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ORIGINAL STUDY

The 'hand squeeze' test for posterior 'muscle patterning instability' of the shoulder

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Muscular patterning can be a contributor of positional posterior shoulder instability. Failure to recognize this pattern may lead to unnecessary surgical treatment with high failure rate. We analyzed the results of a new simple clinical test (hand squeeze test). The test is regarded positive, if during squeezing with the contralateral hand and elevation of the involved arm, in pronation, no posterior shoulder dislocation occurs. The test is regarded negative if posterior dislocation does occur regardless of the "hand squeeze". The patients with positive test were treated conservatively. Ten patients (12 shoulders) were treated between July 2006 and July 2010. The 'hand squeeze' test was positive in 8 patients (10 shoulders) and negative in 2 patients (2 shoulders). Both patients with a negative sign had structural lesions in the glenohumeral joint confirmed on arthro-MRI and were treated operatively.

Keywords : clinical test ; shoulder instability ; muscle patterning ; conservative treatment

INTRODUCTION

Shoulder instability is not uncommon but, in contrast to anterior shoulder instability, only a small subset of patients have posterior instability, which usually is a subluxation of the joint, rather than a dislocation (*6*).

The stability of a shoulder joint depends partly from a normal anatomy of the joint and partly from precise synchronised muscle contractions and relaxations during movement. Each of the 30 muscles moving and stabilising the shoulder needs to be activated at specific times. If this pattern is altered, instability can occur and this is called muscle patterning instability (*4*).

In patients with posterior instability the shoulder may sublux involuntarily when the arm is placed in flexion, adduction, and internal rotation. As the arm moves into abduction from this position, the shoulder visibly and audibly relocates (*6*). This instability is called positional posterior shoulder instability.

Positional posterior shoulder instability may be caused by muscular patterning, by structural lesions or by a combination of both (*4*).

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Fig. 1. — Positional posterior shoulder instability

Posterior instability caused by muscle patterning usually occurs in younger patients who can voluntarily slip the shoulder out of joint as a trick movement, but may then go on to dislocate repeatedly uncontrolled (involuntary).

In case of instability due to muscular patterning, the treatment of choice is an individualized rehabilitation programme with comprehensive strengthening and specific balancing of rotator cuff muscles and scapular stabilizers (*1*). In patients with structural lesions, existing abnormal muscle patterns must be corrected pre-operatively, for surgery to be successful (*3*). We analysed a new simple clinical test (hand-squeeze test), described by the senior author (O.L.), that can help in evaluating the contribution of muscle patterning in positional posterior instability.

METHODS

All patients with recurrent positional posterior shoulder dislocation that were treated in our department between July 2006 and July 2010 were evaluated. After a standard clinical examination of the shoulder, the 'hand-squeeze test' is performed and video-recorded. First the occurrence of a positional posterior shoulder dislocation or subluxation on elevation of the arm with the hand in pronation is confirmed clinically (Fig. 1). Next, the patient is asked to squeeze, as hard as possible, the examiner's hand with his contralateral hand, while he lifts the symptomatic arm as before. Squeezing the examiner's hand distracts the patient's attention from the affected shoulder. The patient is reminded several times to squeeze as hard as possible. If during elevation no posterior shoulder dislocation or subluxation is shown, the test is regarded positive (Fig. 2) and muscle patterning is supposed to be a significant contributor to the instability. Patient's distraction has diminished or abolished the wrong muscle activation pattern. Intensive rehabilitation including a biofeedback and proprioception programme under supervision of a specialized shoulder physiotherapist is initiated. If the 'hand squeeze' test does not prevent positional posterior dislocation or subluxation, the test is regarded as negative, and a structural pathology should be suspected. An arthro MRI is performed and when structural pathology is found, surgery is considered.

Fig. 2. — Absence of positional posterior shoulder instability during hand-squeeze test.

In February 2011, all the patients with recurrent positional posterior shoulder dislocation treated in our department between Jul 2006 and Jul 2010 were contacted by phone and were evaluated using the Neer-Foster satisfaction scale (*5*).

RESULTS

In total 10 patients (12 shoulders) were included in the study (Table I). The mean age at the time of clinical presentation was 19.8 years (range : 15 to 29). There were 4 women and 6 men. The mean delay since first symptoms was 10 months (range : 3 to 18 months). In 9 shoulders a minor injury was said

Table I. — Patient list

Patient #	Age (yrs)	Dominant side	Affected side	Aetiology	Symptoms (months)	Previous treatment	Hand-squeeze test	Treatment	Follow-up (months)	Neer-Foster rating scale
1	16	right	right	minor trauma	18	physiotherapy	pos	biofeedback training	54	satisfactory
	16	right	left	no trauma	3	no	pos	biofeedback training	48	satisfactory
2	15	right	left	minor trauma	12	arthroscopic capsular shrinkage	pos	biofeedback training	52	satisfactory
3	23	right	right	no trauma	15	arthroscopic capsular shrinkage	pos	biofeedback training	44	satisfactory
4	15	right	right	minor trauma	5	no	pos	biofeedback training	28	satisfactory
5	19	right	left	minor trauma	6	physiotherapy	neg	a'scopic post stabilisation	24	satisfactory
6	21	right	left	minor trauma	12	a'scopic capsular shrinkage and open posterior capsular shift	pos	biofeedback training	20	unsatisfactory
	22	right	right	no trauma	5	no	pos	biofeedback training	14	unsatisfactory
7	23	right	left	minor trauma	12	physiotherapy	neg	a'scopic post stabilisation	15	satisfactory
8	29	right	right	minor trauma	12	physiotherapy	pos	biofeedback training	14	unsatisfactory
9	22	right	right	minor trauma	18	physiotherapy	pos	biofeedback training	8	satisfactory
10	16	right	right	minor trauma	5	no	pos	biofeedback training	6	satisfactory

