



# Prévention, examen, diagnostic et traitement

(de l'entorse et) de l'instabilité chronique de cheville







## La cheville traumatique

Approche clinique et scientifique...

Mécanismes lésionnels et facteurs de risques





#### **Brice PICOT:**

Kinésithérapeute du Sport-PhD Société Française des Masseurs Kinésithérapeutes du Sport

#### **François FOURCHET**

Kinésithérapeute du Sport-Ostéopathe-PhD



#### Origines mécaniques et/ou fonctionnelles de l'ICC

#### Version 2002

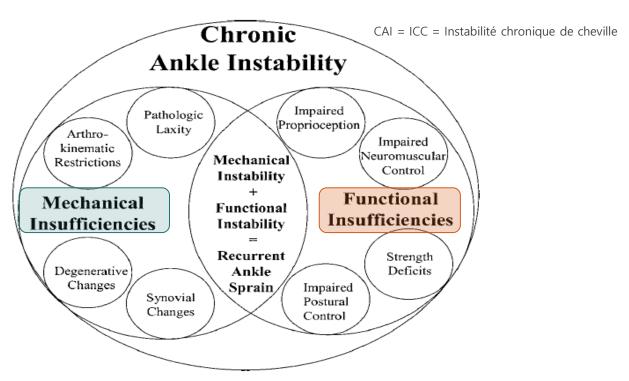


Figure 5. Paradigm of mechanical and functional insufficiencies that contribute to chronic ankle instability.

Hertel et al. (2002)



#### Origines mécaniques et/ou fonctionnelles de l'ICC

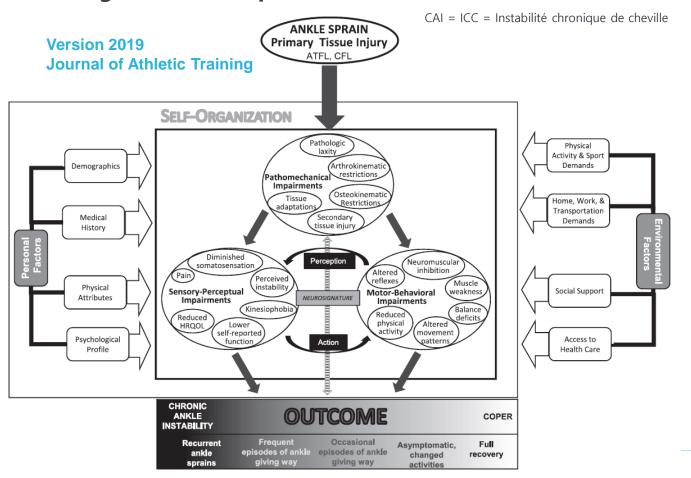


Figure 1. The updated model of chronic ankle instability (CAI). The outcome is determined at least 12 months after the initial ankle sprain. Abbreviations: ATFL, anterior talofibular ligament; CFL, calcaneofibular ligament; HRQOL, health-related quality of life.

Hôpital



de Cheville

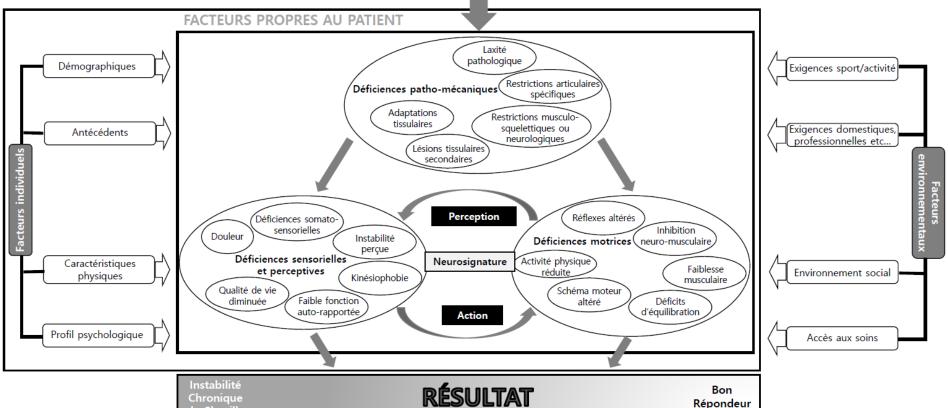
**Entorses** 

de cheville

récidivantes



## **Multifactoriel**



Episodes

de dérobement

occasionnels

Asymptomatique,

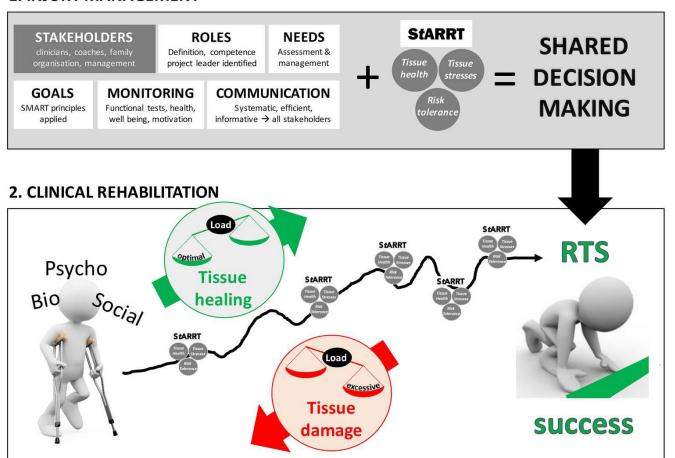
avec changement

d'activité

Récupération

complète

#### 1. INJURY MANAGEMENT



# Return to sport decisions after an acute lateral ankle sprain injury: introducing the PAASS framework—an international multidisciplinary consensus

Michelle D Smith , Bill Vicenzino, Roald Bahr, Andrea Macaluso, Sae Yong Lee, Andrea Macaluso, Andrea Reid, Bruno Tassignon, Andrea Masafumi Terada, Kristian Thorborg, Andrea Macaluso, Andrea M

## Comprendre l'étendue du problème





Consensus statement



2016 consensus statement of the International Ankle Consortium: prevalence, impact and long-term consequences of lateral ankle sprains

Phillip A Gribble, <sup>1</sup> Chris M Bleakley, <sup>2</sup> Brian M Caulfield, <sup>3</sup> Carrie L Docherty, <sup>4</sup> François Fourchet, <sup>5</sup> Daniel Tik-Pui Fong, <sup>6</sup> Jay Hertel, <sup>7</sup> Claire E Hiller, <sup>8</sup> Thomas W Kaminski, <sup>9</sup> Patrick O McKeon, <sup>10</sup> Kathryn M Refshauge, <sup>8</sup> Evert A Verhagen, <sup>11</sup> Bill T Vicenzino, <sup>12</sup> Erik A Wikstrom, <sup>13</sup> Eamonn Delahunt <sup>14</sup>





**Récidives** (30-70%)



Instabilité chronique de cheville (40%)



Arthrose de cheville (15-20%) 70%-80% des arthroses sont post traumatiques

## Qui est qui?

#### Sportif sain

Pas d'antécédents d'entorse

« Indivuals with no history of Lateral Ankle Sprain (LAS) » (Hertel et al. 2002)

#### Sportif « coper »



- Première entorse "grave"
- Retour à la pratique sans épisode d'instabilité
- (> 12 mois)
- Minimum voire une absence de gène fonctionnelle

1

"individuals who have suffered an LAS but failed to develop CAI" (Wikstrom et al. 2013)

#### Sportif instable



- Episodes de « giving way » fréquents
- sensation d'instabilité articulaire
- Entorses latérales fréquentes, avec ou sans instabilité mécanique
- Douleurs et perte de fonction
- Limitations dans AVS antérieures



30%-70% des patients ayants subis une LAS ((Hertel et al. 2002, Anandacoomarasamy et al. 2005, Hershkovich et al. 2015)



#### **CAIT**

#### QUESTIONNAIRE

French version of the Cumberland Ankle Instability Tool (F-CAIT). Echelle d'auto-évaluation pour les instabilités de cheville

Geerinck A et al. French translation and validation of the Cumberland Ankle Instability Tool, an instrument for measuring functional ankle instability. Foot Ankle Surg. 2019 May 9. pii: \$1268-7731(19)30065-7

ICC si score <24

Nom du patient :			Date :		
Pour chaque question, merci de cocher la	phrase o	qui déc	crit le mieux vos chevilles.		
1. J'ai des douleurs à la cheville  Jamais  Quand je fais du sport  Quand je cours sur des surfaces irrégulières  Quand je cours sur des surfaces planes  Quand je marche sur des surfaces planes  Quand je marche sur des surfaces planes	Gauche 5 4 3 2 1 0	Droite 5 4 3 2 1	6. J'ai l'impression que ma cheville est INSTABLE quand  Jamais  Je sautille d'un côté à l'autre Je sautille sur place Je saute	Gauche 3 2 1	Droite 3 2 1
2. Ma cheville me semble INSTABLE quand  Jamais  Parfois quand je fais du sport (pas à chaque fois)  A chaque fois que je fais du sport  Parfois lors d'activités quotidiennes  Fréquemment lors d'activités quotidiennes	Gauche 4 3 2 1	·	7. J'ai l'impression que ma cheville est INSTABLE quand  Jamais  Je cours sur des surfaces irrégulières Je trottine sur des surfaces irrégulières Je marche sur des surfaces irrégulières Je marche sur des surfaces planes	Gauche 4 3 2 1	Droit: 4 3 2 1 0
3. Quand je pivote BRUSQUEMENT, j'ai l'impression que ma cheville est INSTABLE  Jamais  Parfois quand je cours  Souvent quand je marche  Quand je marche	Gauche 3 2 1	Droite 3 2 1	8. HABITUELLEMENT, quand ma cheville commence à se tordre, je peux l'arrêter   Immédiatement   Souvent   Parfois   Jamais   Je ne me suis jamais tordu la cheville	Gauche 3 2 1 0	Droit 3 2 1 0 3
4. Quand je descends les escaliers, j'ai l'impression que ma cheville est INSTABLE  Jamais  Si je vais vite  Occasionnellement  Toujours	Gauche 3 2 1	Droite 3 2 1	9. Après un incident HABITUEL de torsion de cheville, ma cheville revient à la « normale »  Presque immédiatement  En moins d'une journée  En un à deux jours  In plus de deux jours	Gauche 3 2 1	3 2 1 0
5. Quand je marche sur UNE jambe, j'ai l'impression que ma cheville est INSTABLE   Jamais  Quand je suis sur la pointe du pied  Quand j'ai le pied à plat	Gauche 2 1 0	Droite 2 1 0	☐ Je ne me suis jamais tordu la cheville  Score total /30 à Gauche  Merci d'avoir pris le temps de répondre à ce question	3 /30 à Droi nnaire.	3 ite

1.	J'ai des douleurs à la cheville			
	Jamais			5
	Quand je fais du sport			4
	Quand je cours sur des surfaces irrégulières			3
	Quand je cours sur des surfaces planes			2
	Quand je marche sur des surfaces irrégulières			1
	Quand je marche sur des surface planes			0
2.	Ma cheville me semble INSTABLE quand			
	Jamais			4
	Parfois quand je fais du sport (pas à chaque fois)			3
	A chaque fois que je fais du sport			2
	Parfois lors d'activités quotidiennes			1
	Fréquemment lors d'activités quotidiennes			0
3.	3. Quand je pivote BRUSQUEMENT, j'ai l'impression que ma cheville est INSTABLE			
	Jamais			3
	Parfais quand je cours			2
	Souvent quand je cours			1
	Quand je marche			0
4.	Quand je descends les escaliers, j'ai l'impression que ma cheville est INSTABLE			
	Jamais			3
	Si je vais vite			2
	Occasionnellement			1
	Toujours			0

<ol><li>Quand je me tiens sur UNE jambe, j'ai l'impression que ma cheville est INSTABLE</li></ol>			
Jamais		2	
Quand je suis sur la pointe du pied		1	
Quand j'ai le pied à plat		0	
J'ai 1'impression que ma cheville est INSTABLE quand			
Jamais		3	
Je sautille d'un côté à l'autre		2	
Je sautille sur place		1	
Je saute		0	
7. J'ai l'impression que ma cheville est INSTABLE quand			
Jamais		4	
Je cours sur des surfaces irrégulières		3	
Je trottine sur des surfaces irrégulières		2	
Je marche sur des surfaces irrégulières		1	
Je marche sur des surfaces planes		0	
<ol><li>HABITUELLEMENT, quand ma cheville commence à se tordre, je peux l'arrêter</li></ol>			
Immédiatement		3	
Souvent		2	
Parfois		1	
Jamais		0	
Je ne me suis jamais tordu la cheville		3	
9. Après un incident HABITUEL de torsion de cheville, ma cheville revient à la « normale »			
Presque immédiatement		3	
En moins d'une journée		2	
En un à deux jours		1	
En plus de deux jours		0	
Je ne me suis jamais tordu la cheville		3	

L'objectif prioritaire de la rééducation c'est...

### **EVITER LA RECIDIVE**



Clinical assessment of acute lateral ankle sprain injuries (ROAST): 2019 consensus statement and recommendations of the International Ankle Consortium

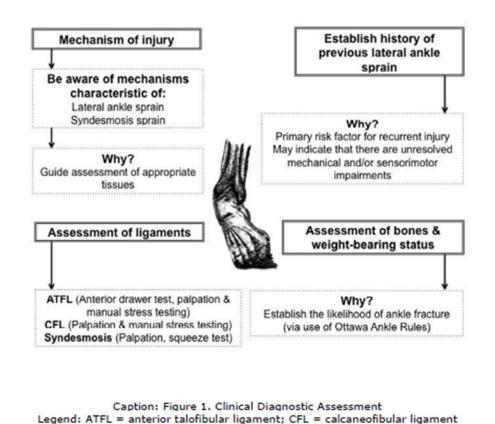
Eamonn Delahunt, <sup>1,2</sup> Chris M Bleakley, <sup>3</sup> Daniela S Bossard, <sup>1,2</sup> Brian M Caulfield, <sup>1,4</sup> Carrie L Docherty, <sup>5</sup> Cailbhe Doherty, <sup>4</sup> François Fourchet, <sup>6</sup> Daniel T Fong, <sup>7</sup> Jay Hertel, <sup>8</sup> Claire E Hiller, <sup>9</sup> Thomas W Kaminski, <sup>10</sup> Patrick O McKeon, <sup>11</sup> Kathryn M Refshauge, <sup>9</sup> Alexandria Remus, <sup>4</sup> Evert Verhagen, <sup>12</sup> Bill T Vicenzino, <sup>13</sup> Erik A Wikstrom, <sup>14</sup> Phillip A Gribble <sup>15</sup>

# Importance de l'examen initial de l'entorse de cheville:

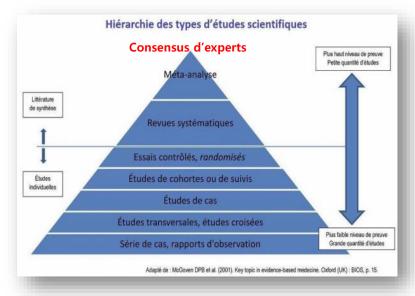




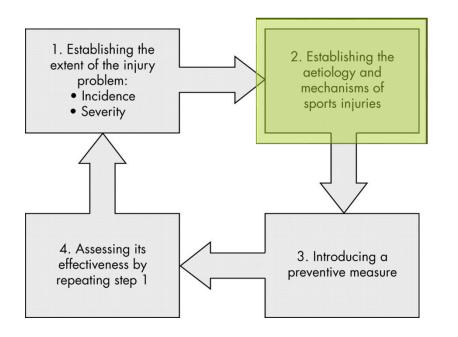


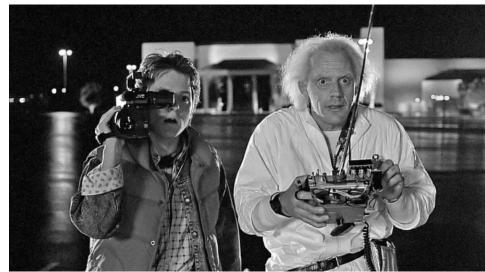


Article de **consensus d'experts (i.e. Delphi Process)** sur le bilan initial d'une entorse.



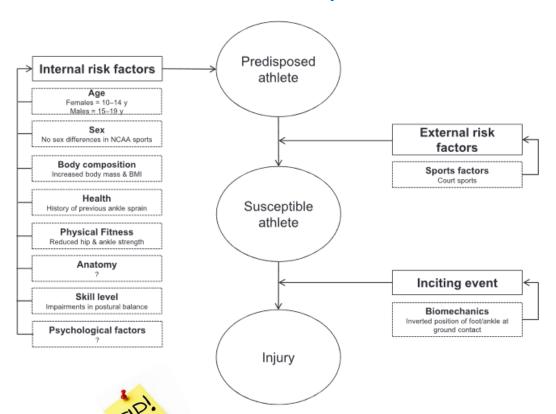
"How best can clinicians undertake a clinical assessment of acute lateral ankle sprain, if the primary aim is to prevent the development of lateral ankle sprain recurrence?"





## Les facteurs de risques





Journal of Athletic Training 2019;54(6):611–616 doi: 10.4085/1062-6050-44-18 © by the National Athletic Trainers' Association, Inc www.natajournals.org

Current Concepts

## Risk Factors for Lateral Ankle Sprains and Chronic Ankle Instability

#### Eamonn Delahunt, PhD, BSc (Physiotherapy)\*†: Alexandria Remus\*‡

\*School of Public Health, Physiotherapy and Sports Science, †Institute for Sport and Health, and ‡Insight Centre for Data Analysis, University College Dublin, Ireland

Lateral ankle sprains (LASs) are a common injury sustained by individuals who participate in recreational physical activities and sports. After an LAS, a large proportion of individuals develop long-term symptoms, which contribute to the development of chronic ankle instability (CAI). Due to the prevalence of LASs and the propensity to develop CAI, collective efforts toward reducing the risk of sustaining these injuries should be a priority of the sports medicine and sports physiotherapy communities. The comprehensive injury-causation model was developed to

illustrate the interaction of internal and external risk factors in the occurrence of the inciting injury. The ability to mitigate injury risk is contingent on a comprehensive understanding of risk factors for injury. The objective of this current concepts review is to use the comprehensive injury-causation model as a framework to illustrate the risk factors for LAS and CAI based on the literature.

Key Words: sports, athletic injuries, sprains and strains, lower extremity, ankle

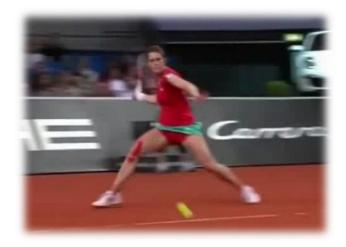


"A history of ankle sprain is a **primary risk factor** for recurrent injury..."





# Les entorses latérales : quel(s) mécanisme(s) lésionnel(s)



## Pourquoi s'intéresser au mécanisme?











"Establishing the **mechanism of injury** is advocated as it can give clinicians [...] what tissues should be **prioritised during clinical assessment** »

## Les mécanisme(s) lésionnel(s)

### Société Française des Masseurs Kinésithérapeute du Sport

#### ✓ Contexte

- Observation visuelle d'une supination (varus) + possiblement flexion plantaire
- > Traduction anglais inversion/supination
- Vitesse angulaire du traumatisme
- > Thonnard 1986... une notion de délai ??
- > Problème éthique...
- Méthodes d'études (modèle mathématiques, cadavres, MBIM...)



