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Ankle supports enhance only psychological aspects of the Ankle-GO score in patients with chronic ankle instability.

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ABSTRACT:

CONTEXT: Chronic ankle instability (CAI) is the most serious long-term complication following an ankle sprain. Taping and bracing are frequently employed in the return to sport (RTS) continuum to avoid injury recurrence and to maximize post-injury performance. The Ankle-GO score is a valid and reliable objective RTS criteria, but the influence of ankle supports on this score in CAI patients remains unknown.

OBJECTIVES: We aimed to evaluate the induce effects of taping or bracing on the Ankle-GO score among patients suffering from CAI.

DESIGN: Crossover Study

SETTING: Sports medicine research laboratory

PATIENTS: Thirty CAI patients (13 males and 17 females, 33.4 ±11.7 years) performed the Ankle-GO score in three conditions (taping, bracing and no ankle support).

MAIN OUTCOME MEASURES: The Ankle-GO is a 25-point score clustering 2 self-reported questionnaires (Foot and Ankle Ability Measure and Ankle Ligament Reconstruction-Return to Sport after Injury) and 4 functional tests (Single Leg Stance, Star Excursion Balance Test, Side Hop Test and Figure-of-eight test). Performances on each

component as well as the total score were compared between conditions using repeated measures of ANOVA.

RESULTS: Taping and bracing significantly and equally improved the Ankle-GO score compared with no support (12.8 ±5.3 and 11.2 ±4.2 vs. 8 ±4.5 points respectively, P<.001). However, significant improvements were found solely in self-reported questionnaires with ankle support (P<.001). No differences were found in functional tests, although both taping and bracing significantly lowered instability perception during the tests (+1.9 and +1.8 points, respectively).

CONCLUSION: Ankle-GO scores were significantly enhanced with taping or bracing. However, only self-reported function and psychological readiness were improved. Functional performance was not altered, although external supports enhanced *perceived* stability. Both taping and bracing supports appear equally important in improving self-confidence and perceived ankle stability among individuals with CAI returning to sport.

Key Words: Ankle sprain; Return to Sport; Ankle-GO™; Taping and Bracing; Psychological readiness

Abstract word count: 287

Key Points

- Taping and bracing improved Ankle-GO score among CAI patients
- Only psychological and perceptual aspects were improved, with no increase in performance in functional tests
- Ankle supports may help patients during the RTS continuum

INTRODUCTION

Lateral ankle sprain (LAS) is the most common injury, with an estimated incidence of 0.6-11.5 per 1000 inhabitants in the general population[1] and a high recurrence rate.[2] Up to 40% of LAS patients develop chronic ankle instability (CAI) marked by perceived instability, episodes of giving-way, recurrences, loss of function, and kinesophobia during daily activities and sports.[1] A key contributor to LAS recurrence and then CAI is poor management of return to sport (RTS).[1,3] This is probably partly due to the lack of consensus on objective RTS criteria[3,4] and decisions are typically time-based with many patients returning to sport with persistent deficits.[5]

The Ankle-GO is a newly developed score designed to monitor LAS treatment progress throughout the RTS continuum.[6] Poor performance on this test has been shown to reduce the likelihood of returning to the same level of play[6] and increase the risk of recurrence ninefold within 2 years of the LAS.[7] The Ankle-GO score combines 4 functional tests and 2 self-reported questionnaires assessing both perceived level of function and the psychological readiness of patients. This score has already been the subject of several publications relating to the multidimensional definition of CAI,[8] especially the dramatic consequences of LAS recurrences and the challenge to become coper.[9] Indeed, considering only this risk of recurrence, recent findings revealed that the Ankle-GO score at two-month following injury was lower in patients with a recurrent LAS (5.4 ± 2.8 vs. 9.1 ± 4.5 points) and predicted the risk of reinjury (with AUC = 0.75): Patients with a score inferior to 8 points were found to have a significantly higher risk of reinjury (OR = 8.6; 95%CI: 2-37.2).[7] In addition patients scoring an Ankle-GO above 8 points were 5 times more likely to return to sport at the same level of play within 4 months.[6] Regarding the challenge to become coper or conversely the high risk to fall into CAI after an initial LAS, it has been shown that LAS patients (initial

LAS or recurrence) scoring an Ankle-GO above 11 points were 12 times more likely to become LAS coper.[10] Therefore, it seems reasonable and relevant to use the Ankle-GO score among CAI population, considering the valuable insights it has already provided in the literature regarding several key components of CAI.

Ankle supports are also commonly employed in the late phase of rehabilitation (i.e. patients gradually resume dynamic tasks such as running, hoping, jumping/landing…),[3,11] and there is strong evidence to support the use of prophylactic taping and bracing for the prevention of LAS.[11,12] For example, in a large randomized controlled trial involving 1,460 male and female high school basketball players, the incidence of acute first-time and recurrent ankle injuries was significantly reduced in the braced group compared to the control group (0.47 versus 1.41 per 1,000 exposures).[12] Several systematic reviews[13–15] identified that external supports were effective at preventing first-time LAS or recurrences. Conversely, it has been proposed that the restriction of movement caused by ankle support could negatively impact functional performance[16] leading to debate regarding their potential value.

