CLINICAL NOTES

Shoulder Impingement in Tennis/Racquetball Players Treated With Subscapularis Myofascial Treatments

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Conservative care of the athlete with shoulder impingement includes activity modification, application of ice, nonsteroidal anti-inflammatory drugs, subacromial corticosteroid injections, and physiotherapy. This case report describes the clinical treatment and outcome of three patients with shoulder impingement syndrome who did not respond to traditional treatment. Two of the three were previously referred for arthroscopic surgery. All three were treated with subscapularis trigger point dry needling and therapeutic stretching. They responded to treatment and had returned to painless function at follow-up 2 years later.

Key Words: Myofascial pain syndromes; Shoulder impingement syndrome; Tendinitis; Tennis; Rehabilitation.

SHOULDER IMPINGEMENT is a common problem in tennis/racquetball players, as well as in other athletes whose activities require overhead motions.[1,2] In the nonathletic population with shoulder impingement, physical therapy and arthroscopic surgery are equally effective in pain relief and functional improvement.[3] In the athletic population, however, arthroscopic subacromial decompression and acromioplasty have achieved good results in relief of pain but were not as successful regarding return to function.[4] Conservative care of shoulder impingement includes rest, application of ice, nonsteroidal anti-inflammatory drugs, subacromial corticosteroid injection, and physical therapy.[5-7]

The rotator cuff consists of four muscles: the supraspinatus located superiorly, the infraspinatus and teres minor located posteriorly, and the subscapularis (SSC), the largest of the rotator cuff muscles,[8,9] located anteriorly. A thorough understanding of the biomechanics of the shoulder in overhead activities such as throwing and playing tennis is needed to develop a scientifically based rehabilitation program. In an electromyographic study by Ryu and associates,[10] the SSC electromyographic activity was present at 113% and 102% of maximal internal rotation manual muscle test activity during late cocking and early acceleration of tennis serves and forehand strokes, respectively. The SSC muscle undergoes a stretch-shorten cycle[11] to enhance the internal rotation torque at late cocking and early acceleration, which was identified as a critical point by Fleisig and colleagues[12] in a study of the kinetics of baseball pitching. Because the stretch-shorten cycle causes eccentric muscle injury that leads to temporary muscular tenderness, weakness, and shortening,[13-15] injury to the SSC may be a factor in the development or exacerbation of shoulder impingment syndrome.

Conventional treatment of the syndrome has emphasized stretching the posterior rotator cuff muscles and has dictated that stretching the anterior rotator cuff muscles is contraindicated.[16,17] This article describes a treatment regimen that goes against this conventional wisdom. Three racquet-sports patients with shoulder impingement, two of whom did not respond to conventional treatment, were successfully treated with trigger point dry needling and stretching of the SSC muscle.

METHODS

Assessment

Each patient underwent a history assessment and a physical examination that tested the shoulder for mobility, tenderness, impingement,[18,19] and instability.[20] Manual muscle testing for internal and external rotation strength of the shoulder was assessed at 0° abduction. Muscle trigger point tenderness was determined by palpating the SSC in the posterior axillary wall. To do this, the patient is placed supine with the arm abducted to 90°, externally rotated to 60° and flexed to 15°, and the elbow flexed to 90°. The examiner supports the extremity at the wrist to assure proper relaxation while the examining hand, starting at the lateral border of the scapula, and moves superomedially along the posterior wall of the axilla toward the apex of the axilla. The three trigger points, as described by Travell and Simons,[21] are firmly but carefully compressed against the scapula using flat palpation to find local tenderness, a local twitch response, referred pain, and pain recognition.[22]

To assess anterior rotator cuff inflexibility, a maneuver called the "SSC stretch" sign is used diagnostically and throughout the course of treatment to evaluate response. With the patient lying supine at the edge of the table, the shoulder is abducted to 90° with the elbow flexed to 90° while the examiner grasps the distal forearm. The arm is then allowed to fully extend and externally rotate with the patient supporting the full weight of the limb with the shoulder musculature. The shoulder is then passively abducted from 90° to full overhead (180°), and the examiner takes note of the location and type of sensation at 90°, 135°, and 180° of abduction as well as the presence of crepitus or clunks noted by the palpating hand. The "SSC stretch" sign is positive when pain or other sensation is noted outside the site of normal stretching or when a clunk or click is palpated. In a negative "SSC stretch sign," stretch is perceived in the pectoral area at 90° of abduction, in the axilla at 135° of abduction, and on the lateral border of the scapula at 180° of abduction (Ingber, personal observation).

Treatment

Myofascial treatment is administered to the SSC muscle by dry needling or ischemic compression (myofascial massage)[21]

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and followed by carefully controlled stretching of the SSC and patient instruction in SSC therapeutic stretching.