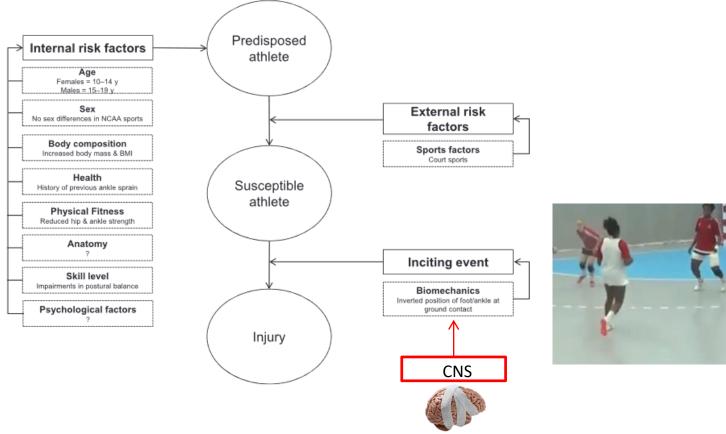




## Inciting event?

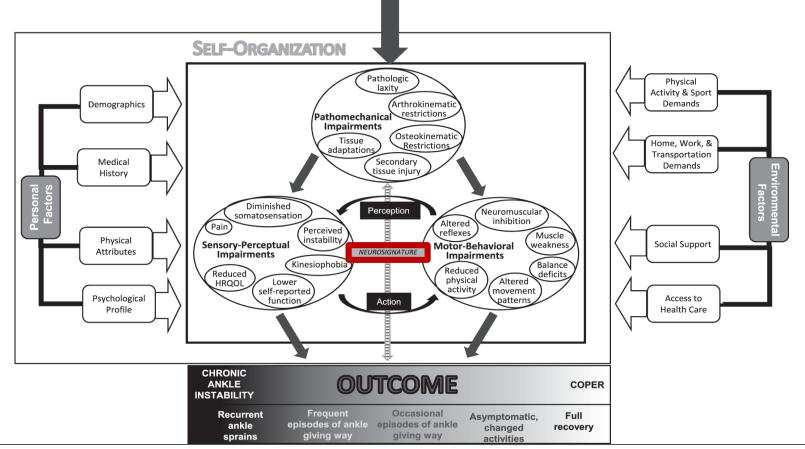






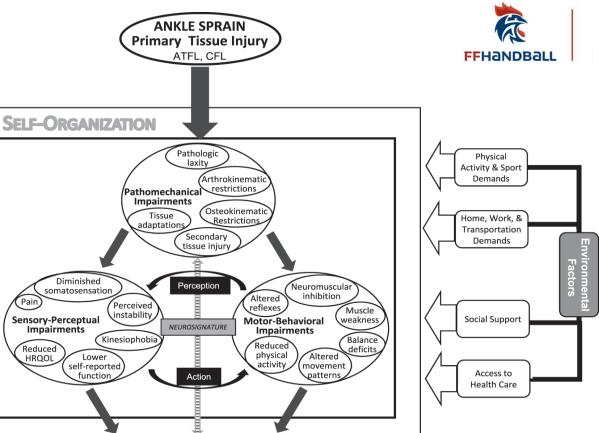






ANKLE SPRAIN
Primary Tissue Injury

ATFL, CFL





Demographics

Medical

History

**Physical** 

Attributes

**Psychological** 

Profile

Pain

Impairments

Reduced

HRQOL

Société Française

des Masseurs Kinésithérapeutes

## Inciting event...!!





J Sci Med Sport. 2017 Dec;20(12):1057-1061. doi: 10.1016/j.jsams.2017.05.006. Epub 2017 May 25.

Biomechanical analysis of ankle ligamentous sprain injury cases from televised basketball games: Understanding when, how and why ligament failure occurs.

Panagiotakis E1, Mok KM2, Fong DT3, Bull AMJ4.



Landing-related ankle injuries do not occur in plantarflexion as once thought: a systematic video analysis of ankle injuries in world-class volleyball

Christopher Skazalski, <sup>1</sup> Jacek Kruczynski, <sup>2,3</sup> Martin Aase Bahr, <sup>4</sup> Tone Bere, <sup>1,4</sup> Rod Whiteley, <sup>1</sup> Roald Bahr<sup>1,3,4</sup>

## C'est le pied ...

- Quantifier la contrainte ligamentaire à partir du MBIM ??
- 4 entorses au Basket en réception sur le pied adverse
- > Evaluation du ITFA et du ICF

"All cases exhibit a high level of inversion (>70°) with **no plantarflexion."** 

J Sci Med Sport. 2017 May 25. pii: S1440-2440(17)30432-2. doi: 10.1016/j.jsams.2017.05.006. [Epub ahead of print]

#### Biomechanical analysis of ankle ligamentous sprain injury cases from televised basketball games: Understanding when, how and why ligament failure occurs.

Panagiotakis E1, Mok KM2, Fong DT3, Bull AMJ4.

Author information

#### Abstract

OBJECTIVES: Ankle sprains due to landing on an opponent's foot are common in basketball. There is no analysis to date that provides a quantification of this injury mechanism. The aim of this study was to quantify the kinematics of this specific injury mechanism and relate this to lateral ankle ligament biomechanics.

#### DESIGN: Case series.

METHODS: The model-based image-matching technique was used to quantify calcaneo-fibular-talar kinematics during four ankle inversion sprain injury incidents in televised NBA basketball games. The four incidents follow the same injury pattern in which the players of interest step onto an opponent's foot with significant inversion and a diagnosed ankle injury. A geometric analysis was performed to calculate the in vivo ligament strains and strain rates for the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL).

RESULTS: Despite the controlled selection of cases, the results show that there are two distinct injury mechanisms: sudden inversion and internal rotation with low levels of plantarflexion; and a similar mechanism without internal rotation. The first of these mechanisms results in high ATFL and CFL strains, whereas the second of these strains the CFL in isolation.

CONCLUSIONS: The injury mechanism combined with measures of the ligament injury in terms of percentage of strain to failure correlate directly with the severity of the injury quantified by return-to-sport. The opportunity to control excessive internal rotation through proprioceptive training and/or prophylactic footwear or bracing could be utilised to reduce the severity of common ankle injuries in basketball





## C'est le pied ...

Landing-related ankle injuries do not occur in plantarflexion as once thought: a systematic video analysis of ankle injuries in world-class volleyball

Christopher Skazalski, <sup>1</sup> Jacek Kruczynski, <sup>2,3</sup> Martin Aase Bahr, <sup>4</sup> Tone Bere, <sup>1,4</sup> Rod Whiteley, <sup>1</sup> Roald Bahr<sup>1,3,4</sup>

- √ Mécanisme lésionnel un peu différent (moins rotation médiale)
- ✓ La réception sur un pied se fait **sans flexion plantaire** de cheville. (Confirmé par Skazalski et al. 2017, sur 24 entorses au volley.)
- ✓ Limites de l'étude mais prometteur, calcul possible du **degré de contrainte ligamentaire** à partir de l'analyse vidéo.

## Cas particulier : la syndesmose



"dorsiflexion and external rotation with a firmly planted foot is most commonly described." (Sman et al. 2013)





Lésion en **livre ouvert** avec atteinte prédominante du LTiFib ant (Lin et al. 2006, Sman et al. 2013, Van Djick et al. 2016)

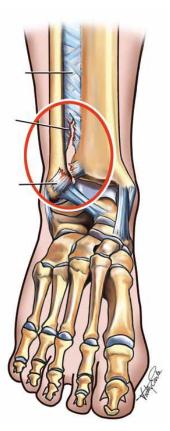


### Mécanismes lésionnels

dorsiflexion and external rotation with a firmly planted foot is most commonly described.









Lésion en **livre ouvert** avec atteinte prédominante du <u>compartiment</u> antérieur



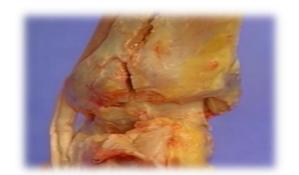


✓ Importance de l'interrogatoire et/ou de l'observation

#### Bilan du ligament deltoide +++







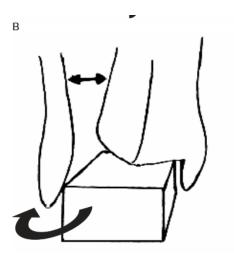


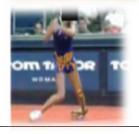
FIGURE 2. (A) The wider anterior portion of the talar dome forces the distal tibiofibular syndesmosis apart when the talus is subjected to a forceful dorsiflexion load. (B) The talus forces the distal tibiofibular syndesmosis apart when the talus is subjected to a forceful external rotation load.

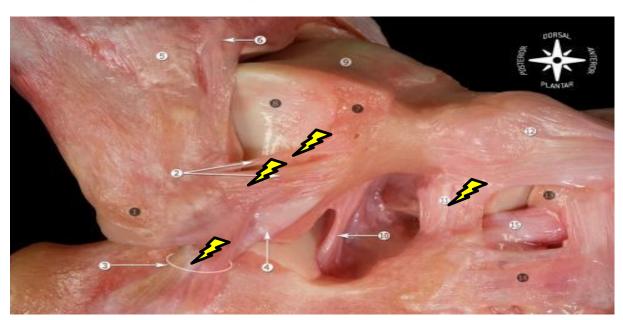


Rotation médiale + Supination => LTFA+ LCF Ligament cervical









**Hand-Basket-Foot-tennis** 

« Non contact injury » lors de changements de direction

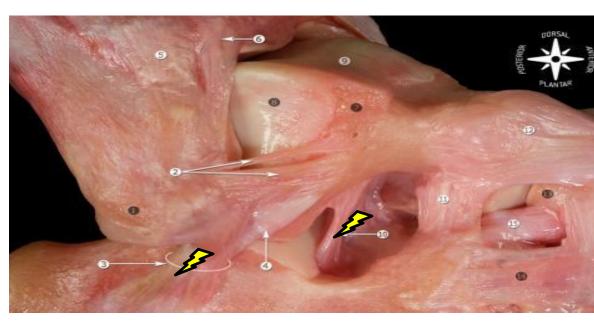


## Supination => <u>LCF + sous talienne</u>









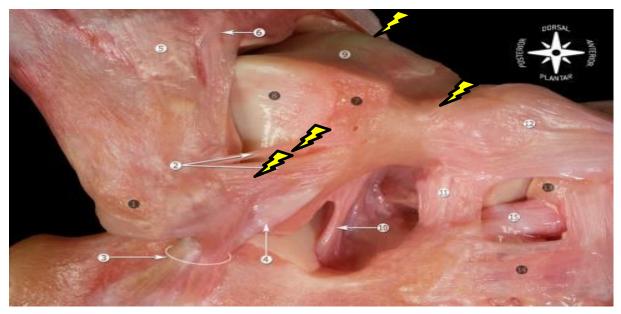
Volley réception sur un pied



Flexion plantaire forcée => capsule antérieure + LCM + Lisfranc



Figure 7. Probable mechanism for development of footballer's ankle. Illustration reproduced with permission by <sup>©</sup>Oslo Sports Trauma Research Center/T. Bolic.



#### **Football:**

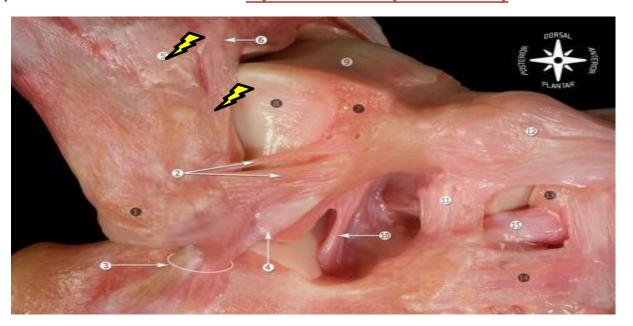
- Lésions antérieures des ligaments collatéraux +capsule articulaire



Rotation latérale et/ou flexion dorsale => Syndesmose (LTiFibAnt)







- Pied ancré au sol et rotation du tibia en chaine fermée.

## Conclusion et implications pratiques

#### Mécanismes lésionnels

- Comprendre les amplitudes lésionnelles
- Vitesses angulaires élevées > 600°/s
- > Entre 90 et 180ms selon la vitesse de course



Peu ou pas de flexion plantaire

#### A l'examen clinique:

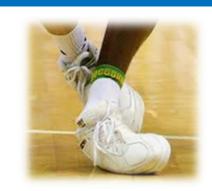
- Importance de l'interrogatoire et observation du mécanisme lésionnel (Garrick et al. 1977)
  - Tests cliniques proches du mécanisme lésionnel! (Delahunt et al. 2018)

## Conclusion



#### Analyse cinématique et cinétique:

- > Déficit sur l'ensemble du membre inférieur
- Le problème semble commencer avant la pose du pied au sol



➤ Glissement latéral du centre des pressions (ICC +++) (Morrison et al. 2010)

#### **En rééducation:**

- La rééducation des instabilités chroniques de cheville pourrait se concevoir dans un contexte de ré apprentissage moteur (Thonnard 1986)
- ➤Il semble important de développer le système de **feed forward** de l'ensemble du **membre inférieur** lors de la rééducation sensori-motrice et de la prévention des récidives (*Terada et al. 2015*)







# La cheville traumatique

Approche clinique et scientifique...

Examen clinique et PEC terrain



#### **Brice PICOT:**

Kinésithérapeute du Sport-PhD Société Française des Masseurs Kinésithérapeutes du Sport





#### **François FOURCHET**

Kinésithérapeute du Sport-Ostéopathe-PhD





### Examen sur le terrain

- Dans l'urgence (rapide)
- Eliminer les critères de gravité
- Envisager les lésions associées
- Orienter la prise en charge
- Appliquer les Premiers soins



566

Acta Orthop Scand 1996; 67 (6): 566-570

#### Diagnosis of ligament rupture of the ankle joint

Physical examination, arthrography, stress radiography and sonography compared in 160 patients after inversion trauma

C Niek van Dijk<sup>1</sup>, Ben Willem J Mol<sup>2</sup>, Liesbeth S L Lim<sup>1</sup>, René K Marti<sup>1</sup> and Patrick M M Bossuyt<sup>2</sup>



Examen peu précis: 71%sens et 33% spé dans l'urgence

=> Réexamen 3-5j



### Examen sur le terrain



#### **Interrogatoire**

(mécanisme, localisation, paresthésies)



#### **Observation**

(plaie, déformation, coloration, œdème)



#### **Palpation**

(Osseuse, tendineuse, ligamentaire ...)

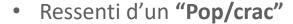


#### Prise en charge

(P.OL.I.C.E, décharge, Réorientation...)

### Interrogatoire....

Décrire le mécanisme lésionnel





- Historique d'entorses, d'imagerie ou traitement en cours...
- Présence d'autres drapeaux rouges





On enlève la chaussure/chaussette lors de l'examen



Emergency Medicine Australasia (2017)



#### REVIEW ARTICLE

Review article: Best practice management of common ankle and foot injuries in the emergency department (part 2 of the musculoskeletal injuries rapid review series)

Kirsten STRUDWICK <sup>1,2,3</sup> Megan MCPHEE, Anthony BELL, Melinda MARTIN-KHAN and Trevor RUSSELL



### Observation/inspection

- Plaie, déformation
- Présence d'un hématome/ oedème consequent
  - ⇒ Atteinte ligamentaire voire d'une fracture
- Palpation (osseuse, tendineuse, ligamentaire ...)



n'apportent pas d'éléments diagnostiques pertinents au moment de la blessure





On-field Management of Emergent and Urgent Extremity Conditions

Scott D. Flinn, MD

### Examen initial sur le terrain

Absence de corrélation anatomo-clinique entre l'impotence fonctionnelle immédiate et

la gravité de la lésion

MPORTANT

(stade 1 ou 2 notamment)



### Mais...:



→ L'association <u>craquement + douleur localisée + impotence fonctionnelle</u> est un facteur prédictif positif (75%) d'une rupture du LTFA

### I. Eliminer une fracture



• Premier facteur de gravité à envisager en cas de traumatisme...



# DIAGNOSTIC ACCURACY OF CLINICAL DECISION RULES TO EXCLUDE FRACTURES IN ACUTE ANKLE INJURIES: SYSTEMATIC REVIEW AND META-ANALYSIS

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"The OA(F)R are the most accurate decision rules for excluding fractures in the event of an acute ankle injury"

lan G Stiell, MD, FRCPC\*
Gary H Greenberg, MD, FRCPC\*
R Douglas McKnight, MD, FRCPC\*
Rama C Nair, MStat, PhD\*
I McDowell, PhD\*
I McDowell, PhD\*

A Study to Develop Clinical Decision Rules for the Use of Radiography in Acute Ankle Injuries

Ils sont fiables et utilisables à partir de **5ans** 

1. Impossibilité de se mettre en <u>appui</u> et de faire <u>4 pas</u> (i.e 2 fois 2 pas pour chaque pied)



Sensibilité de 92-100% et spécificité 16-51% avec RV+ 1,23 et RV- 0,10

Plus fiables dans les premières 48h mais à reproduire, ils permettent de diminuer le nombre de clichés jusqu'à 40%

lan G Stiell, MD, FRCPC\*
Gary H Greenberg, MD, FRCPC\*
R Douglas McKnight, MD, FRCPC\*
Roma C Nair, MStat, PhD\*
I McDowell, PhD\*
James R Worthington, MD, FRCPC\*

A Study to Develop Clinical Decision Rules for the Use of Radiography in Acute Ankle Injuries

 Douleur à la palpation osseuse du bord postérieur de la fibula ou du tibia sur une hauteur de 6 cm ou au niveau de la pointe d'une des 2 malléoles





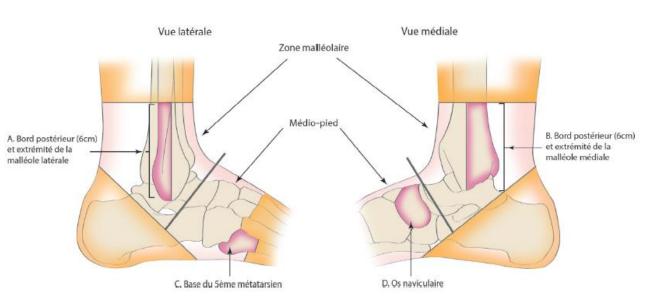
lan G Stiell, MD, FRCPC\* Gary H Greenberg, MD, FRCPC\* R Douglas McKnight, MD, FRCPC\* Rema C Nair, MStat, PhD\* I McDowell, PhD\* James R Worthington, MD, FRCPC\* A Study to Develop Clinical Decision Rules for the Use of Radiography in Acute Ankle Injuries

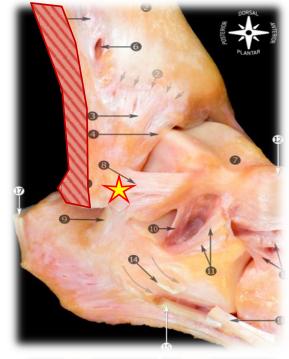
3. Douleur à la palpation du naviculaire ou de la base du 5<sup>ème</sup> métatarsien













### Les critères d'Ottawa... chez les kinés ?

#### Review



### Diagnostic accuracy of the Ottawa Ankle and Midfoot Rules: a systematic review with meta-analysis

Paula R Beckenkamp, 1,2,3 Chung-Wei Christine Lin, Petra Macaskill, Zoe A Michaleff, Chris G Maher, Anne M Moseley



"clinicians who are not medical doctors, [such as Physiotherapists] can apply the Rules without any reduction in the diagnostic accuracy of the Rule."

### Et depuis Ottawa...





Evaluating fracture risk in acute ankle sprains: Any news since the Ottawa Ankle Rules? A systematic review

Pascale Jonckheer, Tine Willems, Roel De Ridder, Dominique Paulus, Kirsten Holdt Henningsen, Lorena San Miguel, An De Sutter & Philip Roosen

Table 5. Diagnostic indicators performance of different tests in identifying fracture.