to have triggered the symptoms, in three shoulders no trauma could be recalled. In the two patients with bilateral problems, the symptoms in the first symptomatic shoulder started after a minor trauma, in the other shoulder no trauma could be recalled.

Eight patients (8 shoulders) had been treated at another institution and were referred to our department due to recurrence of instability. Five patients (5 shoulders) had general physiotherapy without specific training. Three patients (3 shoulders) had had surgery : 2 patients had an arthroscopic posterior plication and one patient had a thermal capsular shrinkage and open capsular plication. These patients continued to dislocate despite the surgical treatment. Two patients (two shoulders) had no prior treatment. The two patients with bilateral problems did not receive any treatment for the second shoulder and had bilateral problems on their first presentation.

The 'hand squeeze' test was positive in 8 patients (10 shoulders) and negative in the other two patients (two shoulders). The arthro-MRI in these two negative 'hand squeeze' test cases showed a posterior labral tear, and an arthroscopic posterior stabilisation procedure was performed. The 8 patients (10 shoulders) with positive "hand squeeze" test were treated non surgically with specialised physiotherapy directed to improve proprioception, biofeedback, core and scapular stability and rotator cuff strength. At a mean follow-up of 27.3 months

(range : 54 to 6), 8 patients (9 shoulders) had a satisfactory result. Two patients (3 shoulders) rated their shoulder unsatisfactory. Both still had a positive 'hand-squeeze' test. One of these patients underwent two previous operations on one shoulder elsewhere, and did not want further surgery. At his last clinical follow-up in January 2011, he had a bilateral positive 'hand-squeeze' test.

DISCUSSION

Poor surgical treatment outcome is described in patients with positional posterior subluxation due to muscle patterning. Surgical treatment is indicated only when a repairable structural lesion is found in the absence of muscle patterning (*9*). Failure to recognise the contribution of abnormal muscle patterning to the instability may lead to unnecessary expensive investigations and contraindicated surgery with a high rate of failure (*3*).

In patients with posterior instability, muscle imbalance can exist between weak external rotator and strong internal rotator muscles of the shoulder. This imbalance is also known in infants with neonatal brachial plexus palsy causing a chronic posterior subluxation or dislocation (*2*). In contrast to the newborn with brachial plexus palsy, the posterior imbalance due to muscular patterning in young adults is not a constant but a dynamic problem. This muscle patterning may become a voluntary feature with posterior dislocation/subluxation, when the patient succeeds to selectively contract his internal rotators (latissimus dorsi, pectoralis major, and subscapularis muscles) and may lead to an imbalance of muscle forces with the combined strength of the internal rotators overwhelming the external rotators (infraspinatus and teres minor muscles). This muscle pattern is subconsciously embedded and the dislocation becomes involuntary (*7,8*).

The "hand squeeze" test is a simple test to assist the clinician in assessment and recognition of this muscle patterning instability. During the 'hand-squeeze' test we try to produce an inhibition of the overactive muscle group responsible for the abnormal pattern by distracting the patient's mind from the shoulder and focusing on the squeezing of the examiners hand with the other hand.

A positive test suggests that an abnormal muscular pattern is a contributor to the patient positional posterior instability and that an individualized proprioceptive biofeedback rehabilitation programme can be successful. In our study, 6 out of 8 patients that were treated conservatively had a good result. Two patients were not satisfied with their shoulder although the test was still positive. Because in our opinion muscular imbalance was still an important contributor, conservative treatment was continued.

A negative test may suggest the presence of a structural lesion causing the instability. In this group, further imaging is indicated with an arthro-MRI or arthro-CT to exclude structural lesions. In the two cases with negative 'hand-squeeze' test in our series, a structural lesion was found on imaging. We did not have a patient with a negative "hand squeeze" test and a negative scan in our series ; however, our group of patients was small.

A weakness of the study is the fact that no imaging data is available to evaluate structural lesions in the patients with a positive test. But as discussed, surgical treatment is only indicated when there is no inappropriate muscle patterning. We believe that the diagnosis and treatment of the muscular patterning is primordial on the evaluation of a structural lesion. Another weakness is the small and inhomogeneous group of patients with a variable prior treatment history (surgical – conservative).

To conclude**,** the "hand squeeze" test is a simple clinical test that can help in making the clinical diagnosis of posterior muscle patterning instability. A positive sign should be regarded as a contraindication for surgery and suggest a conservative treatment with an intensive biofeedback and proprioceptive program.

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