A growing body of evidence indicates that ankle support may act as a placebo effect, by improving self-confidence, reducing kinesiophobia and alleviating movement apprehensions.[17] For instance, Hunt and Short's qualitative investigation with 11 US collegiate athletes, revealed that taping positively influenced athlete confidence and decreased their anxiety for injury or re-injury.[18] Similarly, survey data with 132 Division III collegiate athletes suggest that regardless of history of ankle injury, a majority believed that ankle taping may act as a prophylactic modality in preventing injury.[19] These findings suggest that ankle supports may have psychological benefits above and beyond any potential functional enhancements.

The primary aim of this study was therefore to evaluate the effects of ankle strapping or bracing on the Ankle-GO score in patients with CAI. It was hypothesized that both types of support would increase Ankle-GO score compared to no-support (normal) condition. The secondary aim was to analyze each component of the Ankle-GO to better understand which of the 6 components of the score would be potentially altered. Based on previous studies[11,20–22] we hypothesized that taping or bracing would mainly improve perceived stability, level of function and psychological readiness scores without altering functional performances. It was also hypothesized that taping or bracing would have identical effects on the Ankle-GO and its 6 components.

METHODS

Study design and settings

This laboratory cross-sectional study complies with the STROBE statement.

Population

Based on previous research on the Ankle-GO score among patients with CAI,[6] an *a priori* sample size calculation revealed that at a minimum 28 patients would be needed to obtain a statistical power of 0.80 and type 1 error of 0.05.

Patients were recruited from 2 clinics (XXX and YYY). The study was performed in accordance with the Declaration of Helsinki. All patients provided written informed consent, their rights were protected and the study received Institutional Ethics Approval (IRB00010835).

Patients were included only if they met the International Ankle Consortium recommended criteria for CAI.[9] More specifically, patients were required to be more than 12 months from the index ankle sprain and have suffered from at least 2 recurrent sprains; report feelings of

instability (Cumberland Ankle Instability Tool < 24); and loss of self-reported function (Foot and Ankle Ability Measure ADL scale<90% or Sport scale <80%). The most recent LAS occurred more than 3 months prior to the study enrollment. Only patients with a detectable anterior talo-fibular or calcaneofibular ligament lesion were included. The presence of a lesion was assessed by clinical examination (anterior drawer test and talar tilt combined with palpation) and confirmed by imaging (MRI). Patients were excluded in case of fracture or suspicion of syndesmotic injuries.

After inclusion, patients performed the Ankle-GO score under the supervision of an experienced physical therapist during a single session. To limit bias, patients were blinded on the objectives and hypothesis of the study.

Ankle-GO score

This reliable and valid tool was designed to evaluate sporting patients with CAI during the RTS continuum.[6] The score cluster 6 components targeting the main deficits associated with LAS (Table 1) composed by 4 functional tests: the Single Leg Stance (SLS), the modified Star Excursion Balance Test (mSEBT), the Side Hop Test (SHT) and the Figure-of-8 Test (F8T). In addition, 2 patient self-reported questionnaires are included: the Foot and Ankle Ability Measure, comprised of two subscales evaluating activities of daily living ($FAAM_{adl}$) and sports ($FAAM_{sport}$), as well as a measure of psychological readiness to RTS, the Ankle Ligament Reconstruction-Return to Sport after Injury (ALR-RSI).[4]

- <u>Self-reported questionnaires</u>
    - FAAM

This inventory evaluates patient-reported function with 21 items assessing daily activities such as walking, going up and down stairs, and 8 items focus on perceived sports functional abilities such as running, jumping, cutting. The patients respond to each item on a 5-point

Likert scale scale ranging from *0* (“Incapable of performing the exercise”) to *4* (“without difficulty”) or by responding «Not-Applicable» when the activity in question is limited by something other than the foot or ankle. The percentage of each subscale is then determined.

- ALR-RSI

This questionnaire includes a total of 12 items such as confidence, emotions and risk appraisals to assess psychological readiness to RTS among patients with LAS.[23] Items are scored on a scale from *0* (“No confidence”) to *10:* (“Fully confident”). The global score is expressed as a percentage (%).

- Functional performance tests
  - SLS

The subject must stand barefoot on one leg, with the knee slightly flexed (10°), hands on the hips for 20 seconds with the eyes closed on a firm surface. This test evaluates static postural control based on the patient’s number of errors. One error was recorded for any of the following: lifting hands-off hips, moving the thigh into more than 30° of flexion or abduction, lifting the forefoot or heel, remaining out of the testing position for more than 5 seconds, or opening one’s eyes. After completion of two learning trials the test was performed once.