Ref.	Tests	n	Missed fractures n	Total fractures n	Sensitivity % (95% CI)	Specificity % (95% CI)	Risk of bias
[23]	Tuning fork test applied on the tip of the lateral malleolus in patients with positive OAR	49	0	5	100 (46–100)	61 (46–75)	Low
[23]	Tuning fork test applied on the distal fibula shaft in patients with positive OAR	49	0	5	100 (46–100)	95 (83–99)	Low
[24]	Bernese ankle rules	354	0	28	100	91	Low
[31]	Utrecht ankle rules	647	17	41ª	59 (42-74)	84 (81-87)	
[26,31]	Leiden ankle rules	647	5	41 <sup>a</sup>	88 (74-96)	57 (53-61)	Low
[35]	Leiden ankle rules	514	5	29	83 (69-94)	88 (85-91)	High
[19]	Ultrasound in patients with positive OAR	110	1	11 <sup>b</sup>	91 (66-98)	91 (88-92)	Low

<sup>&</sup>lt;sup>a</sup>After exclusion of 33 clinically insignificant fractures.

<sup>&</sup>lt;sup>b</sup>After exclusion of four clinically insignificant fractures.

### Les critères de Bernese

- Test de contrainte indirecte Fibulaire (10cm)
- Test de contrainte directe sur la Malléole médiale
- Test de compression médio-pied et arrière pied

Sensibilité de **70%** et spécificité **45-91%** avec RV+3,54 et RV-0,38



→ Moins de faux positifs, mais toujours après les OAR !!!

Procedures & Techniques

The Journal of TRAUMA® Injury, Infection, and Critical Care

#### The Bernese Ankle Rules: A Fast, Reliable Test after Low-Energy, Supination-Type Malleolar and Midfoot Trauma

Stefan Eggli, MD, Guido M. Sclabas, MD, Simone Eggli, MD, Heinz Zimmermann, MD, and Aristomenis K. Exadaktylos, MD

Background: Trauma of the midfoot and ankle joint are among the most commonly treated injuries in the emergency unit. The "Ottawa ankle rules" were introduced in 1992 to lower the amount of radiographs based on a standardized clinical examination. The weakness of the "rules" is the low specificity reported in several clinical studies.

Method: We introduced a new indirect stress technique to examine the ankle

and the midfoot after low-energy, supination-type trauma, avoiding direct palpation of the injured region.

Results: In 354 prospectively documented patients, the Bernese ankle test produced a sensitivity of 100% and a specflicity of 91%.

Conclusion: Compared with the original Ottawa ankle rules, the number of false-positive findings could be significantly reduced, resulting in a reduction of

84% in radiographs after low-energy, supination-type trauma ankle and midfoot trauma. Further investigations have to be performed to prove whether these findings are reproducible within other clinical settings, which could result in major cost savings for the health care system.

Key Words: Malleolar trauma, Clinical examination, Ankle rules, Practice guidelines, Ankle injuries,

J Traspna. 2005;59:1268-1271.

rauma of the foot and ankle is commonly seen in patients in the emergency unit.1-4 Nearly all of these patients undergo radiography even though the result is expected to be normal.4-8 The so-called Ottawa ankle rules introduced by Stiell et al. in 19921,8 were widely accepted for lowering the amount of unnecessarily obtained radiographs and at the same time saving time, money, and resources. 1,9,10

The sensitivity for detecting fractures of the ankle and midfoot region while applying the Ottawa ankle rules ranges in the literature from 94.6% to 100%, whereas the specificity remains relatively low at 11.5% to 50%. 1,4,6-8,10-15

To improve the specificity for clinical examination after malleolar and midfoot trauma, we developed a new indirect malleolar stress test. This examination technique is described and first results of a prospectively evaluated cohort are presented in this study.

#### PATIENTS AND METHODS

Between October 2001 and October 2003, a total of 364 patients who had sustained a low-energy, supination-type trauma of the foot and ankle region were treated in our emergency unit. This number represented 7.3% of all patients seen during this time period. Exclusion criteria for entering the study were secure fracture signs (e.g., crepitation, dislo-

Submitted for publication September 12, 2004.

Accepted for publication April 21, 2005. Copyright © 2005 by Lipponcott Williams & Wilkins, Inc. From the Departments of Orthopodic Surgery (S.H.) and Hand Surgery (S.E.), and the Trauma and Emergency Unit (G.M.S., H.Z., A.K.E.), Uniwarnity of Barne, Insolopital, Barne, Switzerland

Address for reprinte: Stefan Figgli, MD, Department of Orthopodic Surgery, University of Berne, Inselspital, CH-3010 Berne, Switzerland; errail: seggli@netscape.net.

DOI: 10.1097/01.ta.0000196436.95569.a3

Clinical Examination

The clinical examination was based on three consecutive steps: indirect fibular stress, direct medial malleolar stress, and compression stress of the mid- and hindfoot.

cation), language barrier, and difficulty in reliably evaluating

the site of injury (e.g., intoxication or diminished sensibility

because of neurologic diseases). This left a population of 354

consecutive patients evaluated in a prospective manner.

There were 204 male patients and 150 female patients. The

average age was 32 ± 13.2 years. The most frequently re-

ported mechanism of accident was an acute varus stress of the

extended foot. Fifty-two percent of the patients sustained the

injury during sports, 21% sustained the injury at work, 13%

sustained the injury at home, 8% sustained the injury during

traffic accidents, and 6% reported other reasons. All patients

were investigated by the same five permanent senior medical

residents, who were initially introduced to the examination

technique in a 20-minute teaching by the main investigator.

The results of the clinical investigation were documented on

a code sheet. Afterward, standardized anteroposterior and lateral radiographs of the ankle and an anteroposterior and

oblique radiograph of the midfoot were obtained. All data

were stored and analyzed using the clinical information da-

tabase Qualicare (Qualidoc AG, Trimbach, Switzerland).

Indirect Fibular Stress

The malleolar fork is compressed approximately 10 cm proximally to the fibular tip, avoiding direct palpation of the niured region (Fig. 1). The compression is executed using the flat of the hand to spread the applied force on a larger area.

November 2005

### Les critères de Bernese

RV+	Interprétation	RV-
>10	Bonne	< 0,1
5,0-10,0	Modérée	0,1-0,2
2,0-5,0	Faible	0,2-0,5
1,0-2,0	Rarement important	0,5-1,0







Sensibilité de 70% et spécificité 45-91% avec RV+3,54 et RV-0,38

### Les critères de Bernese

Injury, Int. J. Care Injured 46 (2015) 1645-1649



Contents lists available at ScienceDirect

#### Injury

journal homepage: www.elsevier.com/locate/injury



Diagnostic performance of the Bernese versus Ottawa ankle rules: Results of a randomised controlled trial



Robert J. Derksen <sup>a,\*</sup>, Lisa M. Knijnenberg <sup>b</sup>, Gerwin Fransen <sup>c</sup>, Roelf S. Breederveld <sup>a</sup>, Martiin W. Heymans <sup>d</sup>, Inger B. Schipper <sup>e</sup>

The sensitivity of the OAR [...] was 97% compared to 69% for the BAR (p= 0.008). The specificity of the OAR [...] (29%) was significantly lower than the BAR (45%) (p<0.001)

Table 3. Diagnostic Accuracy Values and Meta-analysis

Test	Study (First Author, Year)	TP	FN	FP	TN	Sensitivity (95% CI)	Specificity (95% CI)	LR+ (95% CI)	LR- (95% CI)
Bernese Ankle Rules	Eggli, 2005 (5) Kose, 2010 (24) Beceren, 2013 (25) Derksen, 2015 (26) EDr Derksen, 2015 (26) n All studies	28 18 175 20 25	0 1 139 9	30 4 136 96 104	296 77 512 78 70	0.98 (0.85-1.00) 0.93 (0.73-0.98) 0.56 (0.50-0.61) 0.68 (0.50-0.82) 0.85 (0.68-0.94)	0.91 (0.87-0.93) 0.95 (0.87-0.97) 0.79 (0.76-0.82) 0.45 (0.38-0.52) 0.40 (0.33-0.48)	10.5 (7.49-14.8) 16.9 (6.81-41.7) 2.65 (2.21-3.17) 1.24 (0.94-1.64) 1.42 (1.17-1.73) 3.54 (1.73-7.26)	0.02 (0.00-0.30) 0.08 (0.02-0.37) 0.56 (0.49-0.64) 0.71 (0.41-1.22) 0.37 (0.16-0.89) 0.38 (0.21-0.70)

### Les autres outils...



### ✓ Le diapason: (128 Hz)

Meilleurs résultat (sensibilité 100% et spécificité 95% avec RV+22 et RV-0,00) si appliqué au tiers distal de la fibula (!!! Si OAR positifs!!!)



Figure 1 Application of the tuning fork on the tip of the lateral malleolus.



Figure 2 Application of the tuning fork on the distal fibula shaft 5-10 cm proximal to the point of maximum tenderness.

# Arbre décisionnel dans la recherche des fractures du pied et de la cheville



#### Critères d'Ottawa (CO) cheville/pied

RV+ **1,23** et RV- **0,10** Plus fiables dans les 48 premières heures



Pas de radiographie nécessaire (i.e on peut exclure une fracture)

Proposition d'association d'autres critères...

Critères de Bernese (CB)

RV+3,54 et RV-0,38



Les patients diabétiques avec neuropathies périphériques doivent passer une radio même si les critères d'Ottawa sont tous négatifs RV+22 et RV- 0,00
(si la zone malléolaire latérale positive sur CO)

Vibration tiers distal de la fibula 128Hz

Suspecter une absence de fracture

Radiographies

(cheville de face en rotation interne de 15°, profil strict, déroulé d'avant-pied)

# Les ultrasons Ultrasound ability in early diagnosis of stress fracture of metatarsal bone

F Banal, F Etchepare, B Rouhier, C Rosenberg, V Foltz, S Rozenberg, A C Koeger, B Fautrel, P Bourgeois

Ann Rheum Dis 2006:65:977-978. doi: 10.1136/ard.2005.046979

✓ Diagnostic ???

42 year old woman, with rheumatoid arthritis for 14 years, treated with leflunomide 20 mg/day and I prednisolone 5 mg/day, had mechanical pain over the dorsum of the right foot for 3 weeks. She had increased her walking activities a couple of weeks before the pain started. On clinical examination, there was a marked swelling and painful area on the second metatarsal. Plain radiographs were normal.

Sonography of the foot was obtained with a Esaote MP system and a 7.5-13 MHz linear transducer. Only the dorsal aspect of the foot was required in a longitudinal and axial view. A hypoechoic haematoma with periosteal elevation and cortical break was seen over the second metatarsal, which corresponded to the pain area (figs 1 and 2). Vascularity was showed on power Doppler mode in the periosteal elevation.

Magnetic resonance imaging (MRI) of the foot was performed a week later (figs 3-5). It confirmed the initial diagnosis, showing a soft tissue oedema, callus, and continuity break in the bone.

A plain radiograph, 6 weeks after the first one, showed a callus corresponding exactly to the area of periosteal elevation seen on sonography and MRI.

Plain radiographs may be normal for several weeks before a callus or a fracture line appears in the case of stress fractures. Early diagnosis in this case depends on MRI or bone scan scintigraphy, which are considered to be the "gold standard".1 This observation illustrated the diagnostic ability of ultrasound in the early stage of a stress fracture and another use of ultrasound in rheumatology.



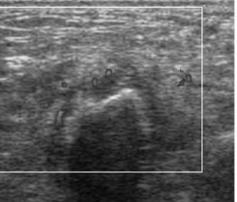


Figure 1 An axial ultrasound image of the second metatarsal bone showed distinct cortical thickening with periosteal haematoma and power Doppler signal.

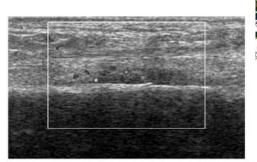


Figure 2 A longitudinal ultrasound image of the second metatarsal bone showed distinct cortical thickening with periosteal hematoma and power Doppler signal.



### Les ultrasons...



✓ <u>Diagnostic</u> ???

"The results of this study do not support the specific use of ultrasound as a stand alone diagnostic test for lower-limb stress fractures."

### [ RESEARCH REPORT ]

ANTHONY G. SCHNEIDERS, PT, PhD1 • S. JOHN SULLIVAN, PhD2 • PAUL A. HENDRICK, PT, PhD3 • BENJAMIN D.G.M. HONES, PT, BPhty4

ANDREW R. MCMASTER, PT, BPhty4 • BRIDGET A. SUGDEN, PT, BPhty5 • CELIA TOMLINSON, PT, BPhty6

The Ability of Clinical Tests to Diagnose Stress Fractures: A Systematic Review and Meta-analysis

### Les lésions associées



Clinics in Sports Medicine
Volume 39, Issue 4, October 2020, Pages 845-858



#### Peroneal Tendinosis and Subluxation

Julian G. Lugo-Pico MD <sup>a</sup>, Joshua T. Kaiser BS <sup>b</sup>, Rafael A. Sanchez MD <sup>a</sup>, Amiethab A. Aiyer MD <sup>c</sup>  $\stackrel{\circ}{\sim}$   $\stackrel{\boxtimes}{\bowtie}$ 





Atteinte du rétinaculum supérieur et luxation des fibulaires



- → Le patient peut décrire spontanément un « cloc »
- → Test d'éversion résistée (en isométrique) ou mouvements rotation de la cheville.

# Résumé du bilan "On field"

✓ Rechercher et exclure une fracture



✓ Déterminer s'il y a une atteinte vasculaire ou nerveuse



✓ Rechercher les atteintes **tendineuses graves** 



d'être touchées



Réorienter si necessaire ou en cas de doutes...

# LA CHEVIILLE ...











#### Vasculaire & NEUROLOGIQUE

#### **Traumatisme**

Critères d'Ottawa (traumatisme < 7 jours)

Douleur sur la pointe ou le rebord postérieur de la malléole médiale (6 cm)

Douleur sur la pointe ou le rebord postérieur de la malléole latérale (6 cm)

Douleur à la palpation sur la base du 5ème métatarse

Douleur à la palpation de l'os naviculaire

Impossibilité de faire 4 pas (un appui même minime compte comme un pas)

Un SEUL signe positif = Radiographie de contrôle

Sensation claquement / coup de poignard partie postéro-inférieure jambe

- ± Test de Thompson ± Test de Matles
- ± Prise du Fluoriquinolone



#### Absence traumatisme

Douleur insidieuse et diffuse qui apparait après l'effort puis pendant l'effort et même la nuit



Femme ± aménohrée ± IMC faible ± athlète longue distance ± ATCD de fracture de stress 🗥



#### **Traumatisme**

Bilan Sensitif F

Déficit / perte de sensibilité superficielle ± profonde :

- partie latérale de la jambe et dorsale du pied.
- territoire latéral de l'hallux et médial du deuxième orteil.
- territoire postéro-inférieur de la jambe, de la cheville et du talon, face plantaire du pied.

Bilan Moteur F

Déficit moteur non lié à la douleur lors de l'éversion, flexion dorsale, flexion plantaire

Bilan Vasculaire K

Sensation en "étau" ± œdème dur ± peau chaude / luisante - localisé à une loge musculaire

Absence / réduction pouls tibial ± pédieux (comparaison bilatérale)

Mollet chaud z douloureux z gonflé z rouge z diminution du ballant du mollet. ± Règles de Wells

#### Absence traumatisme

Mollet chaud ± douloureux ± gonflé ± rouge ± diminution du ballant du mollet ± Règles de Wells





### Examen retardé « Off field »

"The **sensitivity** (96%) and **specificity** (84%) of physical examination using the anterior drawer test are optimised if clinical assessment is delayed for between 4 and 5 days postinjury."

### Un patient consulte pour douleur dans la région pied/cheville



### Préalablement à l'examen clinique

# Interrogatoire:

- Âge
- Traitement corticoïde au long terme
- Doul → Présence d'un traumatisme ? → Bilan ON FIELD
   Anté → Présence d'un traumatisme ? → Bilan ON FIELD





### Eléments préalables au traitment





Be aware of mechanisms characteristic of:

Lateral ankle sprain Syndesmosis sprain

#### Why?

Guide assessment of appropriate tissues

Establish history of previous lateral ankle sprain

#### Why?

Primary risk factor for recurrent injury
May indicate that there are unresolved
mechanical and/or sensorimotor
impairments

Assessment of ligaments

Assessment of bones & weight-bearing status

ATFL (Anterior drawer test, palpation & manual stress testing)

CFL (Palpation & manual stress testing) Syndesmosis (Palpation, squeeze test)

#### Why?

Establish the likelihood of ankle fracture (via use of Ottawa Ankle Rules)

### Examen palpatoire

Journal of Athletic Training 2019;54(6):617–627 doi: 10.4085/1062-6050-484-17 © by the National Athletic Trainers' Association, Inc www.natajournals.org

Current Concepts

#### **Evaluating and Differentiating Ankle Instability**

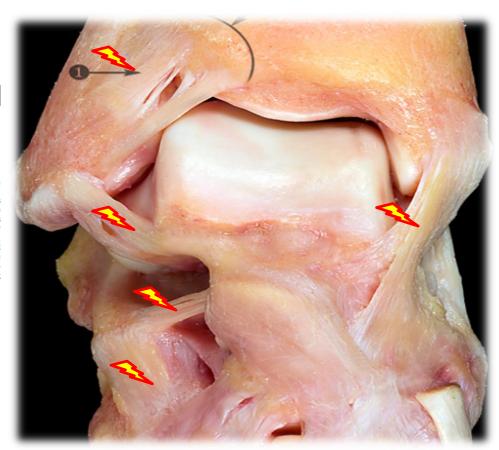
Phillip A. Gribble, PhD, ATC, FNATA

Department of Athletic Training and Clinical Nutrition, College of Health Sciences, University of Kentucky, Lexington

Given the prevalence of lateral ankle sprains during physical activity and the high rate of reinjury and chronic ankle instability, clinicians should be cognizant of the need to expand the evaluation of ankle instability beyond the acute time point. Physical assessments of the injured ankle should be similar, regardless of whether this is the initial lateral ankle sprain or the patient has experienced multiple sprains. To this point, a thorough injury history of the affected ankle provides important information during the clinical examination. The physical examination should

assess the talocrural and subtalar joints, and clinicians should be aware of efficacious diagnostic tools that provide information about the status of injured structures. As patients progress into the subacute and return-to-activity phases after injury, comprehensive assessments of lateral ankle-complex instability will identify any disease and patient-oriented outcome deficits that resemble chronic ankle instability, which should be addressed with appropriate interventions to minimize the risk of developing long-term, recurrent ankle instability.

"Importantly, following an ankle inversion injury, 60% of patients will have pain over the medial malleolus in the absence of a syndesmosis injury or medial malleolus fracture"



- ✓ Le test du tiroir antérieur (LTFA)
  - ✓ (sens 0,73-96 et spé 0,84-0,97)
  - ✓ RV+ infini et RV-0,42

Plusieurs positions décrites (patient allongé ou assis en bord de table)

La laxité semble supérieure à 90° de flexion de genou et 10° de flexion plantaire de cheville



- → On peut chercher à **palper** la tension du LTFA
- → Présence d'un « sulcus »





#### ✓ Le test du tiroir antéro-latéral

(sens 1 et spé 0,5)



Idem que le tiroir mais le pouce est placé au niveau du sinus du tarse. On imprime un mouvement de rotation médiale associé au tiroir antérieur.

### ✓ Le test du tiroir antéro-latéral inversé

(sens 0,9 et spé 0,9)

Idem que le tiroir mais le pouce est placé au niveau du sinus du tarse. On imprime un mouvement de rotation médiale associé au tiroir antérieur.

Knee Surgery, Sports Traumatology, Arthroscopy (2020) 28:55–62 https://doi.org/10.1007/s00167-019-05705-x

KNEE



Reverse anterolateral drawer test is more sensitive and accurate for diagnosing chronic anterior talofibular ligament injury

Qianru Li¹ · Yingchun Tu² · Jun Chen³ · Jieling Shan⁴ · Patrick Shu-Hang Yung⁵ · Samuel Ka-Kin Ling⁵ · Yinghui Hua¹ ©



- ✓ Le talar tilt test (LCF)
  - √ (sens 0,5 et spé0,88)
  - ✓ *RV+4 et RV-0,57*







Une main stabilise le segment jambier Il s'agit d'imprimer un mouvement de varus de l'arrière pied



On peut chercher à palper la tension du LCF

"The range of positive findings has been debated, but in general, more than 10° of movement is believed to indicate instability."

