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Coach-led preventive training program in youth soccer players improves movement technique

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ABSTRACT

Long-term implementation of preventive training programs (PTP) in youth sport requires coach involvement. However, the optimal training of coaches to effectively implement a PTP remains unknown. It is also unknown if the benefits of PTP can be enhanced with multiple sport seasons of exposure.
Objectives: To evaluate the influence of prior PTP exposure on movement technique in youth soccer players after completing a coach-led PTP.
Design: Cluster-randomized controlled trial.
Methods: Twelve youth soccer teams (n = 89; age range 8–14 years) were divided into groups with (Experience (EXP); 6 teams [n = 18 females, n = 25 males]) and without (Novice (NOV); 6 teams [n = 30 females, n = 16 males]) previous professional-led PTP experience. The coaches and players of the EXP teams were exposed to an eight-week professional-led PTP before the coach-led PTP. EXP and NOV coaches attended the educational workshop prior to implementing the coach-led PTP. The Landing Error Scoring System (LESS) was used to evaluate movement technique.
Results: Both groups improved LESS scores over time (mean difference ± SD [post-pre] = −0.8 ± 0.2, 95%CI [−1.2, −0.4], p = 0.0001). Of the 64 participants classified as high risk for injury (LESS ≥5) prior to PTP implementation, a greater proportion of EXP (n = 14) compared to NOV (n = 7) participants changed risk classification from high to low (LESSΔ ≥ 1 and LESS <5; p = 0.03).
Conclusions: Our PTP enhanced movement technique regardless of PTP experience, but the benefits of the PTP impacted a proportionally greater number of players with previous PTP experience supporting continued PTP implementation. Coaches effectively implemented an exercise-based PTP after attending a training workshop regardless of previous PTP experience.

1. Introduction

Youth sport-related lower extremity musculoskeletal injuries need to be prevented to avoid substantial financial, social, and long-term health burdens (e.g., osteoarthritis, obesity, etc.) to both the individual and his or her family.[1–3] Implementing preventive training programs (PTP) prior to puberty normalizes these activities before the child reaches adolescence, when injury risk is highest.[4] Professional-led PTPs have successfully improved movement technique likely reducing injury risk,[5–8] however, they are not feasible, widespread, long-term solutions given the high cost and time-intensive nature.[9,10] Alternatively, limited evidence suggest youth sport coaches can effectively implement a PTP to improve movement technique[11] and reduce injury risk.[12–14]

Youth sport coaches represent the most viable and cost-effective option for long-term implementation of PTPs[12,15] given their leadership roles and extensive team involvement.[9,10,16] Youth sports in general lack the infrastructure and funds for professional-led (i.e., researcher, physiotherapist, athletic trainer) PTPs and are typically coached by volunteers that may lack knowledge of or experience with PTPs.[15] Because coaches are in direct control of program adherence and compliance, there is a need to explore factors to enhance program fidelity and coach ability to effectively implement PTPs.[14,17]

It is unknown if previous exposure to a professional-led PTP, a form of professional role modeling, would augment the abil-

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ity of coaches to learn and effectively implement a PTP. Several recent studies on adult and coach learning preferences stress the importance, preference, and effectiveness of informal learning programs such as mentorship and experiential learning, specifically when social interaction and participation are incorporated.[16,18] Instituting a PTP education and training program prior to implementation based upon coach education best practices may enhance subsequent program effectiveness. Specifically, exposing youth sport coaches to a professional-led PTP prior to independent coach-led PTP implementation may play an integral role in the education, compliance, and fidelity of coaches. Some,[12–14] but not all[14,17] studies have shown that coaches can effectively lead a PTP independently of professional role modeling resulting in reduced injury rates when they receive extensive preseason training. Similarly, players appear to reduce ACL injury risk and retain proper movement technique with longer neuromuscular training exposure.[8,19] It is unknown if exposing both players and coaches to a professional-led PTP would synergistically enhance the effects of a subsequent coach-led PTP on movement technique.

There is need to discover effective and efficient means to train coaches to implement PTPs with high compliance and adherence. The purpose of this study was to evaluate the effectiveness of a coach-led PTP after the coaches and players were exposed to a professional-led PTP on movement technique associated with injury risk. We aimed to determine whether a coaches' workshop in addition to coach and player previous exposure to a professional-led PTP augments PTP efficacy. We hypothesized that in addition to the coaches' workshop, the combination of previous player and coach experience to a professional-led PTP would elicit greater improvements in movement technique compared to soccer players receiving a coach-led PTP by coaches only receiving an educational workshop. Improved movement technique was defined as either improving injury risk classification or reducing the composite Landing Error Scoring System (LESS) score by at least one unit.[7,20] If additional benefits could be realized with a coach-led PTP after a professional-led PTP, this may provide the framework for widespread implementation of effective coach-led PTP.