  - mSEBT

The patient stands barefoot on the tested foot in the center of a « Y » formed by three branches on the ground. He/she must reach as far as possible with the opposite leg in the three directions−anterior (ANT), posteromedial (PM) and posterolateral (PL)−before returning to the original position. The trial is ceased if the patient takes his/her hands off the hips, if the weight-bearing leg moves or if the heel is raised, if the patient loses balance or falls, or if there is a transfer of weight to one’s non-weight-bearing foot. To obtain comparable results, the distances obtained are normalized in relation to the length of the patient’s leg (from the

anterior and superior iliac spine to the medial malleolus). After four learning trials in each direction for each leg, three trials were recorded and averaged. The composite score (COMP), calculated as the average of the ANT, PM and PL directions. One point was added if the measurement in the ANT direction was above 60% and another point if the measurement in the direction of PM was above 90%.

- SHT

This test consists of hopping barefoot on one-leg laterally and medially as fast as possible 10 times over two lines 30cm apart.[24] The first hop is always towards the outside. If the patient touches the line, that back-and-forth hop is not counted.

- F8T

This test involves skipping barefoot on one-leg in a figure 8 around two posts 5m apart as fast as possible.[24] The patient has to perform two consecutive laps (for a total distance of 20m).

Because Caffrey et al.[24] have clearly shown the importance of assessing perceived apprehension in patients with LAS, one additional "apprehension point" was added for each test if the patient did not experience instability during the task. Perceived apprehension was assessed using the question: "when you performed the test, did you perceive feelings of instability or apprehension about your ankle" (YES =0, NO= 1 point).

Patients randomly and successively performed the Ankle-GO score in three different conditions (control, taping and bracing). For each condition, all patients performed the tests in the same order (SLS followed by SEBT, SHT and F8T). Then, patients were asked to answer the questionnaires by imagining wearing the external supports in their daily and sporting activities. Approximately 5 min of rest was given to put on/remove the strap or brace and ensure sufficient recovery between test conditions.

Taping and Bracing Techniques

Taping was applied by the same experienced physiotherapist using a figure-of-8 method with elastic bands, commonly used in sports physiotherapy to limit inversion of the foot (Figure 1). For bracing, the same semi-rigid ankle brace, Malleo Dynastab® - Boa (THUASNE, France) was used for all patients (Figure 1). Taping and bracing were applied to the injured ankle only.

Statistical Analysis

Data from the six components: SLS (in number of errors), ANT, PM, PL and the COMP score of the SEBT (%), SHT (s), F8T (s), $FAAM_{adl}$ and $FAAM_{sports}$ (%) as well as the ALR-RSI (%) and total Ankle-GO score were calculated for each condition (control, taping and bracing). In addition, the sum of 'apprehension points' (i.e points obtained if patient did not report feelings of instability during functional tests, for a maximum 4 points) was calculated for each condition (Table 1).

Data were checked for normality and homogeneity of variance using with Shapiro-Wilk and Levene's tests. Means and standard deviations (SD) were compared between the 3 conditions using Analysis of Variance. Welch corrections were applied in case of assumption violation and post-hoc analysis were conducted if needed (Bonferroni corrections). The statistical analysis was performed using JASP (Version 0.17.2.1, University of Amsterdam). Level of significance was set at 0.05 and effect sizes (η^2) were reported.

RESULTS

30 patients with CAI were included (17 females and 13 males 33.4 ±11.7 years) (Table 2).

Ankle-GO score was significantly higher with both taping or bracing compared with no ankle support (12.8 ±5.3 and 11.2 ±4.2 vs. 8 ±4.5 points respectively, P<.001, η^2= 0.160) (Table 3), indicating that both types of ankle support positively impact functional capabilities among individuals with CAI. When comparing each component of the Ankle-GO, only the self-reported questionnaires ($FAAM_{adl}$, $FAAM_{sports}$ and the ALR-RSI) significantly improved with taping or bracing. No significant differences were identified on the performance of functional tests of the Ankle-GO (Table 3). Nevertheless, apprehension reported during these tests was significantly lowered with both taping or bracing. This last finding further suggests that ankle supports exert its influence on patient's perceptions rather than their actual functional capacities.

Lastly, no significant differences between the taping and bracing were found for any parameters. This indicates that both supports prove equally effective in enhancing patient beliefs regarding ankle perceived stability and psychological readiness to RTS.

DISCUSSION

The primary objective of this study was to evaluate the effects of ankle strapping or bracing on the Ankle-GO score in patients with CAI. Results indicated that both supports improved the Ankle-GO score compared to no support, with increases of +4.8 and +3.2 pts, for taping and bracing, respectively. These improvements exceed the minimum detectable change (MDC=1.2 points),[6] indicating a significant impact of ankle support during the RTS continuum. Notably, ankle supports helped patients to overcome a critical Ankle-GO cut-off score of 8 points, which predicts RTS at the same level of play[6] and reduces recurrence risk[7] following LAS, in patients with or without CAI. Patients scoring above 8 points were 5 times more likely to RTS at the same level of play within 4 months and 9 times less likely to suffer

a reinjury within 2 years after a LAS.[6,7] Recent findings also revealed that patients scoring above 11 points were 12 times more likely to fully recover (i.e., become LAS coper).[10] In the present study, both taping and bracing helped patients exceed this threshold with scores of 12.8 and 11.2, respectively. Since the Ankle-GO score is the first objective RTS criterion following LAS (inaugural episode of sprain or recurrence), these results may support the recommendation for prophylactic bracing to enhance psychological readiness and potentially reduce reinjury risk in CAI patients.[11]