# The Epidemiology of Ankle Injuries Identified at the National Football League Combine, 2009-2015

Mary K. Mulcahey, \*† MD, Andrew S. Bernhardson, \*† MD, Colin P. Murphy, \*† BA, Angela Chang, \*† BS, Tyler Zajac, \*† ATC, George Sanchez, \*† BS, Anthony Sanchez, \*† BS, James M. Whalen, \*† MSEd, ATC, Mark D. Price, \*† MD, Thomas O. Clanton, \*† MD, and Matthew T. Provencher, \*† MD, CAPT, MC, USNR

Investigation performed at Steadman Philippon Research Institute, Vail, Colorado, USA





# Epidemiology of Syndesmosis Injuries in Intercollegiate Football

Incidence and Risk Factors From National Collegiate Athletic Association Injury Surveillance System Data from 2004-2005 to 2008-2009



des Masseurs Kinésithérapeutes du Sport

- La cheville est <u>l'articulation la plus touchée</u>
- Des chiffres **sous estimés** (entre 2 et 5,5 fois)
- Concerne jusqu'à <u>30% des lésions</u> de cheville dans les sports contacts (hockey, rugby, A. football... et ski)



« In 1990, ankle syndesmosis injury was reported to constitute 1% of all ankle sprains, whereas in 2013 almost 25% of ankle sprains were reported to affect the ankle syndesmosis"

### Interrogatoire et Observation

#### ✓ L'interrogatoire est l'élément clé du diagnostic

→ Le mécanisme lésionnel (Rot.Ext/Flex D) (Se 83% et Sp 22%)



- → Œdème et douleur ressentie en supra-malléolaire
  - → Segment jambier
  - → Genou



→ Incapacité à marcher (se 89% et Sp 21%) et faire un saut (se 89% et Sp 29%)







### L'examen clinique

Société Française des Masseurs Kinésithièrapeutes

- Douleur majorée en flexion dorsale (fente avant douloureuse)
- Douleur à la palpation de l'interligne articulaire (se 92% et Sp 78%) + membrane IO





3. Cross leg test positif

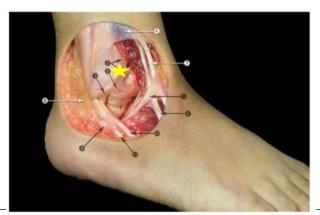


#### Bilan du ligament deltoide +++

Original article

# Diagnostic accuracy of clinical tests for ankle syndesmosis injury

Amy D Sman, <sup>1</sup> Claire E Hiller, <sup>1</sup> Katherine Rae, <sup>2</sup> James Linklater, <sup>3</sup> Deborah A Black, <sup>1</sup> Leslie L Nicholson, <sup>1</sup> Joshua Burns, <sup>1</sup> Kathryn M Refshauge <sup>1</sup>





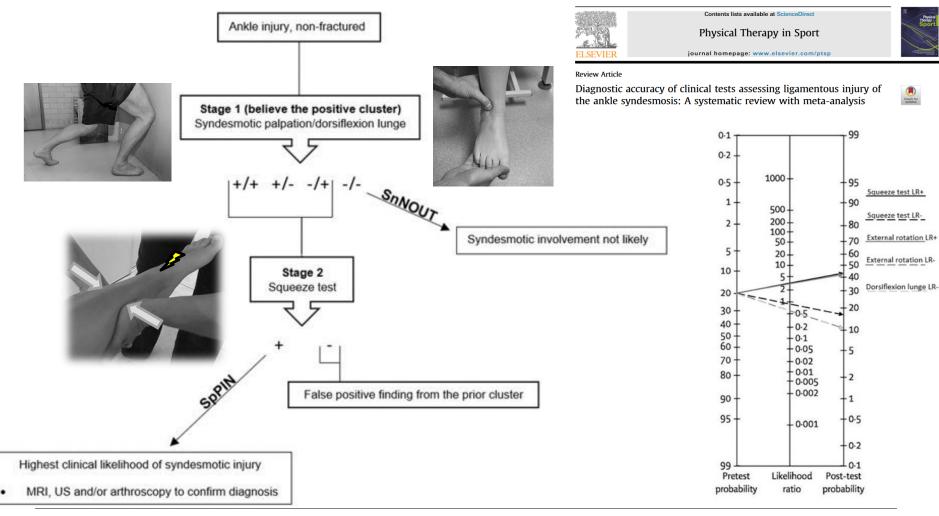
- Squeeze test
  - ✓ Sens 26% Spé 88%
  - ✓ RV+ 2,95 et RV- 0,84
- Cotton test
  - ✓ sens 29%...
- External rotation stress test
  - ✓ sens 71% Spé 63% ✓ RV+ 1,93 RV- 0,46
- Fibular translation test
  - ✓ sens 64% Spé 57%
  - ✓ RV+ 1,50 RV- 0,63











### Classification



Acute (< 6 semaines)

Sub acute ( >6 semaines)

Chronique (> 6 mois)

- Grade I: Lésion partielle ou totale du LTFAI uniquement.
- Grade IIa: Lésion du LTFAI + MIO mais pas d'atteinte du ligament deltoïde

c

Traitement conservateur

- Grade IIb: Lésion du LTFAI + MIO + atteinte confirmée du deltoide
- Grade III: Instabilité nette impliquant tous les ligaments + compartiment postérieur, le ligament deltoide et potentiellement la présence d'une fracture

N S T A B

Traitement chirurgical

### Traitement conservateur



Immobilisation par botte platrée ou attelle 6 semaines (Pas consensus).

Remise en charge progressive (proprioception, contrôle neuromusculaire...)

#### ATTENTION à la flexion dorsale de cheville



12 semaines pour un grade II avant reprise des changements d'appui

→ Capacité à enchainer les sauts à cloche pied sans douleurs pendant 30s





#### **Prévention ????**

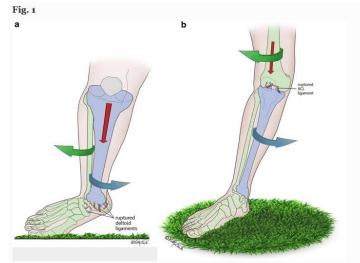


Attention délais de reprise plus longs qu'une entorse classique (3 à 5 fois sup)



### **CONCLUSION**

- <u>Ne pas sous estimer</u> les atteintes de la syndesmose (jusqu'à 30% dans les populations sportives)
- <u>Interrogatoire +++</u> (douleur, mécanisme lésionnel)
- Se méfier des <u>complications</u> (fractures)
- Les tests cliniques sont <u>peu précis</u>... (imagerie souvent nécessaire pour confirmation)
- Grades I et IIa → traitement conservateur
- Grade IIb et III → Avis chirurgical
- Délais de <u>reprise +++</u> (course 6 semaines minimum)



a Mechanism of ankle syndesmosis injury. With the forefoot fixed in the grass and valgus/pronation of the hindfoot, the deltoid ligament ruptures. External rotation of the (for/mid) foot/talus/fibula complex causes rupture of the AITFL-IOL-(PITFL) (green + green arrow). Internal rotation of body and tibia (blue + blue arrow). Axial body load (red arrow). b Mechanism of ACL injury. Whole foot fixed in the grass. Valgus moment. External rotation of the femur and internal rotation of the tibia causing the postero-lateral bone bruise on the tibia (subluxation) (green and blue arrow). Axial load of body weight (red arrow)

# Résumé du bilan "Off field"

✓ Précisez les lésions ligamentaires ou associées



✓ Réorienter si nécessaire



✓ Faire un bilan complet (ROAST)



Réorienter si necessaire ou en cas de doutes...

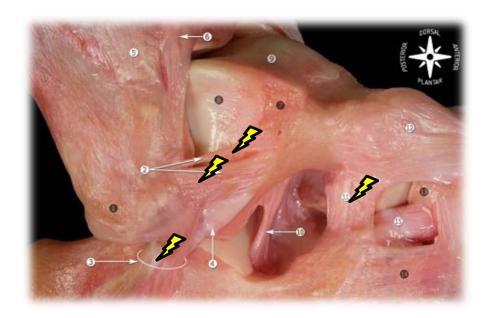
# Cas cliniques n°1

➤ Rotation médiale + Supination => <u>LTFA ?+ LCF ? + Ligament cervical ?</u>









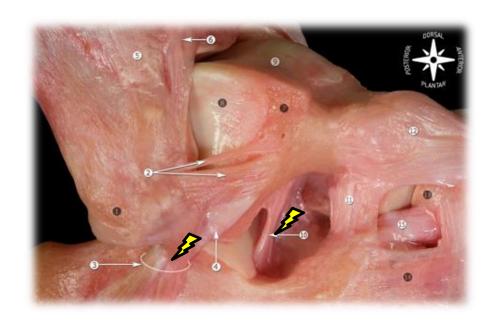
# Cas clinique n°2

> Supination => LCF ? + sous talienne ?







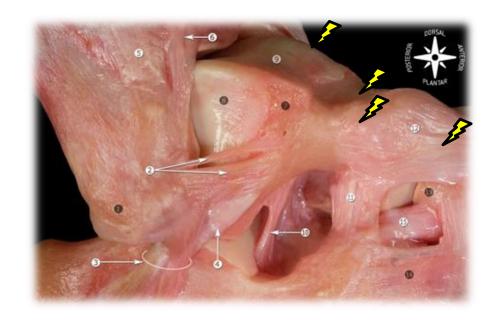


# Cas cliniques n°3

Flexion plantaire forcée => capsule antérieure ? + LCM ? + Lisfranc



Figure 7. Probable mechanism for development of footballer's ankle. Illustration reproduced with permission by \*\*Oslo Sports Trauma Research Center/T. Bolic.



#### Football:

- Lésions antérieures des ligaments collatéraux +capsule articulaire

### Cas clinique n°4

Rotation latérale et/ou flexion dorsale => Syndesmose (LTiFibAnt) ? Fracture ?



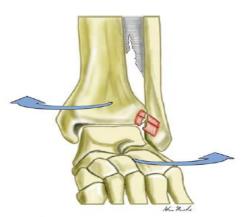
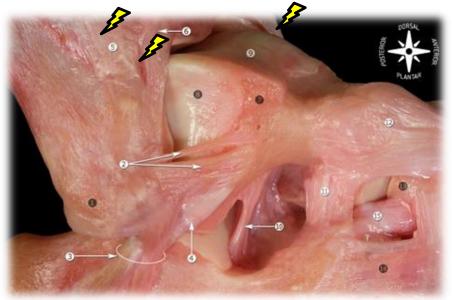


Fig. 6.5 Drawing illustrates mechanism of injury for syndesmotic injury thought to be the caused by external rotation resulting in separation of the fibula from the tibia (Lin et al. 2006). In football this can occur by a tackle to the outside of the knee with the body internally rotated and the foot planted in relative external rotation or a collision to the lateral leg with the foot planted causing internal rotation of the leg relative to the foot



#### Football/Rugby:

- Pied ancré au sol et rotation du tibia en chaine fermée.

### 1. Interrogatoire: mécanisme lésionnel, localisation de la douleur

### 2. Examen clinique

- Cutané trophique
  - Plaie/ Déformation
  - Œdème
  - Hématome
- Osseux
  - Critères Ottawa
  - Critères de Bernese
  - Choc Calcanéen
  - Diapason
- Ligamentaire
  - Palpation LCL et LCM
  - Ligament cervical + ligt bifurqué
  - LTibFib inférieur



- Les fibulaires
- Tendon d'Achille
- Vasculo Nerveux
  - Pouls Tibial
  - Pouls Pédieux
  - Nerf tibial
  - Nerf fibulaire Superficiel
  - Nerf Sural ?





A vous de jouer...

### Et en pratique ?

### 3. Tests cliniques

- Tibio-Tarsienne
  - Tiroir Antérieur
  - Talar tilt test
- Syndesmose
  - Palpation
  - Flexion dorsale en charge
  - Cross leg test
  - Squeeze Test
  - Cotton Test
  - External rotation stress test
  - Attention collatéral médial (deltoïde)

- Rupture tendon achille
  - Thompson
  - Matles
- Conflit postérieur
  - Flexions P passives maximales répétées







# La cheville traumatique

Approche clinique et scientifique...

Le bilan complet





#### **PICOT Brice:**

Kinésithérapeute du Sport, PhD Société Française des Masseurs Kinésithérapeutes du Sport





François FOURCHET

Kinésithérapeute du Sport-Ostéopathe-PhD

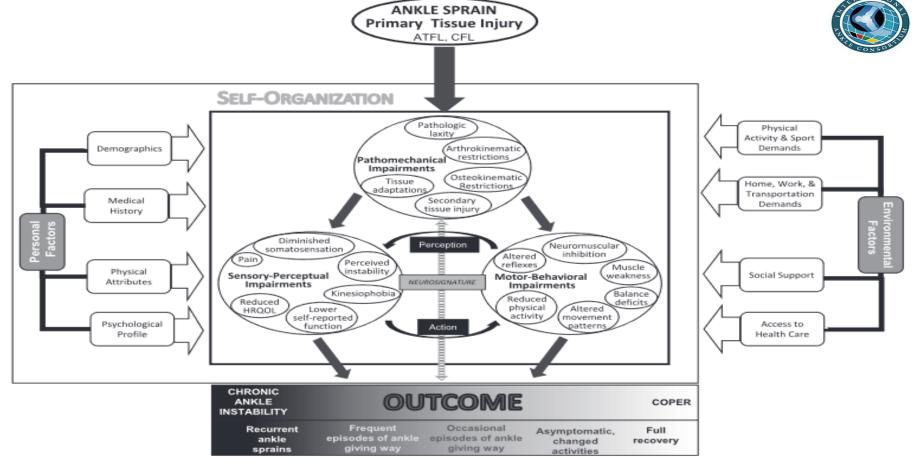


Figure 1. The updated model of chronic ankle instability (CAI). The outcome is determined at least 12 months after the initial ankle sprain. Abbreviations: ATFL, anterior talofibular ligament; CFL, calcaneofibular ligament; HRQOL, health-related quality of life.



#### Consensus statement



Clinical assessment of acute lateral ankle sprain injuries (ROAST): 2019 consensus statement and recommendations of the International Ankle Consortium

Eamonn Delahunt, <sup>1,2</sup> Chris M Bleakley, <sup>3</sup> Daniela S Bossard, <sup>1,2</sup> Brian M Caulfield, <sup>1,4</sup> Carrie L Docherty, <sup>5</sup> Cailbhe Doherty, <sup>4</sup> François Fourchet, <sup>6</sup> Daniel T Fong, <sup>7</sup> Jay Hertel, <sup>8</sup> Claire E Hiller, <sup>9</sup> Thomas W Kaminski, <sup>10</sup> Patrick O McKeon, <sup>11</sup> Kathryn M Refshauge, <sup>9</sup> Alexandria Remus, <sup>4</sup> Evert Verhagen, <sup>12</sup> Bill T Vicenzino, <sup>13</sup> Erik A Wikstrom, <sup>14</sup> Phillip A Gribble <sup>15</sup>



### The International Ankle Consortium Rehabilitation Oriented Assessment

Assessment
Designed by CYLMSportScience

Reference: Delahunt et al. BJSM 2018

resigned by GILINSportScience

#### Lateral ankle sprains are the most It's never just a "rolled" or "twisted" ankle prevalent lower limb injury in many sports

40% of individuals develop chronic ankle instability within 1-year after their 1st ever lateral ankle sprain



- A "feeling" of ankle joint instability
- "Giving way" of the ankle joint

Recurrent lateral ankle sprain injury

Chronic ankle instability develops due to the interaction of mechanical and sensorimotor impairments

For that reason, it is important to assess



#### Ankle joint swelling

Swelling can cause arthrogenic muscle inhibition. Guide progression of exercise-based rehabilitation. Evaluate the efficacy of treatments implemented

Ankle joint range of motion



High propensity for the development of a dorsiflexion deficit. Impairments in ankle joint range of motion are consistently identified in individuals with chronic ankle instability

#### Ankle joint arthrokinematics

Disruption can result in a dorsiflexion deficit and are regularly identified in individuals with chronic ankle instability

#### Ankle joint strength

Impairments compromise the functional integrity of the ankle joint and are regularly identified in individuals with chronic ankle instability

#### Static & dynamic postural balance

Patient's level of

physical activity

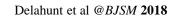
Guide the specificity of exercise-based rehabilitation

Impairments are consistently identified in individuals with chronic ankle instability

#### Gait

Impairments in gait are consistently identified in individuals with chronic ankle instability





Répondez à <u>chaque question</u> en cochant <u>la réponse</u> qui décrit le mieux votre condition dans la dernière semaine.

Si l'activité en question est limitée par autre chose que votre cheville, cochez «Non Applicable » (N/A).

#### Activités de la vie quotidienne

	Pas du tout difficile	Légèrement difficile	Moyennement difficile	Très difficile	Impossible	N/A
Se tenir debout						
Marcher						
Marcher sans chaussure						
Marcher en montée						
Marcher en descente						
Monter des escaliers						
Descendre des escaliers						
Marcher sur un terrain irrégulier						
Franchir un trottoir						
S'accroupir						
Se dresser sur la pointe des pieds						
Commencer à marcher						
Marcher 5 min ou moins						
Marcher environ 10 min						
Marcher 15 min ou plus						

# Le FAAM-AVQ

	Pas du tout difficile	Légèrement difficile	Moyennement difficile	Très difficile	Impossible	N/A
L'entretien de la maison						
Vos activités de la vie quotidienne						
Vos soins personnels						
Les tâches physiques légères à modérées (se tenir debout, marcher)						
Les tâches physiques intenses (port de charges)						
Vos activités de loisir			0			

Comment évalueriez-vous votre niveau fonctionnel actuel dans vos activités quotidiennes de 0 à 100 ; 100 étant votre niveau avant votre pathologie du pied et de la cheville et 0 étant un niveau d'incapacité totale à effectuer vos activités quotidiennes habituelles.

#### RESEARCH ARTICLE

Open Access

Evidence for validity and reliability of a french version of the FAAM

Stéphane Borloz<sup>1\*</sup>, Xavier Crevoisier<sup>2</sup>, Olivier Deriaz<sup>3</sup>, Pierluigi Ballabeni<sup>3,4</sup>, RobRoy L Martin<sup>5,6</sup>, François Luthi<sup>1,2,3</sup>

Stephane Borioz: , Xavier Crevoisier-, Olivier Deriaz-, Pieriulgi Ballabeni---, Robkoy L Martin---, François Lutni---

Borloz et al. @BJSM 2011

# Le FAAM – Sport

Par rapport à l'état fonctionnel de votre cheville, quel niveau de difficulté avez-vous pour faire :

	Pas du tout difficile	Légèrement difficile	Moyennement difficile	Très difficile	Impossible	N/A
De la course à pied						
Des sauts						
Des réceptions au sol						
De départs ou arrêts rapides						
Des changements de direction ou des mouvements latéraux						
Vos activités, sans modifier votre technique						
Vos sports, aussi longtemps que vous voulez						

Comment évalueriez-vous votre niveau fonctionnel actuel dans vos sports et activités physiques de 0 à 100; 100 étant votre niveau avant votre pathologie du pied et de la cheville et 0 étant un niveau d'incapacité totale à effectuer vos activités sportives habituelles.

