



Original research

Interventions preventing ankle sprains; previous injury and high-risk sport participation as predictors of compliance

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ABSTRACT

Objectives: To describe the association between participants' person-related potential predictor variables and cumulative compliance with interventions for preventing ankle sprains: neuromuscular training, wearing an ankle brace, and a combined training and bracing.**Design:** Secondary analysis of compliance data from a randomized controlled trial (RCT) comparing measures preventing ankle ligament injuries.**Methods:** Ordinal regression with a backward selection method was used to obtain a descriptive statistical model linking participants' person-related potential predictor variables with the monthly cumulative compliance measurements for three interventions preventing ankle ligament injuries.**Results:** Having had a previous ankle injury was significantly associated with a higher compliance with all of the preventive measures trialed. Overall compliance with bracing and the combined intervention was significantly lower than the compliance with NM training. Per group analysis found that participating in a high-risk sport, like soccer, basketball, and volleyball, was significantly associated with a higher compliance with bracing, or a combined bracing and NM training. In contrast, participating in a high-risk sport was significantly associated with a lower per group compliance with NM training.**Conclusions:** Future studies should include at least registration of previous ankle sprains, sport participation (high- or low-risk), experience in NM training, and hours of sport exposure as possible predictors of compliance with interventions preventing ankle sprains. Practitioners should take into account these variables when prescribing preventive neuromuscular training or bracing.

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1. Introduction

Preventive interventions are commonly used in various sports to reduce the number of sports injuries. When translating evidence-based preventive interventions into daily practice in sports, an important issue to address is compliance.¹ In sports injury prevention research, compliance is a term used to indicate the athlete's correct execution of the prescribed intervention.² In the preferred

research design setting for the evaluation of the efficacy of sports injury preventive interventions, i.e., a randomized controlled trial (RCT), compliance can be optimized by the use of a well-defined protocol that must be complied with. This compliance can be monitored by researchers, practitioners, coaches or athletic trainers, or self-monitored by the participants.

In recent years, there has been a trend toward more effectiveness studies, to determine how well efficacious interventions work when applied in a practical context.³ In a previous ankle sprain prevention trial on home-based neuromuscular (NM) training by our group, only 23% of the participants fully complied with the protocol. A secondary per protocol analyses showed that the established intervention effect was over threefold higher for fully compliant participants when compared to the controls.² In line with these

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results, Steffen et al.⁴ found a lower risk for lower extremity injuries in high-compliant athletes versus medium-compliant athletes with the FIFA11+ program in soccer. Furthermore, McGuine⁵ et al. recently provided evidence for the use of sports braces, as preventive measures in male and female high school basketball athletes, both with and without a previous history of an ankle injury. In 59% of the training sessions and games, participants were compliant with the preventive brace advice, as monitored by athletic trainers. As this and an earlier study² showed, there can be degrees of usage of an intervention whether it is wearing protective equipment or performing a training program. What is lacking from the literature is a direct comparative assessment of the possible predictors of compliance with home-based interventions preventing ankle ligament injuries.

In a recent RCT, the cost-effectiveness of secondary ankle sprain prevention by the use of NM training or bracing was assessed against the combined use of both NM training and bracing.⁶ Although bracing was found to be superior to NM training for the prevention of recurrent ankle sprains, as could be expected, the compliance with each intervention varied substantially. In the aforementioned studies, higher compliance resulted in a lower relative risk of a recurrent ankle sprain. To predict compliance with sport injury rehabilitation, Taylor and May⁷ applied the protection motivation theory. They concluded that athletes with higher perceptions of susceptibility to reinjury were more likely to adhere to their rehabilitation program. Accordingly, at least in theory, we should be able to optimize preventive effects for the individual if we can tailor intervention advice, taking into account person-related predictor variables associated with higher compliance. Therefore, the aim of this study was to describe the association between person-related potential predictor variables and cumulative compliance with prescribed interventions in this RCT.⁶

2. Methods

This study is a secondary analysis of data from a previously published RCT on the cost-effectiveness of prevention of ankle sprain recurrences.^{6,8,9} The main study design and interventions have been described in detail elsewhere.⁹ The study design, procedures, and informed consent procedure were approved by the Medical Ethics Committee (number 31785.029.10) of the VU University Medical Centre, the Netherlands. Trial register number NTR 2157.

