ISRCTN16780192 https://doi.org/10.1186/ISRCTN16780192

Effects of plyometric and balance training on neuromuscular control of recreational athletes with functional ankle instability: a randomized controlled laboratory study

Submission date
05/05/2021

Recruitment status
No longer recruiting

Registration date
07/05/2021

Overall study status
Completed

Last Edited
13/06/2023

Condition category
Musculoskeletal Diseases

[_] Prospectively registered
[X] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
Ankle sprains injuries are the most common lower limb injuries. These can influence sports activities and lead to diminishing athletic performance. Balance training is an effective way of reducing episodes of inversion in individuals with chronic or functional ankle instability (FAI) and improving joint position error. In addition, plyometric exercise (jump training) is recognized as an effective strategy for “reactive neuromuscular training” since it changes the motor unit recruitment pattern and muscle activity by facilitating the sensorimotor system and increases the excitability of the neurological receptors. Even though the updated evidence obviously shows that plyometrics improves neuromuscular control through the facilitation of the neurological receptors, the feasibility and effects of plyometric training for the neuromuscular rehabilitation of athletes with FAI are unclear. Also, the effects of isolated plyometric training and combined with balance training on neuromuscular adaptation have not been directly compared among athletes with FAI. This study aims to investigate the change of joint position sense and neuromuscular activity of the unstable ankle after a six-week integrated balance /plyometric training and six-week plyometric training.

Who can participate?
Collegiate recreational athletes with functional ankle instability (18-30 years old) were recruited and screened using the Cumberland Ankle Instability Tool questionnaire (the score lower than 24 indicated severe instability).

What does the study involve?
Recreational athletes with functional ankle instability were recruited and allocated into three groups: plyometric group, plyometric integrated with balance training group, and control group. Ankle joint position sense, integrated electromyography (EMG), and balance adjusting time during medial single-leg drop landing tasks was measured before and after a six-week training period.

What are the possible benefits and risks of participating?
Both training groups would increase their lower limb muscles strength and power, and improve the neuromuscular system, leading to reduce the recurrence of ankle sprain risk factors. However, this study might have some minor risks such as muscular fatigue after the training or slip and fall during performing a single-leg drop landing test.

Where does the study run from?
The study was conducted at motion analysis laboratory, Department of Biomedical Engineering, National Cheng Kung University, Tainan, Taiwan

When is the study starting and how long is it expected to run for?
March 2009 to June 2010

Who is funding the study?
Investigator initiated and funded

Who is the main contact?
Associate Professor Cheng-Feng Lin, connie@mail.ncku.edu.tw

Contact information

Type(s)
Scientific

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Study information

Scientific Title
Effects of plyometric and balance training on neuromuscular control of recreational athletes with functional ankle instability: a randomized controlled laboratory study

Study objectives
Both isolated plyometric training and integrated balance and plyometric training improve the joint position error, minimize the time required to stabilization, and increase EMG activity of ankle muscles.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 26/06/2009, Institutional Review Board of National Cheng Kung University Hospital (No.138, Sheng Li Road, Tainan, Taiwan 704, R.O.C.; +886-6-2353535; em73636@mail.hosp.ncku.edu.tw), ref: ER-98-103

Study design
Interventional randomized controlled trial

Primary study design
Interventional

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Isolated plyometric training and integrated balance and plyometric training on neuromuscular control of recreational athletes with functional ankle instability

Interventions
Participants were blinded to the study group and randomly assigned by the sealed opaque envelopes to the plyometric group (P), integrated balance training/plyometric training group (BP), and control group (C). Each training program lasted for 6 weeks with 3 individual sessions per week. Each individual was requested to participate in at least two-thirds of the sessions (i.e., 12 of the 18 sessions) and was advised that failure to do so would result in their exclusion from the study. A licensed physical therapist trained and supervised all the participants in the training period, and properly adjusted the intensity of the training protocol depending on the ability and performance of each participant. The content of plyometric training started with simple squat jump and progressively to challenged jump and hops while the integrated balance training /plyometric training group involved jumps and balanced squat or balanced lunge every week.

Intervention Type
Behavioural

Primary outcome(s)
1. Joint Position Sense was measured using electrogoniometer before and after the training programs
2. muscle activity of the lower limb muscles was measured using a surface EMG system (Myomonitor, Delsys Inc., Boston, USA) before and after the training programs
3. The adjusting time parameter during single-leg medial drop landing was measured using the Kistler force platform (Type 9281B, Kistler Instrument Corp., Winterhur, Switzerland) before and after the training programs

Key secondary outcome(s))
There are no secondary outcome measures

Completion date
24/06/2010

Eligibility

Key inclusion criteria
1. Recreational athletes aged 18-30 years old in sports activities (at least 1-2 hours each time, 2-3 times per week)
2. Have experienced at least one prior ankle inversion sprain that results in swelling, pain and dysfunction over the past 12 months
3. Have experienced multiple ankle sprains or ankle “giving way” events over the past 12 months
4. Score less than 24 on the CAIT questionnaire
5. Clinically test negative in anterior drawer and talar tilt tests

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Upper age limit
30 years

Sex
All

Total final enrolment
30

Key exclusion criteria
1. History of bilateral ankle sprains
2. The ankle with the lower CAIT score was chosen for testing
3. Present neurological disorder, lower extremity injuries that would affect balance, or an ankle sprain within a month

Date of first enrolment
07/10/2009

Date of final enrolment
05/05/2010

Locations

Countries of recruitment
Taiwan

Study participating centre
National Cheng Kung University
Department of Physical Therapy
College of Medicine
No.1 University Road
Tainan
Taiwan
70101

Sponsor information

Organisation
National Cheng Kung University Hospital

ROR
https://ror.org/04zx3rq17

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are/will be available upon request from Prof. Cheng-Feng Lin, connie@mail.ncku.edu.tw for de-ID raw data or averaged mean values of our outcome variables. The signed consent form will not be provided to public.

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		15/05/2021	13/06/2023	Yes	No
Protocol article		01/03/2014	07/05/2021	Yes	No