\_ \_\_ 9

#### MDC:

FAAM AVQ = 7 points FAAM Sport = 18 points

**Déficits fonctionnels =** 

- ≤ 90% sur l'échelle des AVQ
- et/ou ≤ 80% sur l'échelle sportive

Pour le RTS, les deux >95%

#### RESEARCH ARTICLE

**Open Access** 

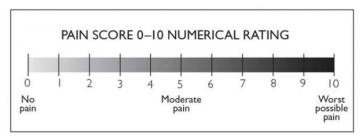
Evidence for validity and reliability of a french version of the FAAM

Stéphane Borloz1\*, Xavier Crevoisier2, Olivier Deriaz3, Pierluigi Ballabeni3,4, RobRoy L Martin5,6, François Luthi1,23

### Evaluer la douleur

Table 1 International Ankle Consortium ROAST			
What clinicians should assess following acute lateral ankle sprain injury	Why?	How?	
Ankle joint pain	Guide progression of exercise-based rehabilitation. Assess the efficacy of treatments implemented.	Numeric rating scale for pain. <sup>35</sup> FADI. <sup>36</sup>	





- Verbalement ou par écrit
- Au repos et/ou dans différentes activités, après la séance
  - Attention MDC=1.5



Clinician's name (or ref)			Patient's name	lor rof		
Official 3 Hame (of Fel)	***		auent s name	(01 161		
Please answer every question with one response activity in question is limited by something other				n within ti	he past wee	k. If the
	No difficulty at all	Slight difficulty	Moderate difficulty	Extrem difficult		ole to do

- FADI & FADI Sport
- Facile à traduire
- 0 à 100% (5 minutes)

MDC = 3,6% (FADI) MDC = 12,3% (FADIsport)

### Evaluer l'oedème

Ankle joint swelling

Swelling can cause arthrogenic muscle inhibition. Guide progression of exercise-based rehabilitation. Evaluate the efficacy of treatments implemented. Figure-of-eight.38-

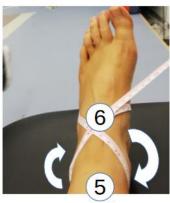




- Mi-distance
   jambier antérieur
   malléole externe
- 2 vers l'intérieur (Tub navi)



- 3 base du 5<sup>ème</sup> métatarsien
- 4 direction de la malléole interne



- 5 tendon d'achille puis malléole externe
- 6 point de départ

MDC no mark = 9,6mm MDC mark = 7,3mm

Figure 11. Anterior-medial view of the figure-of-eight method of ankle swelling measurement

# Amplitude de flexion dorsale



Ankle joint range of motion

High propensity for the development of a dorsiflexion deficit.

Impairments in ankle joint range of motion are consistently identified in individuals with CAI.

Weight-bearing lunge test. 44-46

## ✓ Le Weight Bearing Lunge Test (WBLT)

- distance Hallux-mur en position debout
- Pied à plat sans décoller le talon.
- Pied controlatéral en arrière en position confortable
- Mains sur le mur.

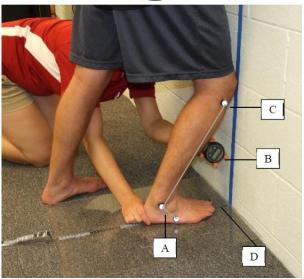


Une différence supérieure à 3cm doit interpeller le praticien, distance mur mini =10cm

# Amplitude de flexion dorsale







#### Forte corrélation entre analyse 2D (r>0.70) et :

- Mesure centimétrique au sol
- ➤ Inclinomètre à 15cm en-dessous la TTA
- Inclinomètre sur la TTA

 $MDC = 4.7^{\circ} \text{ ou } 1.9 \text{ cm}$ 

Systematic review

Reliability and minimal detectable change of the weight-bearing lunge test: A systematic review



Cameron J. Powden a, \*, Johanna M. Hoch b, Matthew C. Hoch b

### Déficit arthrocinématique ?





ORIGINAL ARTICLE

Talar Positional Fault in Persons With Chronic Ankle Instability Erik A. Wikstrom, PhD, Tricia J. Hubbard, PhD

Table 2: Sagittal Plane Talar Position Group Means (mm), SDs, and 95% Confidence Intervals

Group	Ankle	Mean ± SD	95% Confidence Interval
CAI	Involved*†	3.7±1.4	3.1-4.3
	Uninvolved	3.0±1.6	2.3-3.7
Control	Matched involved	2.7±1.2	2.1-3.2
	Matched uninvolved	2.8±1.3	2.3–3.3

- Un défaut de positionnement antérieur du talus est présent chez les sujets CAI par rapport à leur membre sain et comparée au membre apparié d'un groupe témoin.
- Excellente fiabilité intra-testeur et inter-testeur.

### Le Posterior Talar Glide

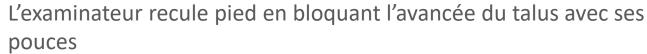
Ankle joint arthrokinematics

Disruption in ankle joint arthrokinematics can result in a dorsiflexion deficit. Impairments in ankle joint arthrokinematics are regularly identified in individuals with CAL

Posterior talar glide test. 48



- recul du talus lors de la flexion passive
- Patient assis en bout de table
- Pied à plat, Tibia à la verticale.



→ l'angle de flexion passive du genou fournit une estimation du glissement talaire postérieur.



#### Reliability

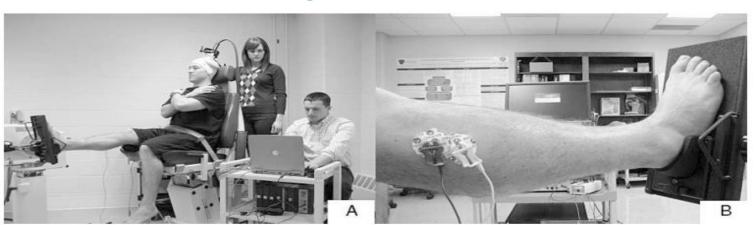
The intratester reliability of the testing procedure of the investigator responsible for taking the measures in this study was taken from repeated trials (reflecting that of a single session of the main experiment) of 5 asymptomatic individuals outcome measure prior to the experiment commencing. The intratester reliability for posterior talar glide and weight-bearing dorsiflexion was estimated by calculating intratester intraclass correlation coefficients (ICC) and the standard error of the measurement (SEM). Analysis of the repeated trials revealed sound levels of reliability, with an ICC<sub>3,3</sub> of 0.99 (95% CI, 0.96-0.99) for posterior talar glide and 0.95 (95% CI, 0.80-0.99) for dorsiflexion. The SEM was 0.4° for posterior talar glide and 0.2 cm for dorsiflexion.

MDC=1.4°

*Normal values are approximately 16°, but have been reported as low as 2.5° in injured ankles...* 

### Faiblesse musculaire

La faiblesse existe et a une origine centrale





"Resting motor threshold and self-reported function were moderately correlated, suggesting deficits in corticomotor excitability might influence function. ". Pietrosimone &

Gribble (2012)

### Evaluer la force musculaire







Ankle joint muscle strength

Impairments in ankle joint strength compromise the functional integrity of the ankle joint.

Hand-held dynamometry.53

Impairments in ankle joint strength are regularly identified in individuals with CAI.

Hand-Held Dynamometry: Reliability of Lower Extremity Muscle Testing in Healthy, Physically Active, Young Adults

Brent M. Kelln, Patrick O. McKeon, Lauren M. Gontkof, and Jay Hertel



### Comment avoir des données précises avec le dynamomètre à main ?

- Avoir un coude dans l'orthogonalité de la force du sujet
- Utiliser si possible un « <u>make test</u> » valeur de repro. >
- Avoir une cheville en position neutre à 90° de flexion (relation force/longueur)
- Placer le dynamomètre à la tête du 5<sup>ème</sup> métatarsien/ 1<sup>er</sup> métatarsien
- 2 essais d'échauffement et 3 essais de 5 secondes de contraction
- Force maximale / poids du sujet = N/kg

### Seulement la cheville ?

Is chronic ankle instability associated with impaired muscle strength? Ankle, knee and hip muscle strength in individuals with chronic ankle instability: a systematic review with meta-analysis

Nafiseh Khalaj , <sup>1</sup> Bill Vicenzino , <sup>1</sup> Luke James Heales, <sup>2,3</sup> Michelle D Smith , <sup>0</sup>

# Proximal Joint (hanche/genou)





Individuals with diminished hip abductor muscle strength exhibit altered ankle biomechanics and neuromuscular activation during unipedal balance tasks

Szu-Ping Lee a,\*, Christopher M. Powers b

\*Department of Physical Therapy, University of Nevada, Las Vegas, Las Vegas, USA

b Division of Biokinesiology & Physical Therapy, University of Southern California, Los Angeles, USA



Knee extension (Hansen et al., IJSPT 2015)

# Les abducteurs de Hanche?

Lee & Powers (2014) ont démontré que des patients qui ont un déficit de force des abducteurs de hanche sont en situation d'instabilité chronique de cheville.

D'où l'intérêt de tester cette fonction et de la restaurer au besoin...

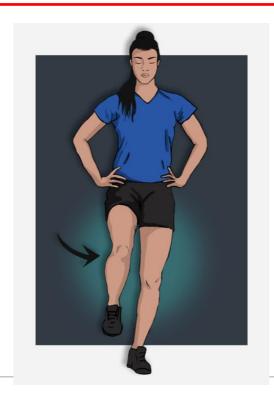


# Contrôle postural statique, Single Leg Stance (SLS<sub>firm</sub>)

Static postural balance

Impairments in static postural balance are consistently identified in individuals with CAI.

BESS.<sup>56</sup> FLT.<sup>57</sup>



En appui unipodal, sur un sol stable les yeux fermés pendant 20s.

Le genou en charge est légèrement déverrouillé (5°)

Le membre controlatéral est fléchi

Les mains sur les hanches

Plusieurs essais de familiarisation sont autorisés

On compte le nombre « d'erreurs »

ICC values of 0.93 and a SEM of 0.45; Cut off=3 erreurs

0 ERREURS 5 ERREURS



#### Type d'erreurs

Les mains se décollent des hanches

Le patient ouvre les yeux

Le patient déplace son pied, trébuche ou tombe

La hanche bouge à plus de 30° d'abduction ou flexion

L'avant ou l'arrière du pied en charge se lève

Le patient quitte la position de départ pendant plus de 5 secondes



## Contrôle postural dynamique

Dynamic postural balance

Impairments in dynamic postural balance are consistently identified in individuals with SEBT. SE

International Journal of Athletic Therapy and Training, (Ahead of Print) https://doi.org/10.1123/ijatt.2020-0106 © 2021 Human Kinetics Inc



# The Star Excursion Balance Test: An Update Review and Practical Guidelines

Brice Picot, PT, MSc<sup>1,2,3,4</sup> Romain Terrier, PhD<sup>2,3,5</sup> Nicolas Forestier, PhD<sup>3,4</sup> François Fourchet, PT, PhD<sup>2,4,6</sup> and Patrick O. McKeon, PhD, ATC, CSCS<sup>7</sup>

<sup>1</sup>French Handball Federation; <sup>2</sup>French Society of Sport Physiotherapist; <sup>3</sup>Savoie Mont-Blanc University; <sup>4</sup>Laboratoire Interuniversitaire de Biologie de la Motricité; <sup>5</sup>Whergo SARL; <sup>6</sup>Hôpital de La Tour; <sup>7</sup>Ithaca College

The Star Excursion Balance Test (SEBT) is a reliable, responsive, and clinically relevant functional assessment of lower limbs' dynamic postural control. However, great disparity exists regarding its methodology and the reported outcomes. Large and specific databases from various population (sport, age, and gender) are needed to help clinicians when interpreting SEBT performances in daily practice. Several contributors to SEBT performances in each direction were recently highlighted. The purpose of this clinical commentary is to (a) provide an updated review of the design, implementation, and interpretation of the SEBT and (b) propose guidelines to standardize SEBT procedures for better comparisons across studies.

Keywords: assessment, functional performance, lower limb, procedure, recommendations, reliability



"The **star excursion balance test** performed in three directions (anterior, posteromedial, and posterolateral) appears to be **the only test** to be **associated with increased injury** risk."

# Contrôle postural dynamique

Dynamic postural balance Impairments in dynamic postural balance are consistently identified in individuals with SEBT. 58 CAI.

#### Table 1 2021 Updated Recommendations for the SEBT Procedure

Important criteria	Recommendations	
Number of directions	Three (ANT, PM, and PL) representing a "Y" instead of eight. 13,16,31 See the proposed compact versions (Figure 3).	MDC:
Setup of the test	Demonstration prior to the test by the experimenter (or video). <sup>7,17</sup>	Ant> 6% / 6cm
Number of familiarization trials	Four in each direction for both limbs, until familiarization with procedure. <sup>7,17</sup>	PM> 8% / 7cm
Number of recorded trials	Three per direction. <sup>7,17</sup> Performances should be stabilized. Switch from one leg to the other between each direction to avoid fatigue. <sup>18</sup>	PL> 8% / 9cm
Hand position	Hands should remain on the hips to target lower limb performance. <sup>14,21</sup>	COMP 70/
Foot placement	Barefoot (or socks), the most distal aspect of the great toe on 0 (crossroad of three lines) during the entire procedure. Need to be standardized across studies. This method avoids possible foot placement errors. <sup>14</sup>	COMP= 7%
Failure criteria	<ul> <li>(a) Subject falls or loses his/her balance (the reaching foot touch the ground).</li> <li>(b) Subject shifts his/her weight on the reach limb when contacting the floor or contacts the floor at multiple times or miss the tape measure.</li> <li>(c) Stance foot moves or heel rises or any part of the foot lifts from the ground.</li> <li>(d) Hands are removed from the hips.</li> </ul>	
Parameter	<ul> <li>(a) Mean of the three trials for each direction and limb.<sup>46</sup></li> <li>(b) Calculation of the composite score (mean of three directions) for normalized (in percentage) and nonnormalized (in centimeters) scores.</li> <li>(c) Qualitative analysis of the movement.<sup>56,57</sup></li> </ul>	
Limb length normalization	Scores are expressed as a percentage of the tested lower limb length (from ASIS to medial malleolus preferably, or lateral malleolus). <sup>21</sup>	

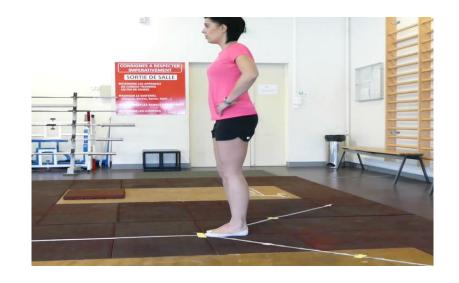
Note. ASIS = anterior and superior iliac spine; ANT = anterior; PL = posterolateral; PM = posteromedial; SEBT = Star Excursion Balance Test.

### Le Star Excursion Balance Test

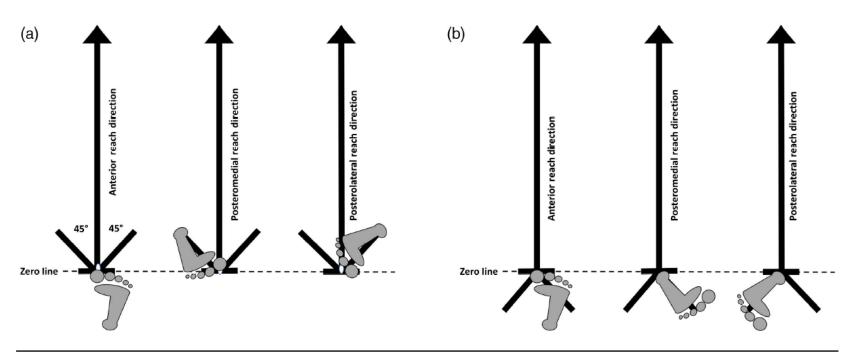
- Le pied en charge ne doit pas bouger, le talon ne doit pas se décoller
- Les mains doivent rester en contact des hanches
- Le sujet ne doit pas chuter
- Le sujet ne doit pas transférer son poids du corps
- Entre chaque essai le pied est reposé au sol



> Figure 5 : prise de mesure de la longueur du membre inférieur. De l'épine lliaque Antéro-supérieure et la malléole médiale



### Le Star Excursion Balance Test



**Figure 3** — A proposed "compact" version of the mSEBT. (a) With foot position in "toe fixed" at 0 for the three directions and (b) the changing toe/heel position according to the reached direction. mSEBT = modified Star Excursion Balance Test.

## Contrôle postural dynamique

Dynamic postural balance

Impairments in dynamic postural balance are consistently identified in individuals with SEBT. SE

#### Review

Clinician-friendly lower extremity physical performance tests in athletes: a systematic review of measurement properties and correlation with injury. Part 2—the tests for the hip, thigh, foot and ankle including the star excursion balance test

Eric J Hegedus<sup>1</sup>, Suzanne M McDonough<sup>2</sup>, Chris Bleakley<sup>3</sup>, David Baxter<sup>4</sup>, Chad E Cook<sup>5</sup>

=> Mais... La limite du SEBT Test est son manque de spécificité vis à vis de la cheville (Gribble et al. 2012, Nardone & Schiepatti 2010) et la divergence des résultats obtenus (Cug 2017)

# Cut off point?

### Score composite:

« Female basketball players with a composite reach distance <94% of their leg length were 6.5 times more likely to have a lower extremity injury." (Plisky et al. 2006)

**TABLE 6.** Adjusted odds ratios for potential lower extremity injury risk factors among high school basketball players.

,		*
Risk Factor	Category	LE Injury AOR <sup>‡</sup> (95% CI)
All players		
Normalized composite right reach distance*	≤94.0%	3.0 (1.5, 6.1)
Anterior reach distance differ- ence <sup>†</sup>	≥4 cm	2.7 (1.4, 5.3)
Girls		
Normalized composite right reach distance*	≤94.0%	6.5 (2.4, 17.5
Boys		
Ånterior reach distance differ- ence <sup>†</sup>	≥4 cm	3.0 (1.1, 7.7)

<sup>\*</sup> Reach distance is reach distance divided by limb length multiplied by 100. Right reach done by standing on left limb and reaching with the right limb.

<sup>\*</sup> Adjusted odds ratio for gender, grade, previous injury, participation in a neuromuscular training program since initial measurement, and lower extremity tape/brace use.

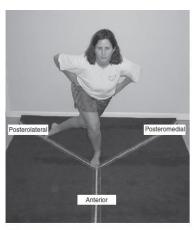


FIGURE 1. Star Excursion Balance Test with reach directions labeled in reference to right stance foot.

### La direction antérieure:

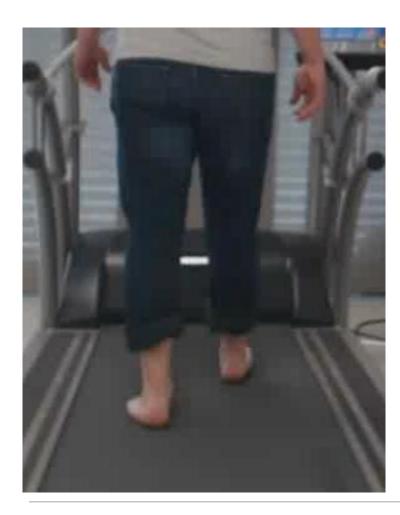
"side-to-side **asymmetry** in the **anterior direction**(...), **discriminated** between injured and noninjured athletes" (Stiffler et al. 2017)

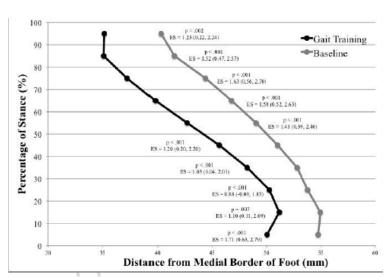
Semble être prédictif de blessures du membre inf: > 4.5% ou 4 cm (Plisky et al. 2006, Smith et al. 2015)

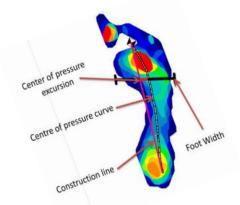
<sup>\*</sup>Difference between right and left anterior reach distances.

