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Original Research Article

Effects of the Graston Technique on Overhead Throwing Velocity in Collegiate Baseball Players

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Abstract

Introduction: Graston Technique (GT) is a form of Instrument Assisted Soft Tissue Mobilization (IASTM) that utilizes stainless steel instruments to allow clinicians to detect soft tissue adhesions in a precise manner. This form of IASTM is currently used as a therapeutic modality and has not been formally utilized as a performance enrichment instrument. The purpose of this study is to evaluate the effects of GT on the overhead throwing velocity of baseball players. **Methods:** Nine collegiate club baseball participants (18-22 years) were involved in a total of eight 30-minute treatment sessions (GT group), while six participants were assigned to the control group. The study had a timespan of four weeks with treatments occurring twice a week with a minimum of 48 hours between sessions. Treatment sessions consisted of 10 minutes of hot pack application over the dominant posterior shoulder, 8 minutes of GT followed by glenohumeral (GH) stretching in the motions of external rotation (ER), internal rotation (IR) and horizontal adduction. **Results:** The two-way repeated measures ANOVA indicated significant interaction (group x time) effects on throwing velocity, ER, and IR ($p < .05$). Therefore, paired samples t tests were employed, which indicated no change in throwing velocity from baseline (M=30.786; SD=4.323) to posttest (M=30.657; SD=3.972) among GT group, while significant decrease was shown among control from baseline (M=32.644; SD=2.307) to posttest (M=34.277; SD=1.744). No change in IR occurred among GT group, while significant increase observed in control from baseline (M=62.56; SD=12.095) to posttest (M=85.00; SD=16.086). Both GT and control groups increased ER from baseline to posttest. **Conclusions:** Use of GT may prevent a decrease in throwing velocity in apparently-healthy baseball players. It would be of interest to examine the impact of GT on throwing during the season among overhead throwers with chronic GH conditions.

Key Words: IASTM, ROM, Internal Rotation, External Rotation, Glenohumeral

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Introduction

Graston Technique (GT) is a form of Instrument Assisted Soft Tissue Mobilization (IASTM) that utilizes the use of stainless steel instruments designed to adapt to various tissue conformations and allows the clinician to detect soft tissue adhesions in a precise and specific manner. Graston instruments have beveled edges that are more advanced at detecting fibrous adhesions in muscles than the pads of the fingers[1]. It is hypothesized that GT re-initiates the inflammatory process of degenerated connective tissue by introducing a controlled amount of microtrauma to the affected region[2]. Healing is then accomplished through the proliferative invasion of blood, nutrients and fibroblasts to the area[2]. One of the areas in the rehabilitative field in which GT has been applied is the athletic population involving overhead throwing. Graston Technique is currently used as a therapeutic modality, but if its effects are correlated with performance enhancement, it could increase the prevalence of the therapy's usage. The glenohumeral (GH) joint is the most mobile joint in the body and is at greater risks for injury, especially in overhead throwing athletes[3]. Overhead throwing mechanics involves the four main muscles of the rotator cuff and are often impacted by the forces of the throwing motion. These muscles can become shortened or elongated in the process of repetitive overhead throwing mechanics and lead to compensatory or insidious injuries[4]. Upon reviewing the relevant research on the effects of GT as well as throwing velocity and shoulder range of motion (ROM), the authors have discovered a need for further examination on the effectiveness of GT on athletic performance (ie., throwing velocity).

Current research findings show that GT increases ROM. A study conducted by Heinecke, Thuesen and Stow[5] suggests that when GT is applied on the rotator cuff muscles— supraspinatus, infraspinatus, teres minor, subscapularis—the technique increases IR and horizontal adduction at the GH joint as seen by a paired-samples t test. A similar study by Laudner, Compton, McLoda, & Walters[6] was conducted to assess the acute effects of IASTM for improving posterior shoulder ROM (GH horizontal adduction & IR) in collegiate baseball players. Baseball players often complain of generalized tightness in the musculature of their posterior shoulders after pitching[7] Limited GH ROM is a common trait seen in baseball players because of the repetitive rotational and distractive forces exerted onto the teres major and minor, as well as the rhomboids and middle trapezius fibers during the deceleration phase of overhead throwing[6]. According to Dwelly et al.[8], changes in ROM may be adaptive, but some changes in ROM are associated with pain, decreased performance, and shoulder disorders. It is widely accepted in the athletic training profession that decreased ROM in the GH

joint of baseball players makes them more prone to a wide variety of shoulder injuries. Participants in the study completed by Launder and colleges included 35 collegiate baseball players that were randomly divided into two groups. The first group received an application of IASTM to the posterior shoulder, whereas the second group did not receive any treatments. It was found that the group receiving IASTM presented greater improvements in GH horizontal adduction ROM as compared to the control group. It was also found that the IASTM group had GH internal rotation ROM improvement[6]. This study suggests that the application of IASTM may be used to provide acute ROM improvements to GH horizontal adduction and GH internal rotation.