When examining the effects of taping or bracing on Ankle-GO scores, it appeared that the performance increase was solely attributable to an improved patients *perceived* abilities, specifically in the subjective aspects of patients' ankle-related function. Notably, both taping and bracing significantly enhanced patient's perception of stability during the functional tests (+1.9 and +1.8 apprehension points, respectively), exceeding the MDC of the Ankle-GO scores. Additionally, self-reported questionnaires ($FAAM_{adl\ and}$ $FAAM_{sports}$), showed significant improvements with ankle support. Interestingly, taping or bracing allowed patients to reach the $FAAM_{adl}$ cut-off score identifying CAI patients (90%).[1] The addition of external supports also surpassed the minimal clinically important difference of the $FAAM_{sports}$ score (9 points),[4] indicating a tangible perceived a beneficial effect. Moreover, a significant increase of 26.5% with taping and 20% with bracing was observed in the ALR-RSI, exceeding the MDC (8.4%) among LAS patients.[23]

Overall results are in line with previous research[17–19] highlighting the beneficial psychological effects of ankle support. A "placebo" effect of taping and bracing has been previously reported, with improvements of feelings of ankle stability, confidence and reassurance during functionals tests in CAI patients.[20,25] Simon and Donahue's[17] critical appraisal of the literature revealed that physically active individuals experienced a significantly increased sense of stability, reassurance, and confidence when their ankle is taped or braced compared to no

support. Authors suggest that ankle taping and bracing are effective in allowing individuals to be more psychologically assured when engaging in dynamic-balance tasks.

However, no difference was observed between conditions in functional tests of the Ankle-GO score, indicating that ankle supports did not affect functional performance. This supports Simon and Donahue's conclusions who reported that despite the psychological benefits of ankle support, ankle taping or bracing did not translate to improved performance during the SEBT or the overall stability index measured by the Biodex Balance System.[17] Research on the impact of ankle taping on performance has shown mixed results.[26–29] Our finding aligned with studies showing no detrimental effects on functional performance,[26,27,30] which is particularly noteworthy for athletes, as it suggests they can use ankle support to reduce injury risk without compromising performance.

The evidence on whether taping or bracing is more effective remains inconclusive.[31] However, bracing appears more efficient to prevent reinjury among LAS patients as measured by the number of patients needed to treat.[32] Additionally, bracing seemed more cost-effective than taping, with lower risk of skin irritation.[31] Nonetheless, both types of supports lose their restrictive properties during exercise,[33,34] with a significant loss of mechanical stability within 20min of exercise.[33] Bracing however, maintains its mechanical properties for a longer period of time,[34] making it a better choice, especially for regular athletes, though clinician experience and patient preference should also be considered.

In this study, we used elastic bands or a semi-rigid brace commonly used by clinicians. Results showed no influence of these external supports on performance in any functional tests. These findings are in adequation with the results from the network meta-analysis of Tsikopoulos et al. 2020[15] revealing that external supports of any type did not improve dynamic postural control in patients with ankle instability. Delahunt et al. 2010[20] compared lateral subtalar sling and fibular repositioning tape with no tape and found no difference in

dynamic postural stability in participants with chronic ankle instability. Such findings also aligns with those of Sawkins et al. 2007,[22] who found no significant differences of two distinct taping techniques (i.e, "real" taping and placebo taping) compared with no taping on SEBT and hopping test performance among CAI patients. The "real" taping technique employed consisted of a combination of three stirrups, a figure-of-6 pattern, and a heel lock using inelastic tape. Conversely the placebo taping involved a single 10-cm rigid tape applied above the lateral malleolus along the lateral aspect of the tibia. More recently, Ridder et al.[25] used a double figure-of-6 and a single heel lock with a non-elastic band in patients with CAI and found no difference in postural control during dynamic landing tasks in the frontal and sagittal planes, but an improvement in perceived instability compared with no tape. It seems therefore that the type (rigid vs elastic) and pattern technique do not influence performance on postural stability and hopping tests but improve perceived stability among CAI patients.

When comparing functional performances obtained in the control condition (Table 3) with the results from Linens et al. 2014[35] in CAI patients, all outcomes were below their proposed cut-off values to identify CAI patients (SLS > 3 errors, SHT >12.8s and F8T > 17.36s), except for PL direction of the SEBT (< 91%).

When focusing on the SEBT scores, McCann et al. 2017[36] revealed similar results on the ANT direction (61 vs 62.8 %) but lower performances on the PM and PL directions (82.5 % and 73.1 % respectively vs 95.9 % and 94.3 % in the present study) among CAI patients with self-reported questionnaires of $FAAM_{adl}$ =89.3%, $FAAM_{sports}$= 71.9% and CAIT = 15 points. SEBT performances from the present study were very similar to those obtained by Doherty et al. (2016)[37] in the ANT, PM and PL directions (61.7%, 93.2% and 100.7% respectively) but CAI patients from their study reported higher self-reported function ($FAAM_{adl}$=95.7%, $FAAM_{sports}$= 85.5% and CAIT= 22.3 pts). The testing procedure of the SEBT could partially explain the difference on SEBT performances among CAI populations.[38,39] When performing

307 the SEBT during the Ankle-GO it is recommend to use a toe fixed position for all three
308 direction[4,6] which leads to very similar results obtained among CAI populations.[37,38]

309 Another explanation of variability in SEBT scores among CAI is the multicausal nature of
310 CAI,[8] with some patients experiencing dynamic postural control deficits, while others do not.

