How Grip Strength and ROM Affect Wrist Injuries in Gymnast

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Abstract

Gymnasts for years have struggled to find relief for their wrist pain during a normal day at practice. This research study focuses on female adolescent athletes who have acute pain in their wrists ranging from mild to moderate pain. Increasing range of motion in the wrist along with increasing grip strength has shown to decrease overall wrist pain in acute scaphoid lunate ligament tears. The study will put gymnast through a 12-week intervention focusing strengthening grip strength and range of motion. The study hypothesizes that by improving both range of motions and grip strength will alleviate pain in female adolescent gymnast.

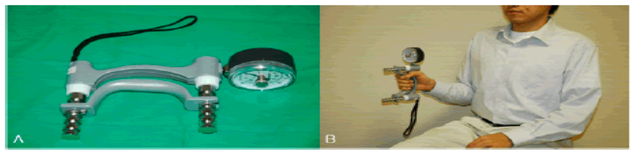

Figure 1: Jamar grip strength dynamometer (Hydraulic Hand Dynamometer, 5030J1) and the position of measurement (A) Jamar dynamometer is set at the level II (B) The subject is in a seated position with the shoulder adducted, not rotated to either side, and the elbow flexed to 90 degrees with the forearm and wrist in neutral position.

Methods

This research study was designed after a case study done by Hincapie (2016). Participants will begin by completing a Par-Q and a medical history to provide prescreening for each individual. The participants will be under the legal age for consent they will need their parents to fill out a parental inform and consent form to let them participate in the study. Once a parental inform and consent form is completed the athlete will then need to complete an informed consent form before participating in the study.

Participants

The participants age will be 9-14 years of age. They will be gymnasts that practice 12-24 hours a week in an annual schedule.

Introduction

Approximately 25% of all sports-related injuries include the wrist (Avery, Rodner, & Edgar, 2016). On average, 82% of gymnasts who have trained every week since they were six years old have experienced wrist pain during their gymnastics career (Guerra, et al., 2016). A gymnast can have up to 16 times their body weight on their bones, ligaments, tendons, and joints during a typical training session (Linderman, 2016). There is a 98% chance of injury in a competitive gymnast's career (Hassmannová, Pavlů, & Nováková, 2019). When gymnasts are participating in gymnastics, the wrist requires an extensive amount of dorsiflexion in order to meet the demands of the skills they are performing (Farana, et al. 2016). The muscles that are associated with grip strength have a large impact on the stability of the bones in the wrist. Wrist flexor muscles are highly task-dependent with a large role in producing handgrip and wrist flexion forces and serve a primary role of wrist stabilization in balancing the forces produced by wrist flexors (Forman, Forman, Robathan, & Holmes, 2019).

Review Of Literature

The most common wrist injury is call Gymnast Wrist (GW) (Benjamin, Engel, & Chudzik, 2017). Gymnast wrist is a growth plate injury (Benjamin, Engel, & Chudzik, 2017). This injury is a concern in the female adolescent athlete with young, growing bones (Benjamin, Engel, & Chudzik, 2017). Due to the young skeleton, the growth plate is more exposed to injury because the joint capsule and ligaments are stronger than the cartilaginous growth plate (Benjamin, Engel, & Chudzik, 2017). Repetitive axial loading and hyper dorsiflexion of the wrist lead the body's forces onto the unfused distal radius which causes inflammation of the epiphysis and widening of the growth plate (Benjamin, Engel, & Chudzik, 2017). Handgrip strength (HGS) is a simple measure of muscular function in the upper body. In this study, wrist flexibility and grip strength will be observed along with a questionnaire (WHOQOL-100) evaluating the gymnasts wrist pain, how long the pain has been present, and when the pain occurs. It is hypothesized that people with greater grip strength, an increase in dorsiflexion and flexibility in the wrist will have less overall pain.

Session	Goal	Treatment technique	Description
1-4	Proprioceptive awareness Improve JPS Retrain physiological motion of the wrist Re-education of wrist muscles. Conscious neuromuscular rehabilitation	Mirror therapy Blinded reproduction of passive angle (sound wrist) with active reposition of the affected wrist DTM with no weight Isometric exercise for ECRL, FCR, and FCU	5-10 min Nonaffected wrist placed in different angles (passively). The patient actively placed the affected wrist in the target angle, 5 times per session With crumbled paper avoiding shoulder or elbow motion Hand resting flat on the table, manual resistance on dorsal-radial side of hand (for ECRL). Hand, resting in supination on the table, manual resistance on palm (10 times, 5 s hold)
5-8	Re-education of wrist stabilizers Strengthening of wrist stabilizers Improvement of neuromuscular control and endurance of wrist muscles Unconscious neuromuscular rehabilitation	Rhythmic stabilization DTM with weight Reactive muscle activation	In different angles of wrist flexion/extension, coactivation of agonists and antagonists using manual perturbation applied by the therapist (3 s for 10 times) Starting with 1 lb medicine ball and progressing according to the patient's tolerance. 2 sets of 10 repetitions Gyroscope. Starting with 3-5 repetitions of 30 s of activation and 30 s rest period in between
9-20	**Same goals as in previous weeks Combination of conscious and unconscious neuromuscular exercises General conditioning of the upper extremities**	**DTM with weight Gyroscope Body blade Throws into rebounder Simulation of movements for Kuhapdo Upper body ergometer**	**Progressive increment in weight Progressive increment in period of activation or oscillation (up to 1 min) and repetitions Starting with 1 lb medicine ball, throwing and catching with forearm in pronation 2 sets of 10 Using weighted bar (starting with 1 lb)**

Table 1. Rehabilitation Program

Figure 2. Dart throwing motion used in rehabilitation program

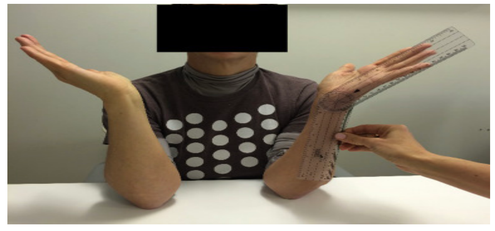

Figure 3. Measuring joint position sense with contralateral matching

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