2. Methods

We used a cluster-randomized controlled trial to compare the effectiveness of two groups of coaches implementing an exercise-based PTP on changes in movement technique in youth soccer players. Twelve teams were recruited by word mouth from the under-9 to under-14 age divisions of a local competitive soccer league. During the fall season (season 1), teams were randomized into a PTP (n = 6) or control (n = 6) group after stratifying for sex and age group. Athletic trainers led the teams in the PTP group through the program before every practice during the 8-week season while the control group teams were instructed to perform their normal warm-up. Two weeks before the subsequent spring season (season 2), coaches of all teams attended a preventive training program workshop and were instructed to implement the PTP as a team warm-up prior to practices and games. In this respect, our experienced (EXP; n = 6 [3 female, 3 male]) group received two bouts (season 1 and 2) while our novice group (NOV; n = 6 [4 female, 2 male]) received only one bout (season 2) of PTP to evaluate the effect of previous coach exposure and player experience on intervention efficacy. The same PTP was implemented in both seasons.

Youth soccer players (n = 122) aged 8–14 volunteered to participate at the start of this study. All participants were free from injury and illness prohibiting sport participation at the first testing session. Parent and coach informed consent and child assent were obtained according to university institutional review board regulations, approval number H13-344. All coaches chose to implement the preventive training program in replacement of their usual warm-up routine, but only players with their parent/legal guardian who volunteered to participate in the study completed testing before (PRE) and after (POST) each season of the intervention period. This allowed for team-wide incorporation of the PTP without excluding non-consenting players, enhancing external validity.

The 90-min hands-on workshop focused on implementing the warm-up while enhancing coach knowledge, implementation ability, and aptitude at recognizing, correcting, and understanding poor movement behavior. Practical application scenarios, consisting of researchers performing exercises in groups for the coaches to correct, after the seminar ensured that coaches were able to accurately implement the PTP and identify and provide appropriate cues to correct poor movement behavior. Coaches were informally assessed during these practical scenarios which continued until all coaches were successful and comfortable with the implementation of all PTP exercises and identification and correction of improper form. Coaches were instructed to provide consistent verbal instruction and feedback to the players about their movement quality using cues such as "land softly", "bend your knees", and "keep your knees over your toes". Coaches were provided reference cards with information on field set-up, standardized exercises, cues, and feedback for correcting movement in all planes of motion (see online supplementary files).

The PTP consisted of 12–13 exercises that included dynamic flexibility, core and lower body strengthening, agility, plyometric, and balance exercises. The program was created from previous PTPs shown to effectively reduce injury risk[21,22] and improve neuromuscular control[5,11,23] in order to match the capabilities of the youth soccer players.[5] Coaches independently delivered the 10–12 min PTP as part of their regular warm-up routine before every practice and game, 3 times per week, for 8 weeks. Age-appropriate exercises that incorporated soccer skills and motions were employed with the option of various exercise progressions to minimize player stagnation and boredom. As players mastered exercises in phase I, coaches were instructed to transition to more demanding exercises in phase II. The transition occurred approximately four weeks into the eight-week season and was individualized at the team level to match PTP exercises with movement skill level. Bi-weekly team visits by a member of the research team (LJD) evaluated program fidelity, compliance and adherence. These visits also allowed coaches to resolve questions or concerns about the program and ensured proper matriculation to the second phase of the PTP program.

Pre- and post-intervention measures occurred in an identical manner less than one week before and after the intervention period, before the start of games/practices to eliminate fatigue as a confounding factor. Height and weight were measured using a stadiometer and calibrated scale. Physical maturation was assessed using the Pubertal Maturational Observational Scale.[24] Movement technique was assessed by the quality of three repetitions of a standardized jump-landing task as described by Padua et al.[20] Two standard digital cameras (Canon FS400-A, Melville, NY) were placed 3 m directly in front and to the side of the landing zone to captured frontal and sagittal plane data.

Digital video data from the jump-landing task were graded using the LESS.[20] A single, experienced researcher blinded to test session and treatment group scored all trials. The LESS clinical movement analysis tool has been validated in a military cadet population[20] and evaluates specific jump-landing characteristics that are associated with lower extremity risk including ACL rupture.[25,26] The LESS predicts lower extremity injury risk in youth soccer players aged 11–18 years old.[7] A high LESS score indicates poor technique and a corresponding high risk of injury. The total number of errors observed during each trial was counted and averaged among the