311 Regarding SHT and F8T performances, poorer scores than Caffrey et al. 2009 were observed
312 for the unstable ankle (10.5 s and 11.3 s respectively).[24] Unfortunately, only the Ankle
313 Instability Instrument was used to include patients in their CAI group and no information
314 about the self-reported function of CAI patients was available.

315

316 *Strength and limitations*

317 A potential limitation of this study is that the effect of ankle support was assessed over a
318 relatively short duration (approximately 15min). Future research could explore the impact of
319 ankle support on the psychological components of the Ankle-GO scores over longer periods,
320 such as after 20 minutes of sports participation. Additionally, it would be relevant to examine
321 whether ankle supports influence perceived function (e.g., confidence, psychological
322 readiness) throughout the RTS continuum. It is reasonable to assume that the psychological
323 benefits of ankle support may be greater in the later stages of rehabilitation as functional
324 deficits diminish and ankle function improves.

325 Patients were asked to "imagine" the potential psychological benefits of ankle support when
326 completing the questionnaires (i.e. FAAM and ALR-RSI), rather than experiencing potential
327 psychological benefits while actually engaging in "real life" tasks. While it is difficult to truly
328 assess the psychological aspects by asking patients to consider the perceived benefits, the
329 increases in reported confidence found in the present study, especially in perceived stability

during functional testing nonetheless provide additional support for the psychological benefits of ankle support.

Lastly, the generalizability of these findings should be approached with caution, particularly for high level athletes or other types of ankle sprains such as syndesmotic injuries. Data indicates poor self-reported function and instability among patients included in the present study ($FAAM_{adl}$ = 82.1%, $FAAM_{sports}$ = 55.5% and CAIT =10.4 pts) and the effect of bracing and taping might be different in patients with more favorable outcomes. Furthermore, regarding the generalizability to a broader population, and given that the present study focused specifically on CAI patients, it is challenging to predict whether ankle supports would have the same effects, or to the same extent, in patients suffering from a first acute ankle sprain.

Clinical Implications

Both taping and bracing may enhance rehabilitation by improving psychological readiness and perceived ankle stability, potentially facilitating an earlier return to active sport.[21] However, caution is needed to avoid pre-mature returns to sport, particularly when psychological readiness exceeds actual physical/functional capabilities. This concern is supported by the present study which found high psychological readiness values (mean ALR-RSI = 61% for ankle bracing),[23] despite comparatively low functional abilities (i.e., mean SEBT composite score <90%).[40] Evidence suggests that social desirability issues (e.g., reporting elevated readiness levels of readiness because that's what "tough-minded" athletes do, because they believe it is desirable in the eyes of others to be confident, or because they believe higher scores will increase the likelihood that decision makers return them to sport) may affect self-reported psychological readiness among athletes. This issue requires careful

consideration when evaluating, interpreting or making decisions based on athletes' readiness to return to sport.

Patients and practitioners can be confident that external support may increase the likelihood of returning to the same level of play without affecting functional performance during sports tasks. Caution is warranted for clinicians to avoid relying solely on ankle supports, to enhance balance and postural stability in individuals with CAI. Unfortunately, clinicians are well aware that many athletes prefer to convince themselves that the ankle brace/tape provides sufficient protection and become "addict" on this tool, rather than engaging in comprehensive rehabilitation.

CONCLUSION

Taping and bracing significantly improved performance on Ankle-GO scores among CAI patients. However, improvements were only associated with psychological aspects and perceived stability and no differences between conditions were observed on functional components of the Ankle-GO. Lastly, no difference was found between taping and bracing on any component of the Ankle-GO score. This indicates that both supports could be used to enhance psychological readiness in the RTS continuum in order to lower the risk of reinjury without incurring any detrimental effects on performance.

REFERENCES

1. Gribble PA, Bleakley CM, Caulfield BM, et al. 2016 consensus statement of the International Ankle Consortium: prevalence, impact and long-term consequences of lateral ankle sprains. *Br J Sports Med*. 2016;50(24):1493-1495. doi:10.1136/bjsports-2016-096188

2. Fong DTP, Hong Y, Chan LK, Yung PSH, Chan KM. A Systematic Review on Ankle Injury and Ankle Sprain in Sports. *Sports Med*. 2007;37(1):73-94. doi:10.2165/00007256-200737010-00006

3. Tassignon B, Verschueren J, Delahunt E, et al. Criteria-Based Return to Sport Decision-Making Following Lateral Ankle Sprain Injury: a Systematic Review and Narrative Synthesis. *Sports Med*. 2019;49(4):601-619. doi:10.1007/s40279-019-01071-3

