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EMG in schouder revalidatie

Joint Together II Klinisch redeneren consensus of contrast

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Thierry Franke, Fysiotherapeut @tjerr

Medisch Centrum Zuid-Flytta @mczflytta

schouder-expertisecentrum.nl @schouderfysio

Student Master Fysiotherapiewetenschappen UU Utrecht

Inhoud

Scapula dyskinesie

EMG-meting

Motorisch leren

Behandeling

Scapula Dyskinesie

"Alterations in static scapular position and dynamic scapular motion."[1]

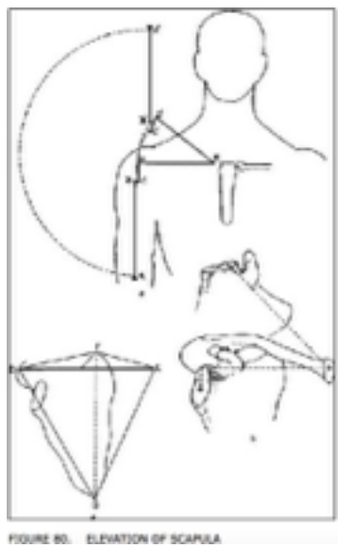
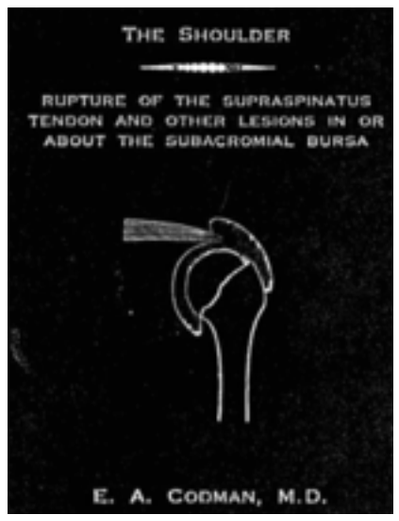


FIGURE 80. ELEVATION OF SCAPULA



[1]Uhl et al. (2009), Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 25, No 11: pp 1240-1248
Afbeeldingen: Codman (1934), The Shoulder

Scapula dyskinesie ⟷ schouderklachten

Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the 'scapular summit'

W Ben Kibler,[1] Paula M Ludewig,[2] Phil W McClure,[3] Lori A Michener,[4] Klaus Bak,[5] Aaron D Sciascia[1]

"scapular dyskinesis by itself is **not** an injury or a musculoskeletal diagnosis"

Kibler et al, Br J Sports Med, 2013

Scapula dyskinesie ⟷ schouderklachten

Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the 'scapular summit'

W Ben Kibler,[1] Paula M Ludewig,[2] Phil W McClure,[3] Lori A Michener,[4] Klaus Bak,[5] Aaron D Sciascia[1]

„There is a limited understanding of how specific tissue pathology relates to shoulder function, as evidenced by asymptomatic rotator cuff tears."

Kibler et al, Br J Sports Med, 2013

Scapula dyskinesie ⟷ schouderklachten

Training Induces Scapular Dyskinesis in Pain-Free Competitive Swimmers: A Reliability and Observational Study

Pernille H. Madsen, PT, Klaus Bak, MD,† Susanne Jensen, PT,* and Ulrik Welter, PT**