The dry needling procedure to the SSC muscle is administered with the patient lying in the supine position with the arm supported by the plinth and positioned in 0° to 15° of internal rotation and 75° of abduction. The SSC trigger points[22] are located by relaxing the patient while palpating for the most tender area in the posterior axillary wall, which is often located near the most superomedial aspect of the scapula. When radiating pain is noted by the patient, the trigger point is dry-needled by rapidly peppering the site with a "fast-in, fast-out" movement[23] of a 30 gauge 2.5in (6cm) sterile acupuncture needle. The trigger point is needled until no further local twitch response is evoked by the needle movement. The arm is then immediately taken through a full range of motion, abducting several times through an arc of 90° to 180° and back to 90°. The dry needling procedure is repeated once weekly as long as the SSC stretch sign remains positive. Subsequently, the SSC trigger point is treated with myofascial massage or ischemic compression. Ischemic compression is performed by progressively increasing finger pressure at the trigger point to tolerance, which often evokes pain radiating to the trigger zone if the patient is properly relaxed.

A progressive therapeutic stretching program for the SSC is also an integral part of the treatment. The patient is instructed in relaxation, deep diaphragmatic breathing, and coordinating the exhalation with the stretching motion. The stretching motion begins similarly to the SSC stretch sign, moving the shoulder from 90° abduction to as fully overhead as possible (180°) while maintaining the elbow flexed at 90°. However, the stretch cycle is completed with the shoulder returning to the original position (90° to 180° back to 90°). The stretch is repeated 3 to 4 times in each set, and 2 to 3 sets are performed. With each stretch, the patient attempts to progressively increase the painless extension while abducting the arm through the range of motion. The patient progresses through the following stretching stages: (1) supported supine, (2) unsupported supine, (3) over-the-edge supine, and (4) wall-assisted and active standing. Precision in the correct position and in avoidance of impingement at 180° abduction and subluxation at 90° abduction is essential. Because there is a narrow therapeutic range to this stretching technique, the patient must be educated as to the limits of a safe stretch.

CASE STUDIES

Case 1

A 39-year-old right-handed male physician—an avocational tennis player—presented with a 6-month history of right shoulder pain. There was no trauma or overuse before onset. The pain was aggravated when the patient was serving in tennis, hitting an overhead volley, shooting a basketball, or reaching behind the body. Treatments by an orthopedist had included ketorolac (10mg/four times daily) for several weeks, a subacromial cortisone injection, and a 6-week course of physical therapy consisting of ultrasound and isotonic and isokinetic strengthening. An orthopedic surgeon advised arthroscopic surgery. The patient's pain was described as sharp, localized to the superior deltoid area, and aggravated by overhead activities and right side-lying. The physical examination showed full range of motion of the cervical spine, slightly diminished range of motion in both right shoulder abduction with bicipital pain and in internal rotation thumb to L1, and moderately severe lateral shoulder pain on right shoulder impingement maneuver. There were marked tenderness of the SSC muscle, diminished strength of internal and external shoulder rotation to 4.5/5, and a positive SSC stretch sign with superior glenohumeral pain felt at all angles. A right shoulder magnetic resonance imaging scan revealed increased signal in the supraspinatus tendon consistent with mild tendinitis, minor impingement of the supraspinatus muscle and tendon at the level of the acromioclavicular joint, and minimal joint effusion.

The diagnosis was right rotator cuff tendinitis and myofascial dysfunction of the right SSC muscle. The patient was treated twice with dry needling of the SSC trigger point and instructed in a controlled supine SSC stretching exercise. He returned 6 weeks later with decreased shoulder pain, but he was still unable to throw a ball. He received weekly sessions of dry needling to the SSC trigger point for 5 weeks more and a progressive therapeutic stretching program for the SSC. When the patient had a negative impingement sign, had 5/5 strength of the rotator cuff muscles, and was able to comfortably perform the SSC wall-stretch, isotonic strengthening was added to the exercise program. He returned 1 month later and was playing basketball again, although there was shoulder soreness for 1 to 2 days afterward. He was seen four times over the next month and treated with ischemic compression (myofascial massage) and exercise review. He returned to playing tennis 10 weeks after starting the wall-assisted SSC stretching and played all summer without problems, using ice on the shoulder after competing.

The patient was seen 11 times, including the initial consultation and six trigger point dry needling sessions in 4½ months. Two years later, the patient continues to play tennis without pain.