4. Picot B, Hardy A, Terrier R, Tassignon B, Lopes R, Fourchet F. 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. *Frontiers in Sports and Active Living*. 2022;4. Accessed June 8, 2022. https://www.frontiersin.org/article/10.3389/fspor.2022.902886

5. Lam KC, Marshall AN, Bay RC, Wikstrom EA. Patient-Reported Outcomes at Return to Sport After Lateral Ankle Sprain Injuries: A Report From the Athletic Training Practice-Based Research Network. *J Athl Train*. 2023;58(7-8):627-634. doi:10.4085/1062-6050-0111.22

6. Picot B, Lopes R, Rauline G, Fourchet F, Hardy A. Development and Validation of the Ankle-GO Score for Discriminating and Predicting Return-to-Sport Outcomes After Lateral Ankle Sprain. *Sports Health*. 2024;16(1):47-57. doi:10.1177/19417381231183647

7. Picot B, Fourchet F, Lopes R, et al. Low Ankle-GO Score While Returning to Sport After Lateral Ankle Sprain Leads to a 9-fold Increased Risk of Recurrence: A Two-year Prospective Cohort Study. *Sports Med Open*. 2024;10(1):23. doi:10.1186/s40798-024-00693-w

8. Hertel J, Corbett RO. An Updated Model of Chronic Ankle Instability. *J Athl Train*. 2019;54(6):572-588. doi:10.4085/1062-6050-344-18

9. Gribble PA, Delahunt E, Bleakley C, et al. Selection criteria for patients with chronic ankle instability in controlled research: a position statement of the International Ankle Consortium. *Br J Sports Med*. 2014;48(13):1014-1018. doi:10.1136/bjsports-2013-093175

10. Picot B, Fourchet F, Rauline G, et al. Ankle-GO score is associated with the probability of becoming coper after lateral ankle sprain: a 1-year prospective cohort study. *Br J Sports Med*. Published online August 9, 2024. doi:10.1136/bjsports-2024-108361

11. Zwiers R, Vuurberg G, Blankevoort L, Kerkhoffs GMMJ. Taping and bracing in the prevention of ankle sprains: current concepts. *Journal of ISAKOS*. 2016;1(6):304-310. doi:10.1136/jisakos-2016-000104

12. McGuine TA, Brooks A, Hetzel S. The Effect of Lace-up Ankle Braces on Injury Rates in High School Basketball Players. *Am J Sports Med*. 2011;39(9):1840-1848. doi:10.1177/0363546511406242

13. Doherty C, Bleakley C, Delahunt E, Holden S. Treatment and prevention of acute and recurrent ankle sprain: an overview of systematic reviews with meta-analysis. *British Journal of Sports Medicine*. 2017;51(2):113-125. doi:10.1136/bjsports-2016-096178

14. Leppänen M, Aaltonen S, Parkkari J, Heinonen A, Kujala UM. Interventions to Prevent Sports Related Injuries: A Systematic Review and Meta-Analysis of Randomised Controlled Trials. *Sports Med*. 2014;44(4):473-486. doi:10.1007/s40279-013-0136-8

15. Tsikopoulos K, Sidiropoulos K, Kitridis D, Cain ATC SM, Metaxiotis D, Ali A. Do External Supports Improve Dynamic Balance in Patients with Chronic Ankle Instability? A Network Meta-analysis. *Clinical Orthopaedics and Related Research®*. 2020;478(2):359. doi:10.1097/CORR.0000000000000946

16. Cordova ML, Ingersoll CD, Palmieri RM. Efficacy of Prophylactic Ankle Support: An Experimental Perspective. *J Athl Train*. 2002;37(4):446-457.

17. Simon J, Donahue M. Effect of Ankle Taping or Bracing on Creating an Increased Sense of Confidence, Stability, and Reassurance When Performing a Dynamic-Balance Task. *Journal of Sport Rehabilitation*. 2013;22(3):229-233. doi:10.1123/jsr.22.3.229

18. Hunt E, Short S. Collegiate Athletes' Perceptions of Adhesive Ankle Taping: A Qualitative Analysis. *Journal of Sport Rehabilitation*. 2006;15(4):280-298. doi:10.1123/jsr.15.4.280

19. Simon JE, Docherty CL. Self-Reported Use and Opinions of Ankle Prophylaxes in Division III Collegiate Athletes: An Exploratory Study. *International Journal of Athletic Therapy and Training*. 2015;20(6):51-57. doi:10.1123/ijatt.2014-0130

20. Delahunt E, McGrath A, Doran N, Coughlan GF. Effect of taping on actual and perceived dynamic postural stability in persons with chronic ankle instability. *Arch Phys Med Rehabil*. 2010;91(9):1383-1389. doi:10.1016/j.apmr.2010.06.023

21. Halim-Kertanegara S, Raymond J, Hiller CE, Kilbreath SL, Refshauge KM. The effect of ankle taping on functional performance in participants with functional ankle instability. *Physical Therapy in Sport*. 2017;23:162-167. doi:10.1016/j.ptsp.2016.03.005

22. Sawkins K, Refshauge K, Kilbreath S, Raymond J. The placebo effect of ankle taping in ankle instability. *Med Sci Sports Exerc*. 2007;39(5):781-787. doi:10.1249/MSS.0b013e3180337371

