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Research Highlight

Recent developments on models and inclusion criteria for chronic ankle instability

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In the most recent report of injury data on 15 sports from the U.S. National Collegiate Athletic Association (NCAA) Injury Surveillance System over a span of 16 years (1988–2004), ankle ligament sprains were the most common injury.¹ Residual symptoms such as recurrent sprains, pain, instability, and giving way are common after an initial, acute ligament sprain. Chronic ankle instability (CAI) is one of these common problems, and has enjoyed increased interest in the recent literature. However, CAI remains a poorly-defined and understood condition.^{2,3}

CAI has been commonly associated with two types of instability, namely mechanical and functional instability. Hertel⁴ in 2002 proposed a CAI model that has been very popular (Fig. 1). In this model, CAI is attributed to both mechanical instability and functional instability. Functional instability may be caused by deficits in proprioception, neuromuscular control, postural control, and/or muscular strength. Mechanical instability may be caused by altered mechanics in one or more joints within the ankle complex. Rather than treating these two types of instability independently, this model considers that they are both part of an instability continuum. When both types of instability are present, recurrent ankle sprain occurs.

In a recent paper, Hiller et al.³ proposed a new and updated CAI model that was evolved from Hertel's original model. In this new model, CAI has a total of seven sub-groups (Fig. 2). In the new model, the triad consists of mechanical instability, perceived instability (instead of functional instability in

Hertel's model) and recurrent sprain are still there. In addition, each of the three sub-groups can exist independently or in combination to give a total of seven subgroups (Fig. 2). This new model was developed after an analysis of two recent studies on patient groups using Hertel's model.^{5,6} Out of the 108 cases of CAI ankle data included from these two studies, 47 cases could not be classified into one of the three sub-groups in the original model. Some of these individuals had both mechanical and functional instability, but did not suffer recurrent ankle sprains. The other subjects who did not fit into the model had recurrent ankle sprains, but did not present with mechanical or functional instability.

Among the 108 ankles used to fit the updated model, the percentage of the classifications was 42.6% (46) for perceived instability, 30.5% (33) for perceived instability plus recurrent sprain, 11.1% (12) for perceived instability plus mechanical instability and recurrent sprain, 9.3% (10) for mechanical plus perceived instability, 2.8% (3) for recurrent sprain, 2.8% (3) for mechanical instability, and 0.9% (1) for mechanical instability plus recurrent sprain.³ In addition to the expanded sub-groups, functional instability is referred to as perceived instability in the newer model "because functional instability is now used with widely different meanings".³ Several limitations were acknowledged by the authors. The model was tested retrospectively using data from previous studies. Only one method was used to test mechanical instability, perceived instability and recurrent sprain in the original data sets. Mechanical instability was examined using an anteroposterior manual testing method. The model was tested with data from limited age and activity groups. Finally, the sample size for some sub-groups was rather small.

Although research interest in CAI has increased steadily in recent years, the results are rather inconsistent.² This may be largely related to the different criteria used to define functional instability, which may have led to subject groups with different instability characteristics. In a recent extensive literature review of 118 studies on the inclusion criteria of CAI studies,

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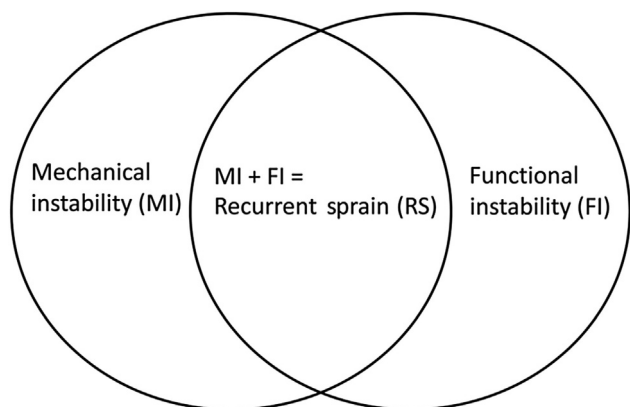


Fig. 1. The original Hertel CAI model.⁴ Adapted with permission.

Delahunt et al.² showed that the most common descriptors for ankle instability and functional instability are frequent ankle sprains and ankle joint giving way. However, most of the studies using the concept of giving way did not actually define or describe the concept. It is also unclear if giving way is the same as a feeling of ankle instability. Therefore, in order to avoid confusion, these authors provided operational definitions for mechanical instability, functional instability, CAI, recurrent ankle sprain, “giving way” of the ankle, the feeling of ankle instability, and acute lateral ankle sprain.² These clearly defined terms may help minimize discrepancies in the targeted populations, and select more homogenous subject cohorts in future CAI studies. In addition to having clearly defined operational terms, the usage of ankle instability surveys such as the Foot and Ankle Ability Measure,⁷ Ankle Joint Functional Assessment Tool,⁸ and Cumberland Ankle Instability Tool⁹ can quantify functional instability and further differentiate CAI patients from healthy controls. For mechanical instability, its presence should be assessed through instrumented measures or manual testing. Instrumented measures can be instrumented arthrometry, stress X-rays or ultrasonography, whereas the manual testing methods should include tests with a clear specification of instability criteria. In addition to mechanical instability signs, Delahunt and colleagues² further suggested that the key inclusion criteria for CAI studies should also include the number of previous ankle sprains, time since the last diagnosed sprain, the presence/frequency of “giving way” episodes, the presence/frequency of feelings of ankle joint instability, the number/frequency of previous ankle sprains, the presence of pain during activities of daily living or sport participation, the history of other injuries particularly at the time of the sprain, the assessment tool scores, the functional assessment tool scores, the activity profile (e.g., sport level, recent activity level, *etc.*), in receipt of treatment and the nature of previous treatment, the history of surgery or

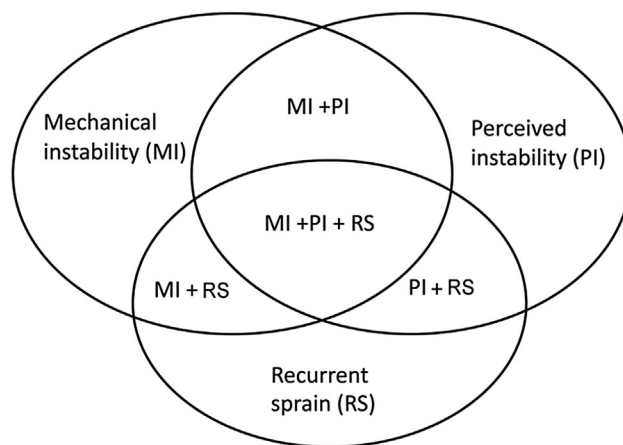


Fig. 2. The new and expanded CAI model.³ Adapted with permission.

arthroscopic findings, and an insidious onset versus a history of trauma.

Chronic ankle sprain is a multifaceted pathological condition that is mostly related to initial and recurrent sprains, and can result in functional and mechanical insufficiencies. The additional combinations of mechanical and functional instability, plus sprain recurrence, in the new proposed model will present new challenges in CAI research. Both mechanical and functional instability should be included as part of the inclusion criteria in CAI studies.

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