Scapular Position in Recreational Overhead Athletes.

M.Kvist & E.H. Bang
School of Medicine & Health

AALBORG UNIVERSITY
DENMARK

Introduction

The recreational and competitive practice of acrobatic sports is growing rapidly around the world [1]. Many studies described the injuries affecting young artistic gymnasts, but only few concerned acrobatic sports [1, 2]. The pathophysiology of the injuries occurring in acrobatic sports remains unclear, especially during training and competition [1, 2]. Acrobatic sports require adapted skills from artistic gymnastics. It may therefore be hypothesised that the injuries occurring in acrobatic sports could overlap with those occurring in artistic gymnastics [1, 2]. Adult gymnasts show a high prevalence of various shoulder pathologies [3, 2]. The causes of shoulder pain and dysfunction in the overhead athlete are controversial, however a common precursor is that underlying mechanisms lead to alterations in the positioning of the shoulder during loading [4, 5].

Objective

The objective of this study was to investigate possible scapular characteristics related to shoulder pain in a specific overhead athlete population namely Acrobatic gymnasts with a high weekly training volume involving overhead activity with a symmetrical bilateral load profile (handstand support). The aim is 2-fold:

1. To present values on scapular positioning and pectoralis minor length in acrobats associated with or without pain.
2. Identify possible factors distinguishing acrobatic athletes in this population with shoulder pain from those without.

Results

37% of 27 athletes reported shoulder pain, 29% women and 45% men, mean SDQ score 47.5% $\pm$ 13.6. Four Athletes reported pain in the dominant, and six athletes reported pain in the non-dominant shoulder. There were no significant differences in the mean scapular upward rotation or mean acromial index distance between the pain and no-pain groups. However when comparing the symptomatic and asymptomatic shoulder in the pain group during active retraction a significant difference was observed $p < 0.05$.

Discussion

This study is the first to examine scapular position and pec-minor length in Acrobatic gymnasts using this method, and highlights several interesting aspects of the evaluation of scapular positioning and pectoralis minor length in Acrobatic gymnasts. Although the assessment protocol was not able to identify statistically significant differences in scapular positioning or pectoralis minor length between athletes with or without shoulder pain, there appear to be some significant differences between the athletes symptomatic and asymptomatic shoulder.

Scapular upwards rotation

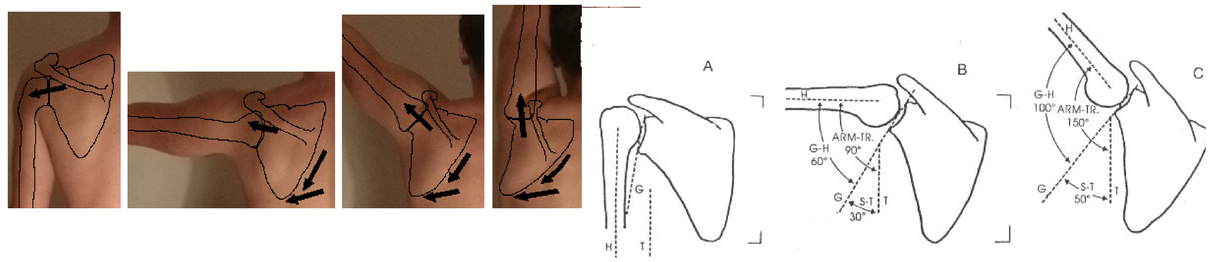

Fig. 1: During total shoulder elevation (TSA) the scapula rotates upwards on the thorax as illustrated on the images, this is known as the Scapulohumeral rythm. It is evident that any limitations in the upwards rotation of the scapula can affect the positioning and subsequently the loading of the shoulder joint (art. glenohumerale) during overhead activity

Methods

Scapular positioning during total shoulder abduction, and acromial distance were assessed in a study of 27 voluntary overhead athletes (Acrobatic gymnasts, 16 women and 11 men) with a mean age of 32.5 $\pm$ 6.9 years, weight 64.8 $\pm$ 10 kg and a height of 170.7 $\pm$ 9.3 cm. All reference points used during the inclinometry and acromial distance was palpated [6] [7]. After acquiring the athlete's weight and height, and gathering relevant demographic data, the experimental assessment was performed in random order:

- measurement of forward shoulder posture (Acromial distance, the measurement from the posterior border of the acromion to the table)
- the measurement of scapular upward rotation (inclinometry). Scapular positioning of both shoulders was assessed.
- The athletes that reported shoulder pain (existing or developed), was asked to fill out the Shoulder Disability Questionaire (SDQ).