23. Picot B, Grimaud O, Rauline G, Haidar I, Moussa MK, Hardy A. Validity and reproducibility of the ARL-RSI score to assess psychological readiness before returning to sport after lateral ankle sprain. *Journal of Experimental Orthopaedics*. 2024;11(3):e12073. doi:10.1002/jeo2.12073

24. Caffrey E, Docherty CL, Schrader J, Klossnner J. The Ability of 4 Single-Limb Hopping Tests to Detect Functional Performance Deficits in Individuals With Functional Ankle Instability. *J Orthop Sports Phys Ther*. 2009;39(11):799-806. doi:10.2519/jospt.2009.3042

25. Ridder RD, Willems TM, Vanrenterghem J, Roosen P. Effect of Tape on Dynamic Postural Stability in Subjects with Chronic Ankle Instability. *Int J Sports Med*. 2015;36(04):321-326. doi:10.1055/s-0034-1385884

26. Ambegaonkar JP, Redmond CJ, Winter C, et al. Ankle Stabilizers Affect Agility but Not Vertical Jump or Dynamic Balance Performance. *Foot & Ankle Specialist*. 2011;4(6):354-360. doi:10.1177/1938640011428509

27. Cordova ML, Scott BD, Ingersoll CD, LeBlanc MJ. Effects of ankle support on lower-extremity functional performance: a meta-analysis. *Med Sci Sports Exerc*. 2005;37(4):635-641. doi:10.1249/01.mss.0000159141.78989.9c

28. Jeffriess MD, Schultz AB, McGann TS, Callaghan SJ, Lockie RG. Effects of Preventative Ankle Taping on Planned Change-of-Direction and Reactive Agility Performance and Ankle Muscle Activity in Basketballers. *J Sports Sci Med*. 2015;14(4):864-876.

29. Mason-Mackay AR, Whatman C, Reid D, Lorimer A. The effect of ankle bracing on landing biomechanics in female netballers. *Physical Therapy in Sport*. 2016;20:13-18. doi:10.1016/j.ptsp.2015.11.002

30. Putnam AR, Bandolin SN, Krabak BJ. Impact of Ankle Bracing on Skill Performance in Recreational Soccer Players. *PM&R*. 2012;4(8):574-579. doi:10.1016/j.pmrj.2012.04.001

31. Kerkhoffs GM, van den Bekerom M, Elders LAM, et al. Diagnosis, treatment and prevention of ankle sprains: an evidence-based clinical guideline. *Br J Sports Med*. 2012;46(12):854-860. doi:10.1136/bjsports-2011-090490

32. Olmsted LC, Vela LI, Denegar CR, Hertel J. Prophylactic Ankle Taping and Bracing: A Numbers-Needed-to-Treat and Cost-Benefit Analysis. *J Athl Train*. 2004;39(1):95-100.

33. Best R, Mauch F, Böhle C, Huth J, Brüggemann P. Residual Mechanical Effectiveness of External Ankle Tape Before and After Competitive Professional Soccer Performance. *Clinical Journal of Sport Medicine*. 2014;24(1):51. doi:10.1097/JSM.0b013e31829ddc74

34. Forbes H, Thrussell S, Haycock N, Lohkamp M, White M. The Effect of Prophylactic Ankle Support During Simulated Soccer Activity. *Journal of Sport Rehabilitation*. 2013;22(3):170-176. doi:10.1123/jsr.22.3.170

35. Linens SW, Ross SE, Arnold BL, Gayle R, Pidcoe P. Postural-stability tests that identify individuals with chronic ankle instability. *J Athl Train*. 2014;49(1):15-23. doi:10.4085/1062-6050-48.6.09

36. McCann RS, Crossett ID, Terada M, Kosik KB, Bolding BA, Gribble PA. Hip strength and star excursion balance test deficits of patients with chronic ankle instability. *J Sci Med Sport*. 2017;20(11):992-996. doi:10.1016/j.jsams.2017.05.005

37. Doherty C, Bleakley C, Hertel J, Caulfield B, Ryan J, Delahunt E. Dynamic balance deficits in individuals with chronic ankle instability compared to ankle sprain copers 1 year after a first-time lateral ankle sprain injury. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(4):1086-1095. doi:10.1007/s00167-015-3744-z

38. Cuğ M. Stance foot alignment and hand positioning alter star excursion balance test scores in those with chronic ankle instability: What are we really assessing? *Physiother Theory Pract*. 2017;33(4):316-322. doi:10.1080/09593985.2017.1302028

39. Picot B, Terrier R, Forestier N, Fourchet F, McKeon PO. The Star Excursion Balance Test: An Update Review and Practical Guidelines. *Int J Athl Ther Train*. 2021;1(aop):1-9. doi:10.1123/ijatt.2020-0106

40. Gribble PA, Hertel J, Plisky P. Using the Star Excursion Balance Test to assess dynamic postural-control deficits and outcomes in lower extremity injury: a literature and systematic review. *J Athl Train*. 2012;47(3):339-357.