Case 2

A 59-year-old right-handed male racquetball player presented with a 1-year history of recurrent right shoulder aching and a 3-month history of sharp right shoulder pain. The pain was unresponsive to ibuprofen and a 2-month program of twice-weekly physical therapy, which included ice, electrical stimulation, ultrasound, massage, shoulder limbering, isotonic strengthening, and the use of an upper body ergometer. The patient was advised by an orthopedist to have arthroscopic shoulder surgery. He described sharp and stabbing lateral shoulder pain that was aggravated by right side-lying and overhead and behind-the-back activities. He had been unable to play racquetball for 3 months before presentation. The physical examination showed right shoulder abduction limited to 135° and internal rotation thumb to L5, subacromial and bicipital tendon tenderness, and severe lateral shoulder pain on shoulder impingement maneuver. There were marked tenderness of the SSC muscle, diminished strength of external and internal right shoulder rotation to 4.5/5, and a positive "SSC stretch" sign.

The diagnosis was right shoulder impingement syndrome and myofascial dysfunction of the right SSC. The patient was treated with dry needling to the trigger points in the SSC muscle and instructed in a progressive therapeutic SSC stretching program. He received weekly treatments for 7 weeks and treatments in the second, third, fourth, and sixth weeks thereafter for a total of 11 treatment sessions with the dry needling technique. One month after the first treatment, when the shoulder impingement and "SSC stretch" signs were negative and the rotator cuff strength was 5/5, he returned to playing racquetball. Shoulder isotonic strengthening was started after only the fifth week of treatment. On telephone follow-up, the patient reported no shoulder pain and full function 1 year later.

Case 3

A 32-year-old left-handed male racquetball player presented with a 5-month history of left shoulder pain, which began 1 day after he had pitched three softball games. One day later, he competed in a racquetball tournament and after that he had been unable to play sports for 5 months because of sharp anterior shoulder pain aggravated by overhead activity. He was unable to resume playing racquetball or do shoulder strengthening exercises despite 2 months of rest, ice, local salicylate cream, and ibuprofen (600mg four times daily for 2 weeks). The physical examination showed left shoulder abduction limited to 165°, internal rotation thumb to T10, mild lateral shoulder pain on left shoulder impingement maneuver, and left bicipital tendon tenderness. There was also trigger point tenderness of the SSC muscle, a positive left SSC stretch sign, and external and internal left shoulder rotation strength of 4.5/5. A left shoulder x-ray was normal.

The diagnosis was left rotator cuff tendinitis/bicipital tendinitis and myofascial dysfunction of the SSC. The patient was treated with a session of dry needling to the SSC trigger point and given instruction in supine SSC stretching. He was able to compete in a racquetball tournament that week; however, 2 days after the game, the shoulder tightened and he was treated again with dry needling to the SSC trigger point, given instruction in wall-assisted SSC stretching, and advised to use ice after playing. He returned 2 weeks later for another treatment, and he was dry-needled weekly twice over the course of a 3-week racquetball tournament. After the tournament, he was treated twice with ischemic compression, review of SSC wall-stretching, and isotonic strengthening. One month later, he played four consecutive games of racquetball, his shoulder tightened again, and he was treated with a dry needle to the SSC trigger point and exercise review. He made follow-up visits 2, 3, and 5 months later, and reported return of full power on serves and forehand strokes. He had no further pain. At telephone follow-up 2 years after initial presentation, the patient reported no further pain or limited shoulder function.

DISCUSSION

The three patients presented with clinical criteria consistent with both shoulder impingement and SSC myofascial dysfunction based upon Simons's diagnostic criteria.[24] There were shortening, weakness, and tenderness of the SSC muscle, which were rapidly reversed by the myofascial treatment and therapeutic stretching exercises. Shoulder impingement occurs when the arm is maximally abducted and extended, as in a tennis serve or overhead smash. Because electromyographic studies have shown the SSC to be highly recruited during the late cocking and early acceleration phases of a tennis serve,[10] theoretically, SSC weakness and shortening may be a mechanical factor in the development of shoulder impingement syndrome.

Patients 1 and 2 failed to respond to standard physical therapy and would most likely have faced arthroscopic surgery had they not undergone our treatment. Benefits of this treatment were best demonstrated in the case of patient 3, who won a racquetball tournament while in treatment. In the study by Tibone and coworkers[4] of competitive athletes treated with subacromial decompression and acromioplasty, the pain was significantly decreased; however, only 15 of 35 (43%) of the shoulders involved returned to preinjury levels of function. For an overhead athlete to return to high-level competition, the rotator cuff muscles must be in balance, and this requires anterior and posterior strength and flexibility. Litchfield and colleagues[16] and Hawkins and Mohtadi[7] advised against stretching the anterior rotator cuff muscles for fear of exacerbating superior impingement and anterior subluxation. No scientific data or specific cases were provided to substantiate this assertion. Results in the three cases presented here suggest that the anterior rotator cuff can be safely stretched.