Researchers have also found ways to increase overhead throwing velocity in athletes. A study conducted by Carter et al.[9] suggests that the effects of upper extremity plyometric training (Ballistic Six) increases overhead throwing velocity and functional strength in collegiate baseball players. The study included an 8-week training protocol involving one group performing the Ballistic Six upper extremity plyometric exercises, and a control group performing regular strength training with no plyometric exercises. After the 8-week training period was completed, the plyometric training group had increased throwing velocity by 2.00 miles per hour, while the control group had increased throwing velocity by only 0.27 miles per hour[9]. The utilization of the plyometric training program throughout the off-season was suggested to be effective in improving shoulder functionality; yet supplementation of GT during in-season training could be done to keep lasting effects throughout the season as well as give quicker effects to athlete performance.

Previous literature lacks information regarding the use of Graston Technique and the improvement of athletic performance. The significance of this study is to evaluate this problem and provide findings that rationalize the use of GT to improve athletic performance. Since previous GT research has been shown to increase GH joint ROM, this study focuses on the rotator cuff muscles of the shoulder and overhead throwing velocity in collegiate baseball players. The purpose of this research is to determine the effectiveness of 4-week GT treatment on shoulder ROM and overhead throwing velocity in college-aged baseball players. It is hypothesized that 4-weeks of GT soft tissue mobilization will increase overhead throwing velocity and ROM at the GH joint in baseball players.

Methods

Participants

The research participants consisted of 17 university club baseball players ranging from 18.5-22.7 years of age. Participants were asymptomatic and had no injuries 6 months prior to participating in the treatment sessions. The participants were

recruited for research by means of volunteer participation. The participants were randomly divided into two groups based on player's position on the field (i.e., pitcher, catcher, outfield, short-stop, basemen). The experimental group consisted of 9 participants, receiving a therapeutic heat pack, GT and passive stretching. Meanwhile, the 8 control participants simply completed baseline and post-experimental overhead velocity assessments without any treatment. Prior to participation, the Institutional Review Board assessed and approved the study. The participants were informed about the study's components, and informed consent was received from each participant prior to data collection.

Experimental Design

Each player's range of motion was measured prior to initial treatment. Internal and external rotation will be assessed in the supine position with a goniometer by the same investigator each session. During each treatment session, participants received a hot pack on the posterior shoulder complex while laying supine for 10 minutes. It was shown in a study done by Nakano et al.[10], that increased ROM was sustained longer after treatments of heating and stretching compared to stretching alone[10]. GT was applied to the heated shoulder by a qualified study investigator in the scripted manner described previously. The participants were then stretched by the investigators. The stretches performed were internal and external rotation and cross body adduction of the shoulder. Each stretch was held for 30 seconds and repeated 3 times per stretching position. All participants were involved in a total of eight 30-minute treatment sessions, with two throwing data collection periods pre and post experimentation. The study occurred over a four week period with treatments taking place twice a week with a minimum of 48 hours between sessions

Instrumentation

For this study, the following instruments were utilized to collect data:

Graston Technique Instruments: The use of Graston Technique employs 6 different stainless steel instruments that were applied in different strokes to create soft-tissue mobilization. For our experimentation, instruments GT-2, GT-3, GT-4, and GT-5 were used. Each instrument was to be used for 2 minutes for a total of an 8-minute treatment. The order we used each tool is GT-4, GT-5, GT-2, and then GT-3. The target area of the Graston Technique treatment will be the infraspinatus, teres minor, and supraspinatus muscles along with upper/middle trapezius and part of the posterior deltoid. Each instrument covered each muscle within the 2 minute allotted time frame.

Pocket Radar Gun: The hand-held device measures speed in miles per hour based on

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objects moving towards the device. The device complies with radio frequency transmissions (Part 15) as noted by the Federal Communications Commission. Player's throwing velocity was recorded once before their first treatment session and once after their last treatment session. Posttest velocity was recorded no earlier than 24 hours after the participant's final treatment session. Participants threw from a distance of 60 feet toward the Pocket Radar. Participants warmed up with overhead throwing repetitions with a baseball for 10 minutes with another participant prior to their collected overhead throwing velocity. After 10 minutes of warm up, official throwing velocity was recorded in miles per hour. Each player threw the ball at their maximum speed 5 times. Each trial throw was recorded and the greatest velocity will be considered for their final throwing velocity data.