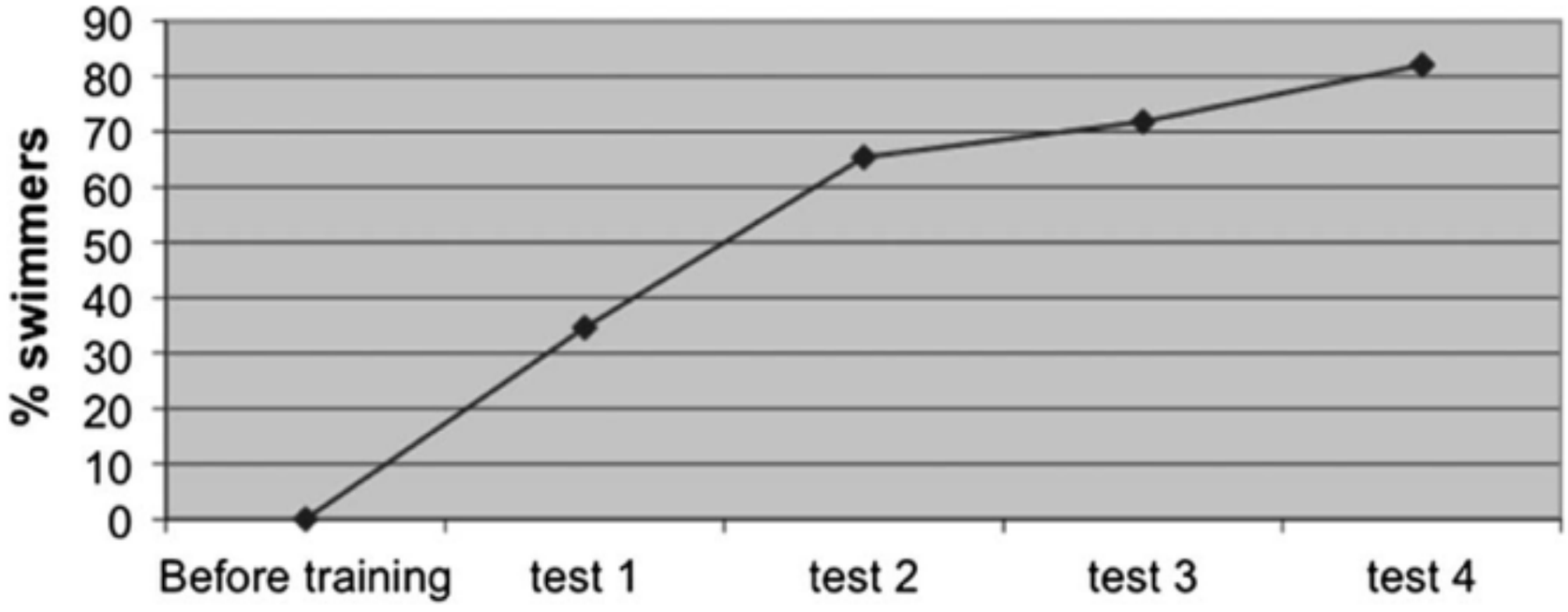


FIGURE 3. Proportion of swimmers with scapular dyskinesis.

Madsen et al, Clin J Sports Med, 2011

Scapula dyskinesie ⟷ schouderklachten

Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete

Ann M J Cools,[1] Filip Struyf,[2] Kristof De Mey,[1] Annelies Maenhout,[1] Birgit Castelein,[1] Barbara Cagnie[1]

„...**no** consensus about the cause–consequence relationship between scapular dyskinesis shoulder and or neck pain. „

Cools et al, Br J Sports Med,
published online first 18-05-2013

Scapula dyskinesie ⟷ schouderklachten

Visual Scapular Dyskinesis: Kinematics and Muscle Activity Alterations in Patients With Subacromial Impingement Syndrome

Andrea Diniz Lopes, DSc,[a,b,d] Mark K. Timmons, PhD, ATC,[c] Molly Grover, BS,[d]
Rozana Mesquita Ciconelli, PhD, MD,[a] Lori A. Michener, PhD, PT, ATC[d,e]