SSC myofascial treatment in conjunction with a controlled, progressive therapeutic stretching program was beneficial in relieving shoulder impingement and returning the three racquetball/tennis athletes to full function. It appears reasonable to suggest that patients with shoulder impingement but no cervical dysfunction may benefit from a series of dry needling treatments to the SSC trigger points. Six to eight treatments may be required over 2 to 3 months, but significant response should be expected after the first 2 to 3 treatments. Further randomized controlled clinical trials would be helpful to compare SSC myofascial treatments with the standard physical therapy protocols.

References

1. Lehman RC. Shoulder pain in the competitive tennis player. Clin Sports Med 1988;7:309-27.
2. Priest JD. The shoulder of the tennis player. Clin Sports Med 1988;7:387-402.
3. Brox JI, Staff PH, Ljunggren AE, Brevik JI. Arthroscopic surgery compared with supervised exercises in patients with rotator cuff disease (stage II impingement syndrome). BMJ 1993;307:899-903.
4. Tibone JE, Jobe FW, Kerlan RK, Carter VS, Shields CL, Lombardo SJ, et al. Shoulder impingement syndrome in athletes treated by anterior acromioplasty. Clin Orthop 1985;198:134-40.
5. Bartolozzi A, Andreychik D, Ahmad S. Determinants of outcome in the treatment of rotator cuff disease. Clin Orthop 1994;308:90-7.
6. Cofield RH. Current concepts review. Rotator cuff disease of the shoulder. J Bone Joint Surg Am 1985;67:974-9.
7. Hawkins RJ, Mohtadi NGH. Rotator cuff problems in athletes. In: Delee JC, Drez Jr D, editors. Orthopaedic sports medicine principles and practice. Philadelphia: W.B. Saunders; 1994. p. 623-56.
8. Lehmkuhl LD, Smith LK. Brunnstrom's clinical kinesiology. 4th ed. Philadelphia: F.A. Davis; 1983.
9. Keating JF, Waterworth P, Shaw-Dunn J, Crossan J. The relative strength of the rotator cuff muscles: a cadaver study. J Bone Joint Surg Br 1993;75:137-40.
10. Ryu RKN, McCormick J, Jobe FW, Moynes DR, Antonelli DJ. An electromyographic analysis of shoulder function in tennis players. Am J Sports Med 1988;16:481-5.
11. Svantesson U, Grimby G, Thombee R. Potentiation of the concentric plantar flexion torque following eccentric and isometric muscle actions. Acta Physiol Scand 1994;152:287-93.
12. Fleisig GS, Andrews JR, Dillman CJ, Escamilla RF. Kinetics of baseball pitching with implications about injury mechanisms. Am J Sports Med 1995;23:233-9.
13. Clarkson PM, Noska K, Braun B. Muscle function after exercise-induced muscle damage and rapid adaptation. Med Sci Sports Exerc 1992;24:512-20.
14. Howell JN, Chila AG, Ford G, David D, Gates T. An electromyographic study of elbow motion during postexercise muscle soreness. J Appl Physiol 1985;58:1713-8.
15. Komi PV, Viitasalo JT. Changes in motor unit activity and metabolism in human skeletal muscle during and after repeated eccentric and concentric contractions. Acta Physiol Scand 1977;100:246-54.
16. Litchfield R, Hawkins R, Dillman CJ, Atkins J, Hagerman G. Rehabilitation for the overhead athlete. J Orthop Sports Phys Ther 1993;18:433-41.
17. Plancher KD, Litchfield R, Hawkins RJ. Rehabilitation of the shoulder in tennis players. Clin Sports Med 1995;14:111-37.
18. Hawkins RJ, Kennedy JC. Impingement syndrome in athletes. Am J Sports Med 1980;8:151-8.
19. Neer CS. Impingement lesions. Clin Orthop 1983;173:70-7.

20. Jobe FW, Kvitne RS. Shoulder pain in the overhand or throwing athlete: The relationship of anterior instability and rotator cuff impingement. Orthop Rev 1989;18:963-5.
21. Travell JG, Simons DG. Myofascial pain and dysfunction: the trigger point manual. Baltimore (MD): Williams & Wilkins, 1983.
22. Gerwin RD, Shannon S, Hong CZ, Hubbard D, Gervitz R. Interrater reliability in myofascial trigger point examination. Pain 1997;69:65-73.
23. Hong CZ, Simons DG. Pathophysiologic and electrophysiologic mechanisms of trigger points. Arch Phys Med Rehabil 1998;79:863-72.
24. Simons DG. Myofascial pain syndrome due to trigger points. In: Goodgold J, editor. Rehabilitation medicine. St. Louis (MO): Mosby; 1988. p. 686-726.