the studies included in this thesis is to define the current best evidence-based treatment and prevention strategies for both lateral ankle sprains and chronic ankle joint instability. An additional objective is to identify potential risk factors for sustaining a lateral ankle sprain, with the objective to further improve subsequent treatment outcome.

## Part I – Recommendations to improve current practice

The best treatment for patients who have sustained a lateral ankle sprain is an ongoing topic for debate. By summarising the latest evidence, **Chapter 2** updates the existing evidence-based guideline on lateral ankle sprains to come to conclusions on the best management strategies. Based on this overview, physical examination, especially delayed physical examination 4 to 5 days after the initial ankle trauma, was found to be the most reliable to diagnose ligament injury. As treatment, immobilisation (>10 days) is not recommended, because functional support by means of tape or brace provides superior results. Supervised exercise therapy is advised for patients as it stimulates recovery and improves functional joint stability. The use of NSAIDs and rest, ice, compression and elevation (RICE) may help to subsequently relieve pain and swelling. In order to return to work and return to sport, a stepwise rehabilitation plan may be required. This stepwise approach aims to avoid an unnecessarily long duration of complaints and recurrent injuries, especially if the concerned activities include high loading forces of the ankle.

According to this guideline update, risk factors, such as ankle malalignment and tibiotalar joint congruency, should receive more attention. Especially as a part of treatment and prevention programs they may increase effectiveness. For patients with ankle malalignment, surgical correction may be beneficial to resolve complaints and prevent subsequent recurrent lateral ankle sprains and chronic ankle joint instability. To optimise correction and subsequent treatment and prevention of recurrent sprains, reliable assessment is a necessity. Rotation of the foot, however, may affect radiographic alignment measurement. **Chapter 3** assesses the effect of foot rotation on reliability of the alignment measurement by using simulated radiographs reconstructed from a lower leg weight-bearing CT-scan. The CT-scan of the lower leg of 20 healthy volunteers were rotated around their longitudinal axis. For each lower leg the alignment axis was drawn on the simulated radiograph. Change in position of the alignment axis at the level of the tibiotalar joint line was measured for each five degrees of rotation. There was no significant change in position of the alignment axis, compared to the neutral position, between 10° of internal rotation and 10° of external rotation and was therefore regarded the 'safe zone'. Measurement of the

ankle alignment within this 'safe zone' will therefore ensure patients optimally benefit a correction procedure.

To ensure patient recovery, questionnaires are used to evaluate treatment effectiveness. Cut-off points may aid to define recovery and readiness to return to work or sport. Requiring a tool fit to provide an objectified translation of subjective findings in patients who sustained a lateral ankle sprain or suffer from chronic ankle joint instability, the objective of **Chapter 4** was to translate and validate the Cumberland Ankle instability Tool (CAIT) score in the Dutch population. A total of 98 patients who suffered from ankle injuries were included in this study. The results showed that the translated questionnaire is valid and reliable. Additionally, a cut-off value for functional ankle instability was found, indicating patients who scored  $\leq 11$  out of 30 points subjectively experienced instability. Therefore in future cases the CAIT score cannot only be used in the Dutch population to assess recovery and evaluate the rehabilitation progress, but also help define who suffers from functional ankle instability.

## Part II – Prognosis and prevention: who is at risk?

Identification of the mechanism underlying a lateral ankle sprain, and identification of potential patients at risk of recurrent sprains, is necessary prevent recurrent injury. To identify risk factors for sustaining a lateral ankle sprain and developing chronic lateral ankle joint instability, a systematic search and meta-analysis was performed in **Chapter 5**. PubMed, Embase, MEDline, Cochrane and PEDro were systematically searched until May 2018, resulting in a total of 80 relevant studies. Based on the meta-analyses, patients who had sustained a lateral ankle sprain showed a higher mean BMI (0.56 points). Patients who had progressed to chronic ankle joint instability had a higher weight (2.5kg) and required a longer time to stabilise during balance tasks (0.23sec) compared to healthy volunteers. This led to the conclusion firstly, that a higher BMI is a risk factor for sustaining a lateral ankle sprain, and secondly, that a higher weight and stabilisation deficits are risk factors for developing chronic ankle joint instability. Addressing these modifiable risk factors in treatment and prevention programs may further improve recovery in patients who have sustained an initial ankle sprain and reduce the risk of recurrent sprains and developing chronic lateral ankle joint instability.

Patients who develop chronic ankle joint instability are more likely to adapt their work and sports activities in order to avoid recurrent lateral ankle sprains, rather than to visit the outpatient clinic for their complaints. This leads to patient delay and to an unnecessarily long period of complaints. **Chapter 6** aims to provide means to intervene in this negative spiral of events through the design of a risk assessment model. This model, based on risk factors, will help identify patients at risk of recurrent lateral ankle sprains or chronic ankle joint instability at initial presentation. Using this risk assessment model, patients that visit the emergency room after sustaining an initial sprain can be classified as 'at risk' or 'not at risk'. Subsequent follow-up and/or treatment advice can be given accordingly, avoiding an unnecessarily long period of



complaints and limitations in ADL, work and sports.