Goniometer: Each player's range of motion of the glenohumeral joint was recorded in the motions of external rotation and internal rotation by the use of a goniometer. This hand-held device uses degrees to measure motions of a joint. The degrees of motion was assessed by the same researcher each time to ensure intra-rater reliability amongst data collected. Participants were measured in the supine position with active range of motion performed by the participant. The greatest range of motion achieved out of two attempts in each movement was taken into account when assessed against post-experimental ranges of motion data.

Statistical analyses

The research conducted in this study is of the pre-test post-test randomized design. This consists of a baseline collection of the velocity of overhead throwing and collecting similar data following the four weeks of treatment sessions. This research is focusing on an independent variable of GT sessions, and the dependent variable being ultimately the participant's throwing velocity. For analysis of this data, use of SPSS version 19 (Statistical Package for the Social Sciences) was utilized. The group by time two-way repeated measures ANOVA was utilized to find the impact of GT treatment on throwing velocity at pre and post-treatment between control and GT groups. A p value of less than 0.05 was set to indicate statistical significance.

Results

Participant characteristics are presented in Table 1. Throughout the course of the research period, one participant removed himself from the study resulting in a total of seven participants remaining within the control group, and nine in the experimental group. A total of 16 participants were ultimately analyzed from baseline to posttest. The two-way repeated measures ANOVA indicated significant interaction (group x time) effects on throwing velocity, ER, and IR ($p < .05$). Experimental group resulted in significant increases in velocity

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(*p*=.013), IR (*p*=.011), ER (*p*=.007) as compared with baseline and posttest values. Therefore, simple effect paired samples t tests were employed, which indicated no change in throwing velocity from baseline (M=30.79; SD=4.32) to posttest (M=30.66; SD=3.97) among GT group, while a significant decrease was shown among the control from baseline (M=32.64; SD=2.31) to posttest (M=34.28; SD=1.74). There was no change measured with IR among the GT group, while there was a significant increase observed in the control from baseline (M=62.56; SD=12.10) to posttest (M=85.00; SD=16.09). The collection of ER ROM increased for both the GT group as well as the control group. The experimental group baseline increasing from (M=81.14; SD=11.51) to a posttest of (M=90.14; SD=14.74) and the control group baseline increasing from (M=80.33; SD=15.79) to posttest data of (M=105.78; SD=15.63).

Table 1. Participant characteristics.

Group	Age (yr)	Height (in)	Weight (lb)
GT group (n = 9)	20 ± 2[a]	72 ± 2	195 ± 35
Control group (n = 7)	20 ± 1	70 ± 3	165 ± 10

[a](Values are mean ± SD).

Discussion

Overhead throwing mechanics involving the rotator cuff musculature is known to be impacted by the forces of the throwing mechanics, especially those of deceleration. The infraspinatus and supraspinatus musculature can become shortened or elongated in the process of repetitive overhead throwing mechanics and lead to decreased ROM, as seen frequently in baseball athletes. Graston Technique is currently used as one of the therapeutic modalities. Findings of this study suggest the potential of maintaining or improving overhead throwing speed in the offseason as a result of therapeutic use of GT.

In previous research conducted by Heinecke, Thuesen, and Stow[5], it was suggested that when GT was applied to the rotator cuff muscles, it increased ROM at the GH joint. The research conducted by Heinecke, Thuesen, and Stow[5] reported the increase of ROM in IR by both groups of participants and an increase in horizontal adduction within the recently collected research data. This suggested that GT had an impact on improving ROM at the GH joint when applied to the rotator cuff muscles. Another study conducted by Laudner et al.[6], assessed acute effects of IASTM for improving posterior shoulder ROM in collegiate baseball players, similar to the GT treatment done to the

experimental group within this study in hopes of improving the participant's overhead throwing velocity. Laudner et al.[6], found that the use of IASTM increased horizontal adduction and IR of collegiate baseball players, which was in conjunction with the findings of Heinecke, Thuesen and Stow[5]. The limited GH ROM is a common trait seen in baseball players because of the repetitive rotational and distractive forces exerted onto the posterior shoulder during the deceleration phase of overhead throwing[6].The increase in ROM among the control group suggest that, once activity and overhead throwing ceases, the IR and ER of the dominant throwing arm normalizes due to the lack of deceleration forces being placed on them during the offseason.

Former research has discovered alternative methods to increase overhead throwing velocity in athletes, as in a study conducted by Carter et al.[9], suggesting that the effects of upper extremity plyometric training increased overhead throwing velocity and functional strength in collegiate baseball players. The outcome of the study conducted by Carter et al.[9], focused on strengthening the musculature as a means of improving velocity by increasing the force produced by the rotator cuff muscles. This is an opposing concept to the use of a therapeutic modality to produce the same outcome as this study observes. The use of GT in the future may allow for the prevention of a decrease in throwing velocity in apparently-healthy baseball players, as found in this experimentation.