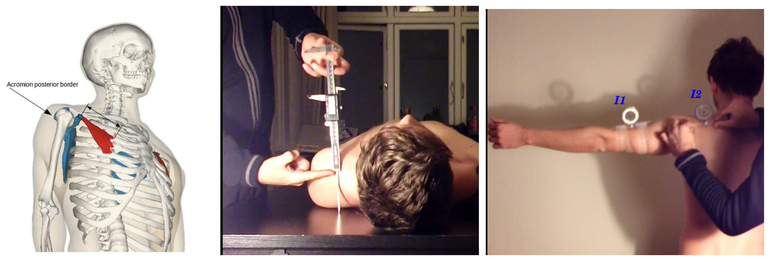

Fig. 2: (A) Pectoralis minor muscle (red) and shoulder blade (blue). Since the pec-minor attaches to the coracoid process it is easy to see how the length of the pec-minor affects the position of the acromion. (B) Measurement of Acromion-table distance. (C) Inclinometry: measuring scapular upwards rotation by means of two inclinometers. (Pec-minor by Anatomography - CC BY-SA 2.1).

Conclusion

None of the scapular positioning or acromial distance measures showed any significant differences between the pain and no-pain group, however there appear to be some significant differences between the athletes symptomatic and asymptomatic shoulder. Our results show similar baseline values to previous studies on symptomatic and asymptomatic overhead athletes [8, 9, 10, 11]. These results might indicate that although the athletes without shoulder pain did not report any pain, that they are at increased risk for developing shoulder problems. The focus on "flexibility" training in acrobatic sports, may offset the possibility of discovering shoulder limitations until the injury actually occurs. This underlines the necessity for development of prevention programs [3].

References

[1] Grapton, X., Lion, A., Gauchard, G.C., Barrault, D., Perrin, P.P.: Specific injuries induced by the practice of trampoline, tumbling and acrobatic gymnastics. Knee Surg Sports Traumatol Arthrosc **21**(2), 494–499 (2013)

[2] Purnell, M., Shirley, D., Nicholson, L., Adams, R.: Acrobatic gymnastics injury: Occurrence, site and training risk factors. Physical Therapy in Sport **11**(2), 40–46 (2010)

[3] Gerhardt, C., Doyscher, R., Boschert, H.P., Scheibel, M.: [The gymnastics shoulder]. Orthopade **43**(3), 230–235 (2014)

[4] Comerford, M., Mottram, S.: Movement and stability dysfunction – contemporary developments. Man Ther (6), 15–26 (2001)

[5] Joshi, M., Thigpen, C.A., Bunn, K., Karas, S.G., Padua, D.A.: Shoulder external rotation fatigue and scapular muscle activation and kinematics in overhead athletes. J Athl Train **46**(4), 349–357 (2011)

[6] Karduna, R., McClure, P., Michener, L., Sennet, B.: Dynamic measurement of three-dimensional scapular kinematics, a validation study. (123), 184–190 (2001)

[7] Lewis, J., Green, A., Reichard, Z., Wright, C.: Scapular position: the validity of skin surface palpation. Man Ther (7), 26–30 (2002)

[8] Struyf, F., Nijs, J., Meeus, M., Roussel, N.A., Mottram, S., Truijen, S., Meeusen, R.: Does scapular positioning predict shoulder pain in recreational overhead athletes? INTERNATIONAL JOURNAL OF SPORTS MEDICINE **35**(1), 75–82 (2014)

[9] Struyf, F., Nijs, J., De Graeve, J., Mottram, S., Meeusen, R.: Scapular positioning in overhead athletes with and without shoulder pain: a case-control study. Scandinavian Journal of Medicine & Science in Sports **21**(6), 809–818 (2009)

[10] Lukasiewicz, A., McClure, P., Michener, L., Pratt, N., Sennett, B.: Comparison of 3-dimensional scapular position and orientation between subjects with and without shoulder impingement. J Orthop Sports Phys Ther (29), 574–586 (1999)

[11] Graichen, H., Stammberger, T., Bonél, H., Wiedemann, E., Englmeier, K.-H., Reiser, M., Eckstein, F.: Three-dimensional analysis of shoulder girdle and supraspinatus motion patterns in patients with impingement syndrome. J Orthop Res (19), 1192–1198 (2001)