# Evaluation de l'excursion du centre de pression à la marche













## L'acuité propriocetive ça sert à quoi ?









"An inability to accurately <u>sense the position</u> of the ankle joint before initial contact is likely to result in a position that <u>predisposes the ankle to move into supination</u> rather than pronation during the loading response."





"an incorrect foot position at touchdown is the highest risk factor for lateral LAS"



JPS flexion plantaire/dorsale



JPS Inversion/éversion

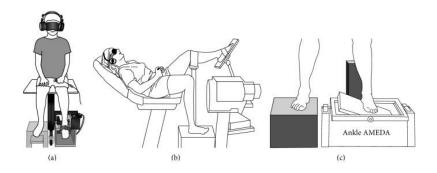


En charge



# Les test de repositionnement et tests de forces des Masseurs Kindistrierpeutes ki















# La cheville traumatique

Approche clinique et scientifique...

5. Prise en charge de l'entorse



#### **Brice PICOT:**

Kinésithérapeute du Sport-PhD Société Française des Masseurs Kinésithérapeutes du Sport





### François FOURCHET

Kinésithérapeute du Sport-Ostéopathe-PhD



# Quelle prise en charge pour une entorse (ou IC) de cheville ?





# Chirurgicale ???

"The **general consensus** of the reviews that investigated a surgical intervention was that a trial of **conservative treatment** should always be attempted **before surgery** is undertaken..."

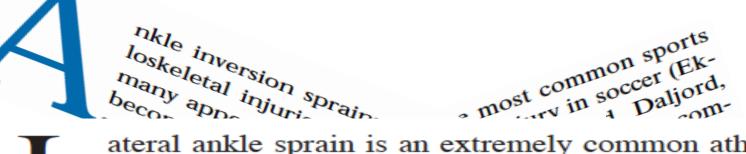


Review

Treatment and prevention of acute and recurrent ankle sprain: an overview of systematic reviews with meta-analysis

Cailbhe Doherty, 1 Chris Bleakley, 2 Eamonn Delahunt, 3,4 Sinead Holden 3

# Quelle efficacité?

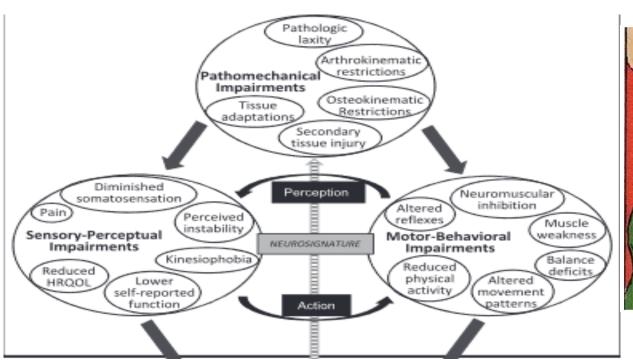




ateral ankle sprain is an extremely common athletic injury. Despite extensive clinical and basic science research, the recurrence rate remains high and the reasons why sprains tend to recur are unclear; thus, successful rehabilitation is difficult. In a review of the potential causes of that 70-80% or review of the potential causes of that 70-80% or review of the potential causes of that 70-80% or review of the potential causes of that 70-80% or review of the potential causes of that 70-80% or review of the potential causes of that 70-80% or review of the potential causes of



# Travailler les déficits identifiés...





# Récupération des amplitudes

✓ Flexion dorsale +++

- ✓ Contracté/relâché, mob spé + Décoaptation
- ✓ Mobilisation spécifique en thérapie manuelle





Fig 1. Manual assessment of the posterior glide of the talus.



Fig 2. Talocrural joint manipulation.

# La Talo crurale

"The joint **mobilization intervention that targeted posterior talar glide** was able to improve measures of function in adults with CAI"

J Orthop Res. 2012 Nov;30(11):1798-804. doi: 10.1002/jor.22150. Epub 2012 May 18.

Two-week joint mobilization intervention improves self-reported function, range of motion, and dynamic balance in those with chronic ankle instability.

Hoch MC1, Andreatta RD, Mullineaux DR, English RA, Medina McKeon JM, Mattacola CG, McKeon PO.



# La Talo crurale

The efficacy of manual joint mobilisation/ manipulation in treatment of lateral ankle sprains: a systematic review

Janice K Loudon, <sup>1</sup> Michael P Reiman, <sup>2</sup> Jonathan Sylvain <sup>2</sup>



Fig 1. Manual assessment of the posterior glide of the talus.



Fig 3. Posterior gliding manipulation of the talus.



Fig 2. Talocrural joint manipulation.

"For treatment of subacute/chronic lateral ankle sprains, these techniques improved ankle range-of-motion, decreased pain and improved function."

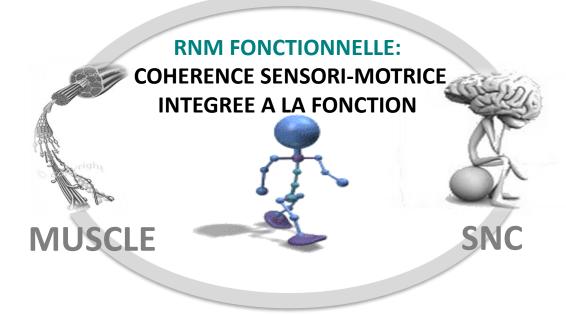




### Mulligan

# Les fondamentaux de la rééducation

**SENSORI:** (RE)AFFERENCES PROPRIOCEPTIVES



**MOTRICITE: COMMANDES MOTRICES** 

# Travail proprioceptif?

### Une méta-analyse :

Manual Therapy 17 (2012) 285-291



Contents lists available at SciVerse ScienceDirect

### Manual Therapy

journal homepage: www.elsevier.com/math



Review article

Effectiveness of proprioceptive exercises for ankle ligament injury in adults: A systematic literature and meta-analysis\*

K. Postle a,\*, D. Pak b, T.O. Smith a

<sup>a</sup> School of Allied Health Professions, Faculty of Medicine and Health Science, University of East Anglia, Queen's Building, Norwich NR4 7IJ, UK

b Norwich Medical School, Faculty of Medicine and Health Science, University of East Anglia, Norwich NR4 7TJ, UK

"The results indicated that **there is no statistically significant difference in recurrent injury** between the addition of proprioceptive exercises during rehabilitation of patients following ankle ligament injury "

















**BALANCE CONTROL** 

"Sensorimotor deficits occur for joint position sense in subjects with FAI"

Both balance control and ankle proprioception are negatively associated with chronic ankle instability

# Déficits proprioceptifs



"Freeman et al. (1965) first described functional instability when they attributed chronic ankle instability to **proprioceptive deficits after ligament injury** " (Hertel et al. 2002, p. 364)







Journal of Science and Medicine in Sport 13 (2010) 2-12

Journal of Science and Medicine in Sport

www.elsevier.com/locate/jsams

#### Review

Evidence of sensorimotor deficits in functional ankle instability:

A systematic review with meta-analysis

Joanne Munn a,b, S. John Sullivan b,\*, Anthony G. Schneiders b

<sup>a</sup> University of Sydney, Australia
<sup>b</sup> Centre for Physiotherapy Research, University of Otago, New Zealand
Received 8 August 2008; received in revised form 4 March 2009; accepted 9 March 2009



Stimuler les déficits stathestésiques (sens de la position) et sens de la force







Sens de la force



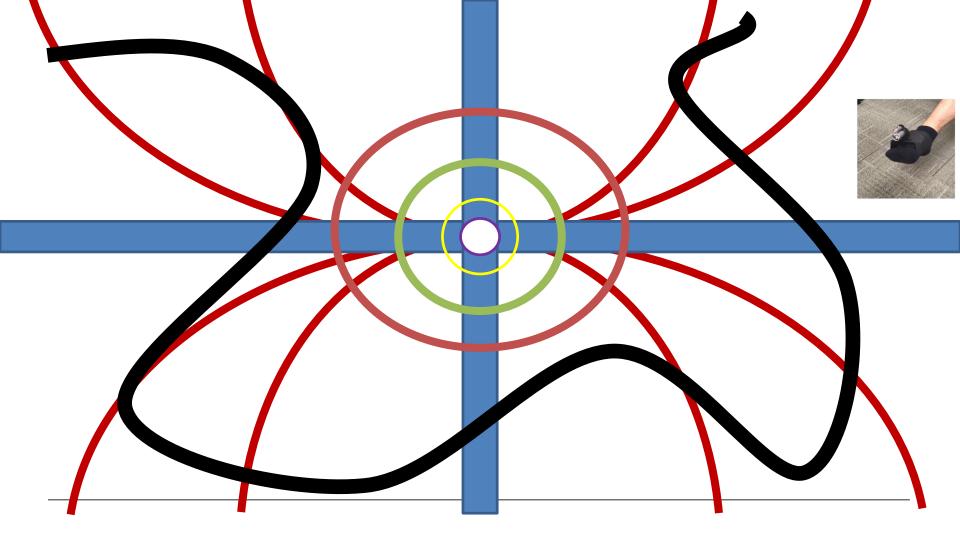
Biofeedback, focus externe

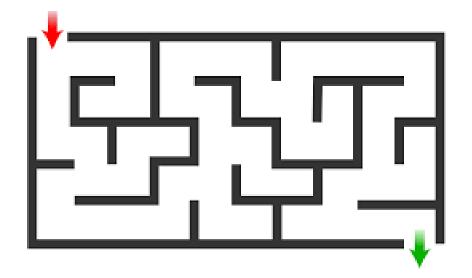


JPS, Réactivité



When assessing ankle proprioception [...], the method used should have <u>ecological validity and allow proprioceptive signals to be integrated</u> in the central nervous system"











**PROPRIOCEPTION** 













Both balance control and ankle proprioception are negatively associated with lower limb injuries...

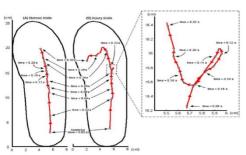


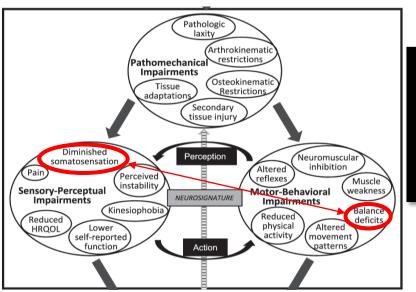




"Balance deficits among patients with CAI may be due to somatosensory impairments, motor impairments, or both"

Figure 4. The excursion path of the center of pressure of the mean of the normal trials (A) and the injury trial (B).







"Ankle proprioception may be one of the <u>more important components</u> contributing to <u>balance control</u> in sport"

# Stimuler la proprioception de la cheville

Deux notions sont trop souvent confondues à tort: l'équilibration sur plan

instable et la stimulation proprioceptive de la cheville

Eur J Appl Physiol (2012) 112:1577-1585 DOI 10.1007/s00421-011-2124-8

ORIGINAL ARTICLE

## Ankle proprioception is not targeted by exercises on an unstable surface

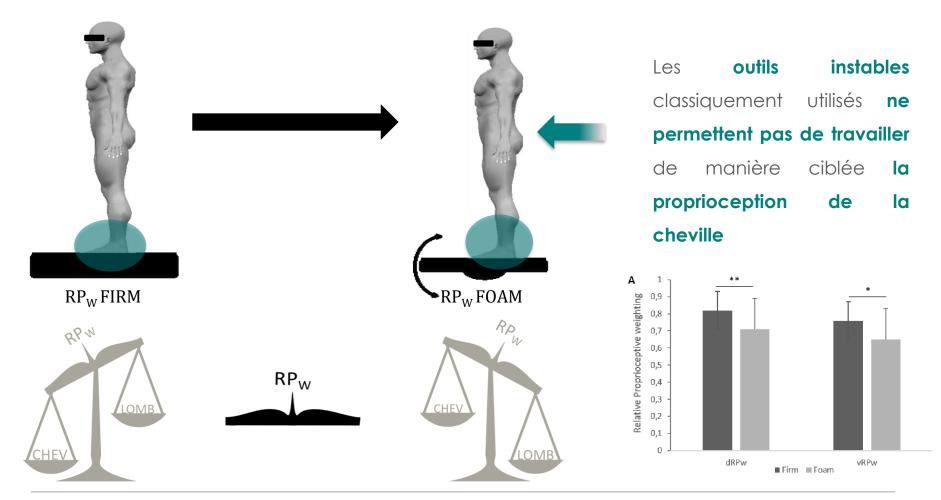
Henri Kiers · Simon Brumagne · Jaap van Dieën · Philip van der Wees · Luc Vanhees





"Results from the present study showed that exercises at unstable surfaces do not challenge peripheral

ankle proprioception in maintaining balance" (Kiers et al. 2012)

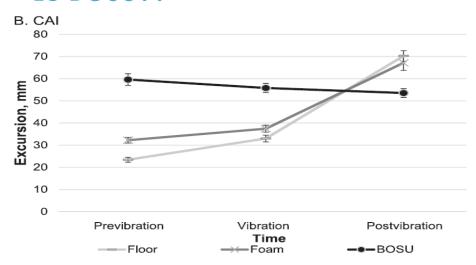


Kiers et al. @G&P 2014, Forestier et al. @AJPMR 2015 Claeys et al. @EJAP JEK 2011,2015, Brumagne et al. @ES 2008, Pinto et al. @Front Neuro 2018



# Stimuler la proprioception de la cheville

### Le BOSU??



Journal of Athletic Training 2017;52(2):97-107 doi: 10.4085/1062-6050-52.1.06 © by the National Athletic Trainers' Association, Inc www.natajournals.org

original research

#### Response to Tendon Vibration Questions the Underlying Rationale of Proprioceptive Training

Anat Vilnai Lubetzky, PhD, PT\*; Sarah Westcott McCoy, PhD, PT, FAPTA†; Robert Price, MSME†; Deborah Kartin, PhD, PT†

\*Department of Physical Therapy, Steinhardt School of Culture Education and Human Performance, New York University: †Department of Rehabilitation Medicine, University of Washington, Seattle

Context: Proprioceptive training on compliant surfaces is used to rehabilitate and prevent ankle sprains. The ability to improve proprioceptive function via such training has been questioned. Achilles tendon vibration is used in motor-control research as a form of proprioceptive stimulus. Using measures of postural steadiness with nonlinear measures to elucidate control mechanisms, tendon vibration can be applied to investigate the underlying rationale of proprioceptive training.

Objective: To test whether the effect of vibration on young adults' postural control depended on the support surface.

**Design:** Descriptive laboratory study. **Setting:** Research laboratory.

Patients or Other Participants: Thirty healthy adults and 10 adults with chronic ankle instability (CAI; age range = 18-40 we are)

Intervention(s): With eyes open, participants stood in bilateral stance on a rigid plate (floor), memory foam, and a Both Sides Up (BOSU) ball covering a force platform. We applied bilateral Achilles tendon vibration for the middle 2 seconds in a series of 60-second trials and analyzed participants' responses from previbration to vibration (pre-vib) and from vibration to postulpration (by post).

Main Outcome Measure(s): We calculated anterior-posterior excursion of the center of pressure and complexity index derived from the area under multiscale entropy curves.

Results: The excursion response to vibration differed by surface, as indicated by a significant interaction of P < .001 for the healthy group at both time points and for the CAI group vibpost. Although both groups demonstrated increased excursion from pre-vib and from vib-post, a decrease was observed on the BOSU. The complexity response to vibration differed by surface for the healthy group (pre-vib, P < .001). The pattern for the CAI group was similar but not significant. Complexity changes vib-post were the same on all surfaces for both groups.

Conclusions: Participants reacted less to anide vibration when standing on the BOSU as compared with the floor, suggesting that proprioceptive training may not be occurring. Different balance-training paradigms to target proprioception, including tendon vibration, should be explored.

Key Words: ankle sprain, chronic ankle instability, balance, postural control. BOSU, toam

" Participants reacted less to ankle vibration when standing on the BOSU as compared with the floor,

### Notion de repondération sensorielle



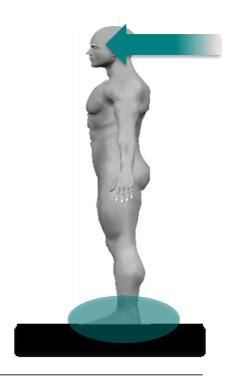


# Increased Visual Use in Chronic Ankle Instability: A Meta-analysis

KYEONGTAK SONG<sup>1,2</sup>, CHRISTOPHER J. BURCAL<sup>3</sup>, JAY HERTEL<sup>4</sup>, and ERIK A. WIKSTROM<sup>1</sup>

<sup>1</sup>Department of Exercise and Sport Science, University of North Carolina at Chapel Hill, Chapel Hill, NC; <sup>2</sup>Human Movement Science Curriculum, University of North Carolina at Chapel Hill, Chapel Hill, NC; <sup>3</sup>Department of Kinesiology, University of North Carolina at Charlotte, Charlotte, NC; and <sup>4</sup>Department of Kinesiology, University of Virginia, Charlottesville, VA

"CAI patients do not utilize somatosensory information to the same extent as uninjured controls and instead <u>upregulate the use of visual information</u> during single limb stance."







## Repondération sensorielle ??







"CAI patients do not utilize somatosensory information to the same extent as uninjured controls and instead upregulate the use of visual information during single limb stance."





### Surutilisation visuelle ??



Journal of Sport Rehabilitation, 2017, e-pub only https://doi.org/10.1123/jsr.2017-0035 © 2017 Human Kinetics. Inc.



### Stroboscopic Vision to Induce Sensory Reweighting During Postural Control

Kyung-Min Kim, Joo-Sung Kim, and Dustin R. Grooms

"It is important for clinicians to determine visual reliance, a newly recognized risk factor for recurrent injuries.

They should also consider alternative therapeutic approaches (<u>i.e.</u>, <u>visual-motor training</u>) other than traditional balance training"





# Contrôle postural et proprioception de la cheville

### **Optimisation du travail proprioceptif**

- Sur sol stable puis instable spécifique

- Du bipodal vers le monopodal

- Travail yeux ouverts/fermés





Travail de double tâche (ballon, ...) et cognitif





# oprioception et contrôle postural



- Importance d'évaluer et travailler l'acuité proprioceptive:
- → Sens de la position et sens de la force
- Evaluation et travail du contrôle postural
- → Les patients présentent généralement une surutilisation visuelle
- Sur sol stable YF les sujets <u>ICC intègrent moins les informations</u> proprioceptives de cheville que les sujets sains
- Les plans instables <u>sollicitent peu la proprioception de cheville</u>... même chez les ICC
- Futurs travaux sur l'évaluation de <u>l'intégration proprioceptive</u>







### Evaluer la présence de facteur de risque d'ICC

What clinicians should assess following acute lateral ankle sprain injury	Why?	How?
Ankle joint pain	Guide progression of exercise-based rehabilitation.	Numeric rating scale for pain. <sup>35</sup> FADI. <sup>36</sup>
Ankle joint swelling	Assess the efficacy of treatments implemented.  Swelling can cause arthrogenic muscle inhibition.  Guide progression of exercise-based rehabilitation.  Evaluate the efficacy of treatments implemented.	Figure-of-eight. <sup>38–41</sup>
Ankle joint range of motion	High propensity for the development of a dorsiflexion deficit.  Impairments in ankle joint range of motion are consistently identified in individuals with CAI.	Weight-bearing lunge test. 44–46
Ankle joint arthrokinematics	Disruption in ankle joint arthrokinematics can result in a dorsiflexion deficit. Impairments in ankle joint arthrokinematics are regularly identified in individuals with CAI.	Posterior talar glide test. <sup>48</sup>
Ankle joint muscle strength	Impairments in ankle joint strength compromise the functional integrity of the ankle joint.  Impairments in ankle joint strength are regularly identified in individuals with CAI.	Hand-held dynamometry. <sup>53</sup>
Static postural balance	Impairments in static postural balance are consistently identified in individuals with CAI.	BESS. <sup>56</sup> FLT. <sup>57</sup>
Dynamic postural balance	Impairments in dynamic postural balance are consistently identified in individuals with CAI.	SEBT. <sup>58</sup>
Gait	Impairments in gait are consistently identified in individuals with CAI.	Visual assessment for antalgic gait.
Physical activity level	Guide the specificity of exercise-based rehabilitation.	Tegner activity-level scale. <sup>63</sup>
Ankle joint specific patient-reported outcome measures	Evaluate the efficacy of treatments implemented.	FADI. <sup>36</sup> FAAM. <sup>65</sup>

BESS, Balance Error Scoring System; CAI, chronicankle instability; FAAM, Foot and Ankle Ability Measure; FADI, Foot and Ankle Disability Index; FLT, Foot Lift Test; ROAST, Rehabilitation-Oriented AS-sessmenT; SEBT, Star Excursion Balance Test.