When the data collected within this study were compared from baseline to posttest, the significance, as analyzed by the two-way repeated measures ANOVA, was considered relevant and is accepted. Yet once the data was split to be analyzed individually by control and experimental group, by means of paired samples t test, the data seemed less significant overall for an increase in overhead throwing velocity as stated in the results section.

The understanding behind the indicated lack of change in throwing velocity from baseline to posttest among GT group, is that the Graston treatment may have helped eliminate the offseason "normalization" of the rotator cuff musculature. This is stating that the GT treatment keeps the musculature in a more flexible, greater ROM state, but the muscles are still able to perform and adhere to the forces of throwing mechanics. The experimental group data suggested that the participant's muscles could adapt to the overhead motion in a more functional way than those participants of the control group, due to their lack of physical demand on the throwing shoulder musculature during the off season. The "normalization" of ROM in the throwing shoulder of the control group was demonstrated by the changes in IR and ER within the study's data collection. There was no change in IR noted

among the GT group, while a significant increase was observed in control group from baseline to posttest. Both GT and control groups increased ER from baseline to posttest which indicated the reduction of deceleration force compensation of the rotator cuff musculature due to the decreased amount of throwing in the offseason.

The outcome of this study may have been influenced by certain aspects of data collection, a major factor being the minimal sample size used. Volunteer participation was utilized in recruiting participants from the roster of the collegiate club baseball team organized at a Division III university. This lead to a smaller sample of men willing to donate four weeks of time to participate in the study. Other limitations that could have affected the validity of this study was if the participants did not put in full effort for baseline or posttest ROM measurements or intra-rater reliability when using the goniometer to measure ROM. Lastly, individual upper extremity strengthening done by the participants during the data collection period could have affected the reliability of the posttest velocities. However, a survey was done following data collection to gather information about outside strengthening or plyometric activities in which none of the participants claimed to have performed throughout this time period.

CONCLUSION

Prior to conducting this study, it was hypothesized that the data collected would suggest an increase in overhead throwing velocity due to increased ROM at the GH joint following four weeks of GT soft tissue mobilization. This hypothesis was left with little support based on the minimal sample size utilized. It is noted within the results of the study that the treatment group participants increased their throwing velocity as compared to that of the control group. This increase was not considered statistically significant. Overall, it is understood by these results that GT treatment may prevent the decrease in overhead throwing velocity in apparently-healthy baseball players, but assessment of its effects would be more useful among those suffering from chronic GH conditions.

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References

1. Kmiecik J, Frattini C, DiNicola A, Wallace S, Cooper K. (2011). ART vs. Graston and their effects on hamstring flexibility. 1-13. September 2011. Accessed February 2012.
2. Hammer W. (2008). The effect of mechanical load on degenerated soft tissue. *J Bodyw Mov Ther*, 12, 246-256.
3. Senbursa G, Baltacı G, Atay A. (2007). Comparison of conservative treatment with and without manual physical therapy for patients with shoulder impingement syndrome: A

prospective, randomized clinical trial. *Knee Surg Sports Traumatol Arthrosc*, 15, 915-921.

4. Scher S, Anderson K, Weber N, Bajorek J, Rand K, Bey M. (2010). Associations among hip and shoulder range of motion and shoulder injury in professional baseball players. *J Athl Train*, 45, 191-197.
5. Heinecke M, Thuesen S, Stow R. (2014). Graston technique on shoulder motion in overhead athletes. *J Undergrad Kines Res,* 10, 27-39.
6. Laudner K, Compton B, McLoda T, Walters C. (2014). Acute effects of instrument assisted soft tissue mobilization for improving posterior shoulder range of motion in collegiate baseball players. *Int J Sports Phys Ther*, 9, 1-7.
7. Reinold M, Wilk K, Macrina L, Sheheane C, Dun S, Fleisig G, Crenshaw K, Andrews J. (2008). Changes in shoulder and elbow passive range of motion after pitching in professional baseball players. *Am J Sports Med*, 36, 523-527.
8. Dwelly P, Tripp B, Tripp P, Eberman L, Gorin S. (2009). Glenohumeral rotational range of motion in collegiate overhead-throwing athletes during an athletic season. *J Athl Train*, 44, 611-616.
9. Carter A, Kaminski T, Douex Jr A, Knight C, Richards J. (2007). Effects of high volume upper extremity plyometric training on throwing velocity and functional strength ratios of the shoulder rotators in collegiate baseball players. *J Strength Cond Res*, 21, 208-215.
10. Nakano J, Yamabayashi C, Scott A, Reid W. (2012). The effect of heat applied with stretch to increase range of motion: A systematic review. *Phys Ther Sport*, 13, 180-188.