TABLES and FIGURES

TABLE 1. List Of Tests And Self-Reported Questionnaires Used For The Construction Of The Ankle-GO Score And System To Determine The Points For Each Component.

	TESTS		RAW VALUES	POINTS	MAXIMUM SCORE
PATIENT REPORTED OUTCOME MEASURE	Foot and Ankle Ability Measure (FAAM)	Activities of Daily Living	< 90%	0	2
			90 – 95%	1	
			> 95%	2	
		Sports	< 80%	0	2
			80 – 95%	1	
			> 95%	2	
	Ankle ligament reconstruction-return to sport after injury (ALR-RSI)		< 55%	0	3
			55-63%	1	
			63 – 76%	2	
			> 76%	3	
FUNCTIONAL PERFORMANCE TESTING	Single leg stance test (SLS)		> 3 errors	0	3
			1 - 3 errors	1	
			0 error	2	
			No apprehension	1	
	Star excursion balance test (SEBT)		< 90%	0	7
			90 - 95%	2	
			> 95%	4	
			Anterior (ANT) > 60%	1	
			Posteromedial (PM) > 90%	1	
			No apprehension	1	
	Side hop Test (SHT)		> 13 s	0	5

		10 - 13 s	2	
		< 10 s	4	
		No apprehension	1	
	Figure-of-8 hop Test (F8T)	> 18 s	0	**3**
		13 - 18 s	1	
		< 13 s	2	
		No apprehension	1	
Ankle-GO score				**25**

TABLE 2. Patients Demographics

Sex	13 Males and 17 Females
Age (years)	33.4 ± 11.7
Injured Side	12 Left and 18 Right
Type of Sport, n (%)	
In line	13 (46.3%)
Pivot	11 (36.7%)
Pivot-contact	6 (20%)
Level of Play, n (%)	
Professional	1 (3.3%)
Intensive (>6 hours per week)	11 (36.7%)
Regular (2-6 hours per week)	15 (50%)
Casual (< 2 Hours per week)	3 (10%)
Cumberland Ankle Instability Tool (points)	10.4 ± 4.9
Foot and Ankle Ability Measure (%)	

- Activities of Daily Living - Sports	82.1 ± 14.3 55.5 ± 22.2

495

496

TABLE 3. Comparison Of The Total Score And Each Component Of The Ankle-GO

	No ankle Support	Taping	Bracing	P value	Effect size
Ankle-GO (/25 pts)	8 ± 4.5 [a]	11.2 ± 4.2	12.8 ± 5.3	**<0.001**	0.160
Ankle-GO apprehension (/4 pts)	2.7 ± 1.3 [a]	3.5 ± 0.9	3.6 ± 1.3	**0.007**	0.108
$FAAM_{adl}$ (%)	82.1 ± 14.3 [a]	89.8 ± 10.9	91.0 ± 9.0	**0.007**	0.108
$FAAM_{sport}$ (%)	55.5 ± 22.2 [a]	71.7 ± 20.0	75.0 ± 19.9	**0.001**	0.148
ALR-RSI (%)	34.2 ± 24.0 [a]	53.4 ± 25.2	60.7 ± 27.1	**<0.001**	0.166
SLS (errors)	3.1 ± 2.6	2.9 ± 2.3	2.4 ± 2.0	0.471	0.017
SEBT Comp (%)	84.4 ± 7.3	86.6 ± 6.5	87.9 ± 7.2	0.152	0.042
SEBT Ant (%)	62.8 ± 6.9	65 ± 6.9	63.9 ± 6.9	0.48	0.017
SEBT PM (%)	95.9 ± 9.8	99.9 ± 10.1	98.2 ± 9.2	0.28	0.283
SEBT PL (%)	94.3 ± 10.6	99 ± 9.1	97.5 ±8.8	0.152	0.042
SHT (s)	24.4 ± 16.0	18.8 ± 12.7	17.6 ± 11.5	0.12	0.048
F8T (s)	19.9 ± 10.7	17.8 ± 9.1	17.9 ± 9.2	0.65	0.010

(Mean ± SD) Between The Control And Ankle Support Conditions.

FAAMadl-sport= Foot and Ankle Ability Measures-Activities of daily living & sports subscales; ALR-RSI= Ankle Ligament reconstruction return to sport after injury; SLS= Single Leg Stance; SEBT=Star Excursion Balance Test; Ant=Anterior, PM=posteromedial, PL=posterolateral; SHT= Side Hop Test; F8T= Figure of eight test

504 [a] indicates a significant difference between control and ankle supports conditions but no

505 difference between the type of support

506

507 **FIGURE**

508

509 **FIGURE 1. Application technique of ankle strapping. A) The elastic band starts at the**
510 **midfoot and stabilizes the lateral edge of the foot (styloid process of the 5th metatarsal)**
511 **limit ankle inversion. B) The band tightens the inferior tibiofibular joint and extends**
512 **towards the medial malleolus, forming a figure of 8, and then stabilizes the calcaneus to**
513 **limit rearfoot varus. C) The final passage in the lateral edge of the foot limits supination**
514 **of the ankle. D) Ankle bracing.**