Clinical assessment of acute lateral ankle sprain injuries (ROAST): 2019 consensus statement and recommendations of the International Ankle Consortium.















### Evaluation de la force musculaire











Evaluation : « fatigabilité »

**Evaluation : « force isométrique»** 











### Evaluation de la force musculaire





**Figures 1 and 2** — Subjects marked with a permanent marker for consistency in dynamometer placement between testers and between testing days.

Context: Hand-held dynamometry (HHD) has been shown to be a reliable, objective way to obtain strength measurements in elderly and physically impaired subjects. Objective: To estimate the intratester, intertester, and intersession reliability of HHD testing of lower extremity movements in young, healthy subjects. Design: Repeated measures. Setting: Sports medicine laboratory. Participants: Nine males and eleven females (Mean age = 26 years). Measurements: Strength measures of 11 right lower extremity movements were taken by 3 different testers on 2 separate days using a HHD. Results: Intratester ICC range was .77 to .97 with SEM range of .01 to .44 kg. Mean intertester ICC range was .65 to .87 with SEM range of .11 to 1.05 kg. Mean intersession ICC range was .62 to .92 with SEM range of .01 to .83 kg. Conclusions: HHD has the potential to be a reliable tool for strength measurements in healthy, strong subjects; however, there are noteworthy limitations with movements where subjects can overpower the testers.

# Hand-Held Dynamometry: Reliability of Lower Extremity Muscle Testing in Healthy, Physically Active, Young Adults

Brent M. Kelln, Patrick O. McKeon, Lauren M. Gontkof, and Jay Hertel























Ratio Inverseur/Everseur: 1; 1.1













### Evaluation de la force musculaire



Updated reliability and normative values for the standing heelrise test in healthy adults

K. Hébert-Losiera, C. Wessman, M. Alricsson, U. Svantesson

So excited to announce that my Calf Raise app can now be downloaded for FREE! Privilege to work with @cbalsalobre (such a legend) on this tool that provides objective measures of Calf Raise performance, including height, power, and work! Test it out now apps.apple.com/us/app/calf-ra..

Kim Hébert-Losier @KimHebertLosier · 7 mai

#### Table 4

Estimates of the normative median (50th), lower (2.5th) and upper (97.5th) percentile values (upper, lower) of the median number of heel-rise repetitions completed during the heel-rise test, presented by sex for each decade of life (i.e. 20 to 80 years)

Age	Male			Female		
(years)						
	Left side	Right side		Left side	Right side	
20	37.4 (15.8, 51.1)	37.5 (16.7, 55.3)		29.6 (13.2, 47.2)	30.7 (13.6, 49.4)	
30	32.7 (12.7, 47.5)	33.0 (13.7, 50.4)		26.8 (10.6, 44.2)	28.0 (11.1, 46.0)	
40	28.1 (9.6, 43.9)	28.5 (10.6, 45.6)		24.0 (8.0, 41.2)	25.3 (8.6, 42.5)	
50	23.5 (6.5, 40.4)	24.0 (7.6, 40.7)		21.3 (5.5, 38.3)	22.6 (6.4, 39.1)	
60	18.8 (3.4, 36.8)	19.5 (4.5, 35.9)		18.5 (2.9, 35.3)	19.9 (3.5, 35.7)	
70	14.2 (0.3, 33.2)	14.9 (1.5, 31.0)		15.7 (0.3, 32.3)	17.2 (1.0, 32.2)	
80	9.6 (0.0, 26.6)	10.4 (0.0, 26.2)		12.9 (0.0, 29.4)	14.5 (0.0, 28.8)	

Estimates are for individuals with a body mass index of 24.2 kg/m<sup>2</sup> and a physical activity







Romain Tourillon (PT, PhD Student, CMP) François Fourchet (PT, PhD, DO)









### Evaluation de la force musculaire des muscles de la hanche

Asserted of Athletic Training 2018;53(9):000-00 doi: 10.4085/1062-6050-238-17 © by the National Athletic Trainers' Association, In

Isometric Hip Strength and Dynamic Stability of Individuals With Chronic Ankle Instability

Ryan S. McCann, PhD, ATC, CSCS\*; Brenn A. Bolding, MS, ATC†; Masafumi Terada, PhD, ATC‡; Kyle B. Kosik, PhD, ATC§; Ian D. Crossett, MS, ATCI; Phillip A. Cribble PhD ATC ENATAS.

Table 2. Between-Groups Comparisons of Primary Outcomes, Controlling for Sex and Limb

Variable	Chronic Ankle Instability (n = 20)	Lateral Ankle Sprain Coper (n = 20)	Control (n = 20)	1-Way Analysis of Covariance $F_{2,57}$ Value	<i>P</i> Value
Resultant vector time to stabilization, s Failed resultant vector time to stabilization trials, No.	1.50 ± 0.04 2.40 ± 3.00	1.49 ± 0.03 2.50 ± 2.90	1.50 ± 0.04 2.70 ± 3.60	1.16 0.02	.32 .98
Isometric hip torque, N·m/kg					
Extension Abduction External rotation	$0.98 \pm 0.33^{a,b}$ $1.29 \pm 0.36$ $0.47 \pm 0.08^{a,b}$	1.30 ± 0.54 1.46 ± 0.48 0.55 ± 0.12	1.38 ± 0.34 1.63 ± 0.38 0.58 ± 0.13	4.59 2.84 4.33	.01 .07 .02

<sup>&</sup>lt;sup>a</sup> Statistically different from the lateral ankle-sprain coper group.

#### **Key Points**

- Individuals with chronic ankle instability (CAI) exhibited decreased isometric strength of the posterolateral hip musculature.
- Isometric hip strength was not representative of the dynamic-stability performance of individuals with CAI.
- Hip strength and dynamic stability should be evaluated in each patient with CAI, and deficits should be corrected through rehabilitation.











<sup>&</sup>lt;sup>b</sup> Statistically different from the control group.





# La cheville traumatique

Approche clinique et scientifique...



Retour au sport

PAASS Ankle-GO



# Répondre à LA question !!!!







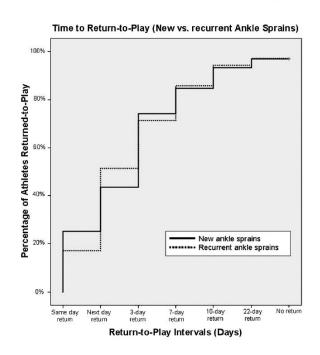




## A timed base decision...







"median RTP for an ankle sprain for a high-school athlete is approximately 1–3 days regardless of injury history."

### Contexte

### Entorse de cheville et RTP ou RTS



2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

Clare L Ardern, <sup>1,2,3</sup> Philip Glasgow, <sup>4,5</sup> Anthony Schneiders, <sup>6</sup> Erik Witvrouw, <sup>1,7</sup> Benjamin Clarsen, <sup>8,9</sup> Ann Cools, <sup>7</sup> Boris Gojanovic, <sup>10,11</sup> Steffan Griffin, <sup>12</sup> Karim M Khan, <sup>13</sup> Håvard Moksnes, <sup>8,9</sup> Stephen A Mutch, <sup>14,15</sup> Nicola Phillips, <sup>16</sup> Gustaaf Reurink, <sup>17</sup> Robin Sadler, <sup>18</sup> Karin Grävare Silbernagel, <sup>19</sup> Kristian Thorborg, <sup>20,21</sup> Arnlaug Wangensteen, <sup>1,8</sup> Kevin E Wilk, <sup>22</sup> Mario Bizzini <sup>23</sup>

Pas d'élément concernant l'entorse de cheville en particulier





# 2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

Clare L Ardern, <sup>1,2,3</sup> Philip Glasgow, <sup>4,5</sup> Anthony Schneiders, <sup>6</sup> Erik Witvrouw, <sup>1,7</sup> Benjamin Clarsen, <sup>8,9</sup> Ann Cools, <sup>7</sup> Boris Gojanovic, <sup>10,11</sup> Steffan Griffin, <sup>12</sup> Karim M Khan, <sup>13</sup> Håvard Moksnes, <sup>8,9</sup> Stephen A Mutch, <sup>14,15</sup> Nicola Phillips, <sup>16</sup> Gustaaf Reurink, <sup>17</sup> Robin Sadler, <sup>18</sup> Karin Grävare Silbernagel, <sup>19</sup> Kristian Thorborg, <sup>20,21</sup> Arnlaug Wangensteen, <sup>1,8</sup> Kevin E Wilk, <sup>22</sup> Mario Bizzini<sup>23</sup>



"premature RTS may be one factor that contributes to the high prevalence of recurrent ankle problems.

#### SYSTEMATIC REVIEW

Criteria-Based Return to Sport Decision-Making Following Lateral Ankle Sprain Injury: a Systematic Review and Narrative Synthesis

Bruno Tassignon $^{1}$  $_{\odot}$  · Jo Verschueren $^{1}$  $_{\odot}$  · Eamonn Delahunt $^{2,3}$  $_{\odot}$  · Michelle Smith $^{4}$  $_{\odot}$  · Bill Vicenzino $^{4}$  $_{\odot}$  · Evert Verhagen $^{5}$  $_{\odot}$  · Romain Meeusen $^{1}$  $_{\odot}$ 

Included

Studies included in systematic review (n = 0)

0 critères de RTP alors que l'entorse est le traumatisme le plus important dans le monde du sport (25%) : O'Loughin et al., 2009

### **DISCUSSION:**

- Facteurs intrinsèques : ROAST +
  - ☑ endurance cardio respi.
  - ¬ pressions plantaires (course)
  - temps de réaction péronéen

### Facteurs extrinsèques :

- Type de sport
- Position du joueur
- Exposition du joueur concernant (surface de jeu, retomber sur le pied d'un adversaire, réception d'un saut...)

# Lack of Consensus on Return-to-Sport Criteria Following Lateral Ankle Sprain: A Systematic Review of Expert Opinions

Erik A. Wikstrom, Cole Mueller, and Mary Spencer Cain

#### TIME DECISION MAKING:

RTS = 3 jours (1<sup>ère</sup> entorse) pour 75%

RTS <24h... (récidive d'entorse) pour 50%



### CRITERIA-BASED RTS DECISION MAKING:

- Sport Specific Movement (Hop Test...) => consensus
  - Static Balance Test => partial agreement (PA)
    - PROMS => PA
    - Strength => PA
      - ROM => PA

C'est juste une entorse de cheville...

> Gribble et al., 2016 Delahunt et al., 2019



Pour éviter la spirale négative:

La qualité du

RTP/RTS!!

# 2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

Clare L Ardern, <sup>1,2,3</sup> Philip Glasgow, <sup>4,5</sup> Anthony Schneiders, <sup>6</sup> Erik Witvrouw, <sup>1,7</sup> Benjamin Clarsen, <sup>8,9</sup> Ann Cools, <sup>7</sup> Boris Gojanovic, <sup>10,11</sup> Steffan Griffin, <sup>12</sup> Karim M Khan, <sup>13</sup> Håvard Moksnes, <sup>8,9</sup> Stephen A Mutch, <sup>14,15</sup> Nicola Phillips, <sup>16</sup> Gustaaf Reurink, <sup>17</sup> Robin Sadler, <sup>18</sup> Karin Grävare Silbernagel, <sup>19</sup> Kristian Thorborg, <sup>20,21</sup> Arnlaug Wangensteen, <sup>1,8</sup> Kevin E Wilk, <sup>22</sup> Mario Bizzini<sup>23</sup>

# Retour à la participation

L'athlète peut participer à une rééducation, à un entraînement (modifié ou non restreint) ou à un sport, mais à un niveau inférieur à son objectif de retour à la compétition.

L'athlète est physiquement actif, mais pas encore «prêt» (médicalement, physiquement et / ou psychologiquement) à la compétition.

Il est possible de s'entraîner à la performance, mais cela ne signifie pas automatiquement retour à la compétition.

## 2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

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# Retour au sport (RTS)

L'athlète est retourné à son sport défini, mais ne réalise pas le niveau de performance souhaité.

Certains athlètes peuvent être satisfaits d'atteindre ce stade, et cela peut représenter un succès de RTS pour cet individu.

## 2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern

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# Retour à la performance

Cela étend l'élément RTS. L'athlète est progressivement retourné à son sport défini et se situe à un niveau égal ou supérieur à son niveau d'avant la blessure.

Pour certains athlètes, cette étape peut être caractérisée par la meilleure performance personnelle ou la progression personnelle attendue en ce qui concerne la performance.