As treatment decisions will be based on the output of the risk assessment model, reliable input variables is key. **Chapter 7**, therefore, includes a reliability assessment of three radiographic input parameters: ankle alignment, fibular position and ankle joint congruency. All observers were asked to measure each of the input parameters on a total of 39 radiographs. All measurements were performed twice with an interval of at least one week in order to assess the intra-observer reliability. Based on these measurements the intra-observer reliability ranged from moderate to excellent for the fibular position and ankle joint congruency (ICC 0.69-0.98). The overall inter-observer reliability was low apart from the fibular position, which showed good reliability (ICC 0.84-0.86). This led to the conclusion that the fibular position can be reliably measured. The other two measurements lack reliability, risking inadequate conclusions regarding treatment if these would be used as input for a risk assessment model.

### Part III – Surgical treatment of the unstable ankle

When a patient, despite participation in exercise treatment programs, progresses to chronic ankle joint instability, many techniques are available to surgically achieve ankle stabilisation. To ensure optimal recovery and aid in the treatment decision, the purpose of **Chapter 8** was to provide an overview of different surgical stabilisation techniques and compare these based on functional outcome. By means of a predefined search the PubMed, Embase, MEDline and the Cochrane Library databases were systematically searched for relevant articles published until April 2016. Through this search a total of 19 relevant studies were identified. The techniques that were compared based on the use of similar PROMs, were anatomic reconstruction, anatomic repair, capsular shrinkage and tenodesis reconstruction. The meta-analyses indicated that procedures that aimed to repair or reconstruct the original anatomy (i.e. anatomic reconstruction and anatomic repair), provided the best functional recovery and the greatest improvement from the preoperative status compared to the non-anatomic techniques. Anatomic reconstruction and repair are therefore the techniques of choice.

In addition to functional recovery, complications and duration of treatment effectiveness (i.e. injury recurrence) are also important outcomes after stabilisation surgery. Therefore, **Chapter 9** aimed to evaluate the long-term functional outcomes after surgical stabilisation through capsular shrinkage and to assess the duration of treatment effectiveness. All patients who were initially included in the short-term follow-up (<1 year) were contacted and asked to participate in this study 12 to 14 years postoperatively, by filling out a questionnaire. In total, 25 out of the initial 39 patients participated in this follow-up. Patients reported a significant improvement as measured using the Karlsson score. However, a total of 17 patients (68%) reported recurrent lateral ankle sprains, 7 patients (28%) experienced pain and joint stiffness, 8 patients (32%) experienced persistent swelling, 12 patients (48%) were limited in ADL and work, and 13 patients (52%) were limited in sport. Based on the high number

of patients that still experience persisting complaints, capsular shrinkage is not recommended to treat chronic ankle joint instability.

#### Part IV – General discussion

To ensure optimal recovery in patients who have sustained a lateral ankle sprain or who have developed chronic ankle joint instability, treatment first and foremost consists of functional therapy including RICE, NSAIDs, exercise therapy and brace use. In order to increase effectiveness of treatment and prevention programs, addressing individual risk factors for sustaining recurrent lateral ankle sprains and developing chronic ankle joint instability, such as a high weight, high BMI and stability deficits, is recommended. In case these treatment options prove insufficient in establishing recovery, surgical stabilisation through anatomic reconstruction or anatomic repair may be the treatment of choice.

Regardless the chosen treatment, monitoring through the use of Patient Reported Outcome Measures (PROMs), such as the CAIT, is necessary to define whether a patient experiences recovery or whether adaptation of the treatment strategy is required. However, these outcome measures are not suitable to measure treatment effectiveness in a low-literate and illiterate population. Adaptation of existing questionnaires and re-validation may be the focus of future research to avoid inequality in treatment due to health-illiteracy.

The sole assessment of risk factors for sustaining a lateral ankle sprain or progressing to chronic ankle joint instability is insufficient to improve patient treatment and injury prevention. Implementation of risk factors in our future risk assessment model will provide opportunity to improve treatment for patients. The output of the model will identify patient as 'at risk' or not. After initial identification of patients that are 'at risk', subsequent application of treatment and prevention strategies will help to avoid a cascade of comorbidities, and limitations in ADL and sports through individualised on-time treatment.

The complexity of a lateral ankle sprain concerns the composition of multiple risk factors and negative prognostic factors. These need to be addressed in prevention programs, in addition to adequate diagnosis of the extent of the injury and individualised treatment from the moment of initial presentation to warrant patient recovery.