All participants provided written informed consent. Briefly, an RCT was conducted in athletes ($n=384$) who had sprained their ankle. All participants received treatment, according to usual care, after which they were randomized to one of the three intervention groups. Participants allocated to the NM training-only group received an 8 week unsupervised NM training program. Participants in this group received a balance board (Avanco AB, Sweden), exercise sheets, and an instructional DVD of the exercises. Participants allocated to the brace-only group received a semirigid ankle brace (Aircast A60, DJO) to be worn during all sports activities for the duration of 1 year and an instruction sheet on brace use. A third combination group received both the NM training program and a sports brace to be worn during all sports activities for the duration of eight 8 weeks. The instruction sheet on brace use, exercise sheet on NM training, and videos of the exercises were also provided on a website that was accessible only to the relevant intervention group.

During a 1 year follow-up, participants self-reported compliance with the prescribed intervention through items in the monthly questionnaire. The item(s) on compliance are presented in Table 1. The term fully compliant was used for participants who reported “always (>75%)” on average for the respective items. The term partially compliant was used for participants who reported “most of

Table 1
Compliance item(s) and answer options per intervention group.

Group	Compliance item	Answer options
NM training (one item)	Did you perform the exercises as prescribed in the last 4 weeks?	No, never Yes, sometimes (about 25% of the prescribed training sessions) Yes, most of the time (about 50% of the prescribed training sessions) Yes, always (more than 75% of the prescribed training sessions)
Brace (two items)	Did you wear the brace during training as prescribed in the last 4 weeks? Did you wear the brace during competition as prescribed in the last 4 weeks?	No, never Yes, sometimes (about 25% of the training/competition sessions) Yes, most of the time (about 50% of the training/competition sessions) Yes, always (more than 75% of the training/competition sessions)
Combination (three items)	Did you perform the exercises as prescribed in the last 4 weeks? Did you wear the brace during training as prescribed in the last four weeks? Did you wear the brace during competition as prescribed in the last four weeks?	No, never Yes, sometimes (about 25% of the prescribed/training/competition sessions) Yes, most of the time (about 50% of the prescribed/training/competition sessions) Yes, always (more than 75% of the prescribed/training/competition sessions)

the time (about 50%)” on average for the respective items. Participants who reported “never (0%)” or “sometimes (about 25%)” on average for the respective items were considered not to have complied with the prescribed program. Although these three categories were chosen arbitrarily, we believe that adding percentages to the description and combining the first two options “never (0%)” and “sometimes (25%)” into a single category of “not compliant” minimizes central tendency bias and differentiates between participants who did and did not comply with the prescribed program.

As no valid measurement or consensus on self-reported compliance with training programs, or brace use exists, the choice to measure compliance through these items was based on the experience in a previous trial.¹⁰ The monthly compliance item scores were recoded into one overall score. As loss to follow-up was only six% we decided to impute the compliance data via “last observation carried forward” method. The scores were recoded into a numerical variable (i.e., 0% = 0; 25% = 1; 50% = 2, and >75% = 3). A mean compliance score across participants allocated to each intervention was calculated and used in the analyses.

In the current study, the association between person-related potential predictor variables and compliance was the primary outcome. Consistent with other studies,² we assumed that a higher compliance with these interventions would generate a larger decrease in injury risk. Person-related potential predictor variables were derived from the available baseline dataset and included: intervention group, age, previous ankle injury, experience with tape/brace use, experience with NM training, high-risk sport participation, education at inclusion, and monthly registered hours of exposure during follow-up. “Intervention group” was included because full compliance to the intervention groups differed substantially (NM training 45%, brace 23%, and combination 28%). Interactions between age and self-motivation for home exercise completion have also been documented.¹¹ A previous ankle sprain has been showed to be followed by a higher perception of susceptibility to reinjury, and therefore, a higher compliance with the intervention is likely.¹² If NM training has been performed previously, there will be participant insight into the features of the

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