### Original research

# Return to sport decisions after an acute lateral ankle sprain injury: introducing the PAASS framework—an international multidisciplinary consensus

```
Michelle D Smith , 1 Bill Vicenzino , 1 Roald Bahr , 2,3 Thomas Bandholm , 4,5 Rosalyn Cooke , Luciana De Michelis Mendonça , 7,8 François Fourchet, 9,10 Philip Glasgow, 11,12 Phillip A Gribble, 13 Lee Herrington, 6,14 Claire E Hiller , 15 Sae Yong Lee, 16,17 Andrea Macaluso , 18,19 Romain Meeusen, 20 Oluwatoyosi B A Owoeye , 21,22 Duncan Reid, 23 Bruno Tassignon , 20 Masafumi Terada , 4 Kristian Thorborg , 25,26 Evert Verhagen , 27 Jo Verschueren, 20 Dan Wang, 28 Rod Whiteley , 3,29 Erik A Wikstrom , 30 Eamonn Delahunt , 31,32
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# **PAASS**

P

#### Pain severity

- · During sport participation
- · Over last 24 hours



#### **Ankle impairments**

- · Ankle range of motion
- · Ankle muscle strength, endurance and power



#### Athlete perception

- Perceived ankle confidence/reassurance
- · Perceived ankle stability
- · Psychological readiness

S

#### Sensorimotor control

- Proprioception
- · Dynamic postural control/balance



#### Sport/functional performance

- Hopping and jumping
- Agility
- Sport-specific activities
- · Ability to complete a full training session



Return to sport decisions after an acute lateral ankle sprain injury: introducing the PAASS framework—an international multidisciplinary consensus



Validation du RTS + « Réponse thérapeutique spécifique » 156

# Résultats

**Seize** éléments d'évaluation ont fait l'objet d'un consensus (>70 % d'accord)

Répartis en cinq domaines qui ont été approuvés par 98 % des membres du panel - PAASS :

- douleur (pendant une activité sportive spécifique et au cours des 24 dernières heures),
- déficiences de la cheville (amplitude de mouvement, force musculaire, endurance et puissance),
- **perception** de l'athlète (confiance/»réassurance» et stabilité perçues au niveau de la cheville ; préparation psychologique),
- contrôle sensorimoteur («proprioception» et contrôle/équilibre postural dynamique),
- performance sportive/fonctionnelle (sautiller, sauter, agilité et exercices spécifiques au sport ; capacité à effectuer une séance d'entraînement complète).

*PAASS:* Pain severity, Ankle impairments, Athlete perception, Sensorimotor control, and Sport/functional performance.

Table 2

be assessed together.

<b>Table 2</b> Consensus on assessment ite in the return to sport decision after an indicating the round of inclusion and le	acute lateral anl	de sprain,
Assessment item to be included	Round (1-3)	Agreement (%
Sport-specific activities	1	98
Pain severity during sport participation	1	93
Ankle range of motion	1	90
Ankle muscle strength	1	87
Hopping	1	87
Agility	1	87
Completion of a full training session	3	87
Jumping	1	84
Pain severity over the last 24 hours	1	81
Perceived ankle reassurance/confidence	1	81
Proprioception	1	74
Perceived ankle stability	1	74
Psychological readiness	1	74
Ankle muscle endurance	1	73
Dynamic postural control/balance	1	73
Ankle (and lower limb) muscle power*	2	72
*Lower limb muscle power and ankle muscle p	ower were initially	presented to

panellists as separate items, but 96% of panellists agreed that these items would

Consensus on assessment items that should not be included in the return to sport decision after an acute lateral ankle sprain, indicating the round of exclusion and level of agreement Assessment item not to be included Round (1-3) Agreement (%) Structural integrity of the ligaments on imaging 89 Pain severity over the last week 88 Pain severity on palpation 88 Health-related quality of life 85 Hip and knee muscle endurance 85

85

84

84

82

81

78

76

76

75

74

74

72

70

3

Ankle muscle length

Aerobic fitness

Anaerobic fitness

Ligamentous laxity

Ankle joint arthrokinematics

Ankle muscle reaction time

Hip and knee muscle strength

Straight-line running speed

Lower limb and/or trunk kinematics

Patient-reported foot and ankle function (using

Measure<sup>34</sup> or Foot and Ankle Outcome Score<sup>35</sup>)

questionnaires such as the Foot and Ankle Ability

Acute:chronic workload

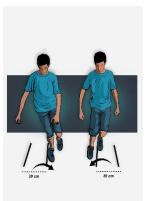
Foot biomechanics

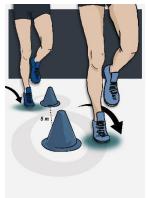
The Functional Movement Screen

# Ankle Go test...











### Which Functional Tests and **Self-Reported Questionnaires Can** Help Clinicians Make Valid Return to **Sport Decisions in Patients With Chronic Ankle Instability? A Narrative Review and Expert Opinion**

Brice Picot 1,2,3\*, Alexandre Hardy 4, Romain Terrier 2,3,5, Bruno Tassignon 6, Ronny Lopes 7 and François Fourchet 28

French Handball Federation, Creteil, France, French Society of Sports Physical Therapist (SFMKS Lab). Pierrefitte-sur-Seine, France, Inter-University Laboratory of Human Movement Biology (LIBM), Savoie Mont-Blanc University, Chambery, France, 4 Clinique du Sport Paris, Paris, France, 5 SARL Whergo, Savoie Technolac (BP 80218), La Motte-Servolex, France. 4 Human Physiology and Sports Physiotherapy Research Group, Faculty of Physical Education and Physiotherapy, Vrije Universiteit Brussel, Brussels, Belgium, 7 Santé Atlantique, Pied Cheville Nantes Atlantique, Nantes, France, <sup>8</sup> Motion Analysis Lab, Physiotherapy Department, La Tour Hospital, Swiss Olympic Medical Center, Meyrin, Switzedand

Lateral ankle sprain is the most common injury in sports, with up to 40% of patients developing chronic ankle instability (CAI). One possible cause underlying this high rate of recurrence or feeling of giving way may be a premature return to sport (RTS), Indeed, except for time-based parameters, there are no specific criteria to guide clinicians in their RTS decisions in patients with CAI. A recent international consensus highlighted the relevance and importance of including patient-reported ankle function questionnaires combined with functional tests targeting ankle impairments in this population. Thus, the aim of this narrative review and expert opinion was to identify the most relevant functional performance tests and self-reported questionnaires to help clinicians in their RTS decision-making process following recurrent ankle sprains or surgical ankle stabilization. The PubMed (MEDLINE), PEDro, Cochrane Library and ScienceDirect databases were searched to identify published articles. Results showed that the single leg stance test on firm surfaces, the modified version of the star excursion balance test, the side hop test and the figure-of-8 test appeared to be the most relevant functional performance tests to target ankle impairments in patients with CAI, A combination of the Foot and Ankle Ability Measure (FAAM) and the Ankle Ligament Reconstruction-Return to Sport after Injury (ALR-RSI) questionnaires were the most relevant self-reported questionnaires to assess patient function in the context of CAI. Although these functional tests and questionnaires provide a solid foundation for clinicians to validate their RTS decisions in patient with CAI, objective scientific criteria with cut-off scores are still lacking. In addition to the proposed test cluster, an analysis of the context, in particular characteristics related to sports (e.g., fatigue, cognitive constraints), to obtain more information about the patient's risk of recurrent injury could be of added value when making a RTS decision in patients

#### OPEN ACCESS

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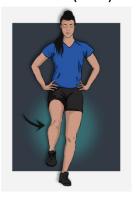


ankle instability? A narrative review and expert opinion.



Brice Picot<sup>1,2,5</sup>\*\*, Alexandre Hardy<sup>4</sup>, Romain Terrier<sup>2,5,5</sup>, Bruno Tassignon<sup>6</sup>, Ronny Lopes<sup>7</sup>, Francois Fourchet<sup>2,5,5</sup>

Single Leg Stance (firm)



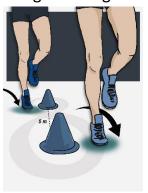
mSEBT



Side Hop Test



Figure of Eight



Results showed that the **single leg stance test on firm surfaces**, the modified version of the **SEBT**, the **side hop test** and the **figure-of-8** test appeared to be the most relevant functional performance tests to target ankle impairments in patients with CAI.







Which functional tests and self-reported questionnaires can help clinicians make valid return to sport decisions in patients with chronic ankle instability? A narrative review and expert opinion.

Brice Picot<sup>1,2,3,\*</sup>, Alexandre Hardy<sup>4</sup>, Romain Terrier<sup>2,3,5</sup>, Bruno Tassignon<sup>6</sup>, Ronny Lopes<sup>7</sup>, François Fourchet<sup>2,3,5</sup>





### Foot and Ankle Ability Measure (FAAM)

Activities of Daily Living Subscale

Please Answer every question with one response that most closely describes your condition within the past week.

If the activity in question is limited by something other than your foot or ankle mark "Not Applicable" (N/A).

No Slight Moderate Extreme Unable N/A Difficulty Difficulty Difficulty to do





#### ALR-RSI scale

Please answer the following questions referring to your main sport prior to injury. For each question, tick a box □√ between the two descriptions to indicate how you feel right now relative to the two extremes.

A combination of the Foot and Ankle Ability Measure (**FAAM**) and the Ankle Ligament Reconstruction-Return to Sport after Injury(**ALR-RSI**) questionnaires were the most relevant self-reported questionnaires to assess patient function in the context of CAI.

# Ankle GO test...

Trontiers

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cice Picot<sup>1,3,5,a</sup>, Alexandre Hardy<sup>4</sup>, Romain Terrier<sup>2,5,5</sup>, Bruno Tassignon<sup>6</sup>, Ronny Lope annois Fourcher<sup>2,5,6</sup>

Outcomes	Proposed cut off score	MDC	MCID
	Functional performance tes	ing	
Single Leg Stance on firm surface	< 3 errors	0.6 errors	NR
Foot lift Test	< 5 lifts	3 errors	NR
Star Excursion Balance Test (normalized to the leg length)			
leg length)	COMP >90%	COMP = 6.7%	
Composite score (COMP)			
	ANT asymmetry <4.5% or	ANT =5.87%	NR
Anterior (ANT)	4cm		
		PM =7.84%	
Posteromedial (PM)	PM >91%		
		PL =7.55%	
Posterolateral (PL)	PL >91%		
Side Hop Test (44)	<10s	5.82s	NR
Figure-of-8 Hop Test (44)	<12s	4.59s	NR
			Picot et al. @Frontiers 2022



# Single leg stance



- Participants stand barefoot on the tested limb, look straight ahead and are then instructed to keep their eyes closed and their hands on their hips for 20s.
- The test must be performed with the weightbearing leg at ~5° of knee flexion and with the hip and knee of the non-weight-bearing limb slightly flexed.
- The examiner counts the number of balance errors that occur during the test.

ICC= 0.93 and SEM of 0.45 with a MDC of 0.6 errors



Familiarization is allowed with several practice trials before performing the test. The total number of errors committed in the trial of each leg are used for analysis



# Single leg stance



**TABLE 2** | Single leg stance test on firm surface derived from the Balance Error Scoring System (BESS).

#### Balance errors assessed by the examiner

### Score calculation ( /3)

> 3errors = 0

1-3 errors = 1

 $\triangleright$  0 errors = 2

Lifting hands off iliac crest

Opening eyes

Stepping, stumbling or falling

Moving hip into more than 30° of flexion or abduction

Lifting forefoot or heel

Remaining out of the test position more than 5 s

If the patient does not report feelings of instability during the test: +1

ICC= 0.93 and SEM of 0.45 with a MDC of 0.6 errors

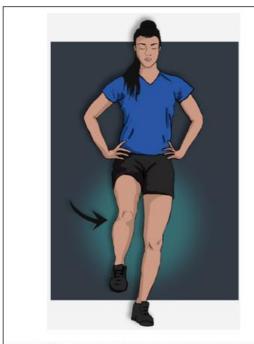


FIGURE 1 | Single leg stance on firm surface or foot lift test of the left limb.



# Star Excursion Balance Test



### Score calculation ( /7):

COMP score:

< 90% = 0

90-95% = 2

> 95% = 4

ANT score ≥ 60% : +1

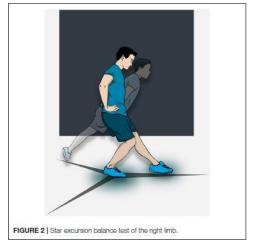
 $\triangleright$  PM score  $\ge 90\%$ : +1

#### Table 1 2021 Updated Recommendations for the SEBT Procedure

Recommendations

important criteria	Recommendations
Number of directions	Three (ANT, PM, and PL) representing a "Y" instead of eight. 13.16,31 See the proposed compact versions (Figure 3).
Setup of the test	Demonstration prior to the test by the experimenter (or video). <sup>7,17</sup>
Number of familiarization trials	Four in each direction for both limbs, until familiarization with procedure. 7.17
Number of recorded trials	Three per direction. <sup>7,17</sup>
	Performances should be stabilized. Switch from one leg to the other between each direction to avoid fatigue. 18
Hand position	Hands should remain on the hips to target lower limb performance. 14,21
Foot placement	Barefoot (or socks), the most distal aspect of the great toe on 0 (crossroad of three lines) during the entire procedure. Need to be standardized across studies. This method avoids possible foot placement errors. <sup>14</sup>
Failure criteria	<ul> <li>(a) Subject falls or loses his/her balance (the reaching foot touch the ground).</li> <li>(b) Subject shifts his/her weight on the reach limb when contacting the floor or contacts the floor at multiple times or miss the tape measure.</li> <li>(c) Stance foot moves or heel rises or any part of the foot lifts from the ground.</li> <li>(d) Hands are removed from the hips.</li> </ul>
Parameter	<ul> <li>(a) Mean of the three trials for each direction and limb. 46</li> <li>(b) Calculation of the composite score (mean of three directions) for normalized (in percentage) and nonnormalized (in centimeters) scores.</li> <li>(c) Qualitative analysis of the movement. 56,57</li> </ul>
Limb length normalization	Scores are expressed as a percentage of the tested lower limb length (from ASIS to medial malleolus preferably, or lateral

Note. ASIS = anterior and superior iliac spine; ANT = anterior; PL = posterolateral; PM = posteromedial; SEBT = Star Excursion Balance Test.



If the patient does not report feelings of instability during the test: +1

Important criteria

ICC values were **0.88** (0.83–0.96), **0.87** (0.80–1.0), and **0.88** (0.73–1.0) for the anterior (ANT), posteromedial (PM) and posterolateral (PL) directions, respectively. MDC were 5.9%, 7.8%, and 7.6% for ANT, PM, and PL directions respectively



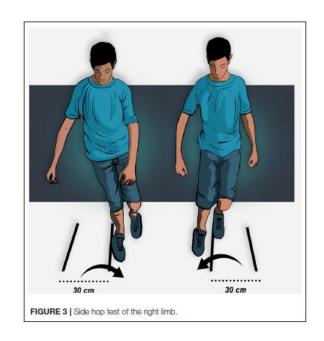
# Side Hop Test



### Score calculation ( /5):

- > 13s = 0
- $\rightarrow$  10 -13s = 2
- > < 10 s = 4

If the patient does not report feelings of instability during the test: +1



ICC= 0.84 and SEM of 2.1s with a MDC of 5.8s



# Figure of 8

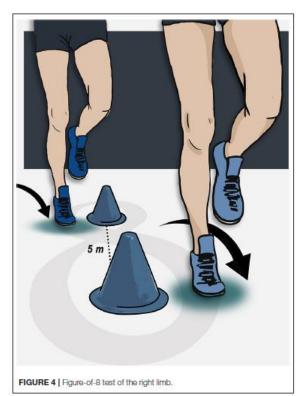


### Score calculation ( /3):

- > 18s = 0
- $\rightarrow$  13 -18s = 1
- > < 13 s = 2

If the patient does not report feelings of instability during the test: +1

ICC= 0.95 and SEM of 1.7s with a MDC of 4.6s









### Score calculation ( /4):

• FAAM<sub>ADL</sub> < 90 % ADL = 0

90-95 % ADL = 1

95 % ADL = 2

• FAAM<sub>sport</sub> < 80 % sport = 0

80-95 % sport = 1

95 % sport = 2

#### Foot and Ankle Ability Measure (FAAM) Activities of Daily Living Subscale

Please Answer every question with one response that most closely describes your condition within the past week.

If the activity in question is limited by something other than your foot or ankle mark "Not Applicable" (N/A).

Applicable? (NT/A)						
Applicable" (N/A).	No Difficulty	Slight Difficulty	Moderate Difficulty	Extreme Difficulty	Unable to do	N/A
Standing						
Walking on even Ground						
Walking on even ground without shoes						
Walking up hills						
Walking down hills						
Going up stairs						
Going down stairs						
Walking on uneven ground						
Stepping up and down curb	s 🗆					
Squatting						
Coming up on your toes						

*ICC*= 0.89 with a MCID of 8 pts

#### Foot and Ankle Ability Measure (FAAM) Sports Subscale

Because of your foot and ankle how much difficulty do you have with:

	No Difficulty at all	Slight Difficulty	Moderate Difficulty	Extreme Difficulty	Unable to do	N/A
Running						
Jumping						
Landing						
Starting and stopping quickly						
Cutting/lateral Movements						
Ability to perform Activity with your Normal technique	0					
Ability to participate In your desired sport As long as you like				0		

*ICC*= 0.87 with a MCID of 9 pts

Score calculation ( /3):

*ICC*= 0.92 *with a MDC of 13,5%* 

< 55 % = 0

55 - 63% = 1

64 - 76% = 2

>76 % = 3

#### ALR-RSI scale

Please answer the following questions referring to your main sport prior to injury. For each question, tick a box □√ between the two descriptions to indicate how you feel right now relative to the two extremes.

1. Are you confident that you can perform at your previous level of sport participation?

2.Do you think you are likely to re-injure your ankle by participating in your sport?

3. Are you nervous about playing your sport?

4. Are you confident that your ankle will not give way by playing your sport?

5.Are you confident that you could play your sport without concern for your ankle?

6.Do you find it frustrating to have to consider your ankle with respect to your sport?

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

Fully confident

Not likely at all

Not nervous at all

Fully confident

Fully confident

Not at all frustrating

Not at all confident pp pp pp pp pp pp pp

Extremely likely

Extremely nervous a a a a a a a a a a

Not at all confident a a a a a a a a a a a

Extremely

frustrating



Fully confident

Fully relaxed

#### 7. Are you fearful of re-injuring your ankle by playing your sport?

Extremely fearful D D D D D D D D D D No fear at all

#### 8. Are you confident about your ankle holding up under pressure?

Fully confident

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

Not at all confident p p p p p p p p p

Not at all relaxed o o o o o o o o

# playing your sport?

None of the time All of the time . . . . . . . . . . . . .

0 1 2 3 4 5 6 7 8 9 10

### 11. Are you confident about your ability to perform well at your sport?

### 0 1 2 3 4 5 6 7 8 9 10

#### 9. Are you afraid of accidentally injuring your ankle by playing your sport?

- 0 0 0 0 0 0 0 0 0 0 Not at all afraid
- 10. Do thoughts of having to go through surgery and rehabilitation prevent you from

0 1 2 3 4 5 6 7 8 9 10

0 1 2 3 4 5 6 7 8 9 10

12. Do you feel relaxed about playing your sport?

Pioger et al. @KSSTA 2022, Sigonney et al. @KSSTA 2020

	TEST	-s	RAW VALUES	POINTS	MAXIMUM SCORE
(5)			> 3 errors	0	
Z	Single leg stance test		1 - 3 errors	1	3
l E	Single leg stance test		0 error	2	3
			No apprehension	+1	
FUNCTIONAL PERFORMANCE TESTING			< 90%	0	
2			90 - 95%	2	
{\bar{4}}	Star eveursion balance test (SERT)		> 95%	4	7
Σ .	Star excursion balance test (SEBT)		Anterior (ANT) > 60 %	+1	,
K			Posteromedial (PM) > 90 %	+1	
X			No apprehension	+1	
			> 13 s	0	
	Side how toot		10 - 13 s	2	r
₹	Side hop test		< 10 s	4	5
			No apprehension	+1	
l Ĕ			> 18 s	0	
9	Figure of O how took		13 - 18 s	1	3
	Figure-of-8 hop test		< 13 s	2	3
ш			No apprehension	+1	
			< 90 %	0	
		Activities of Daily Living	90 – 95 %	1	2
REPORTED COME	Foot and Ankle Ability Measure		> 95 %	2	
	(FAAM)		< 80 %	0	
		Sport	80 – 95 %	1	2
			> 95 %	2	
	(FAAM)  Ankle ligament reconstruction-return to RSI)		< 55 %	0	
		urn to sport after injury (ALR-	55-63 %	1	2
≰			63 – 76 %	2	3
4			> 76 %	3	



# Prospective cohort



4 months  Lower level	No sport
	No sport
/n=20\	
(11–20)	(n=12)
12.4±4.1	9.3±3
92.4±5.9§	86.2±10.5
75.9±17 <sup>§</sup>	62.5±19.4
58.8±18.1	50.4±21
1.9±1.8	2.2±1.8
83.7±7	81.4±7
14.3±7.4	16.8±5.6
14.5±4.8	17.1±6.9
S	
	92.4±5.9 <sup>§</sup> 75.9±17 <sup>§</sup> 58.8±18.1 1.9±1.8 83.7±7 14.3±7.4 14.5±4.8



# Ankle-GO



✓ FAAM <sub>avq</sub>	/2pts
✓ FAAM <sub>sport</sub>	/2pts
✓ ALR-RSI	/3pts
✓ Single Leg Stance	/3pts
✓ Star Excursion Balance Test	/7pts
✓ Side Hop Test	/5pts
✓ Figure of 8 Test	/3pts

	Healthy (n=30)
ANKLE GO (pts)	19.6 ±3.4
FAAM <sub>adl</sub> (%)	99.8 ±0.5
FAAM <sub>sport</sub> (%)	98.9 ±2.2
ALR-RSI (%)	96 .1±5.2
SLS (errors)	1.2 ±1.4
mSEBT COMP (%)	91.9 ±6.7
SHT (s)	11.6 ±2.7
F8T (s)	11.7 ±2.2

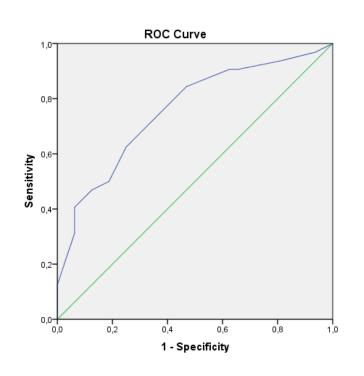
→ Total score Ankle-GO:

/25points



# Premières données pronostiques





# 5x moins de chances de reprendre au même niveau

Two-month, ANKLE GO score showed a good predictive ability for a return to preinjury level at 4 months (AUC=0.77;95%CI:0.64-0.88;p<.001).

A Youden index of 0.38 was observed at a score of 8 points corresponding to a sensitivity of 72% and specificity of 66%.



### **Predictive Ability for Returning to Preinjury Level of Sport or Higher**

La première application pour le retour au sport après traumatisme de cheville!





**APPLICATION GRATUITE** 

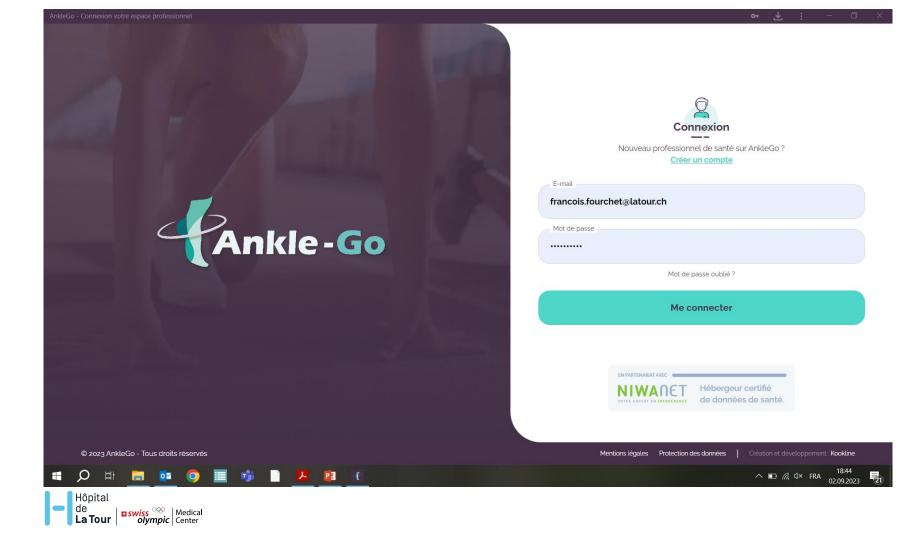


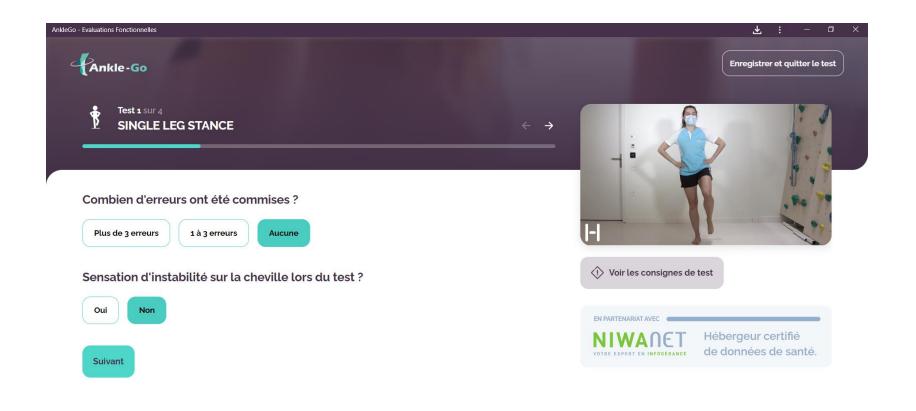


- ✓ 4 tests et 2 questionnaires
- ✓ **Basée sur les données scientifiques** (Picot et al. 2022, 2023)

https://anklego.com/login

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4-5 Octobre October 2024



FRANCE Strasbourg



Save the date!

Traduction en Français

# 10 ème/th INTERNATIONAL ANKLE SYMPOSIUM