Scapular external rotation ↓

Pennsylvania Shoulder score ↓

Upper trapezius activity ↑

Archives of Physical Medicine and Rehabilitation 2015;96:298-306

Scapula dyskinesie ⟷ schouderklachten

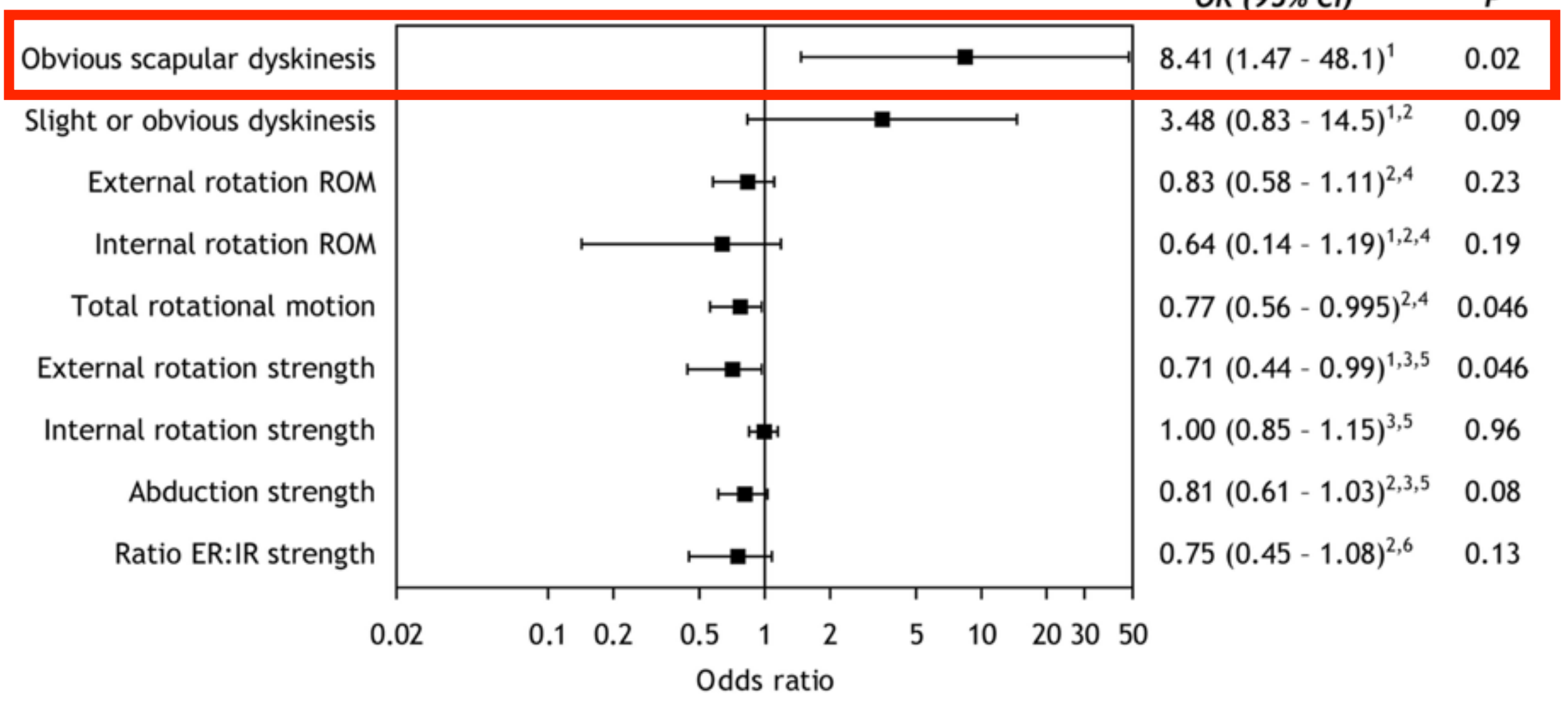


Figure 4 ORs and 95% CIs for associations between risk factors and substantial shoulder problems (average severity score >40) based on multivariable logistic regression analyses adjusted for [1]player position (back player), [2]history of shoulder surgery and [3]body mass. Expressed per [4]5° change, [5]10 Nm change, [6]5% change. ER, external rotation; IR, internal rotation; ROM, range of motion.

N=163

Clarsen et al, Br J Sports Med, 2014

Scapula dyskinesie ⟷ schouderklachten

Is there a relationship between subacromial impingement syndrome and scapular orientation? A systematic review.

Ratcliffe E1, Pickering S2, McLean S3, Lewis J4.

Br J Sports Med. 2014 Aug;48(16)

Currently, there is insufficient evidence to support a clinical belief that the scapula adopts a common and consistent posture in SIS

Review

Scapulothoracic muscle activity and recruitment timing in patients with shoulder impingement symptoms and glenohumeral instability

Filip Struyf [a,b,*], Barbara Cagnie [c], Ann Cools [c], Isabel Baert [a,b], Jolien Van Brempt [a], Pieter Struyf [d], Mira Meeus [a,b,c]

Journal of Electromyography and Kinesiology 24 (2014) 277–284

UT ↑ LT& SA ↓

Measurement properties of existing clinical assessment methods evaluating scapular positioning and function. A systematic review

Camilla Marie Larsen, PhD[1], Birgit Juul-Kristensen, PhD[1,2], Hans Lund, PhD[3,4] and Karen Søgaard, PhD[1]

54 methoden

Larsen et al, Physiother Theory Pract, 2014; 30(7): 453–482

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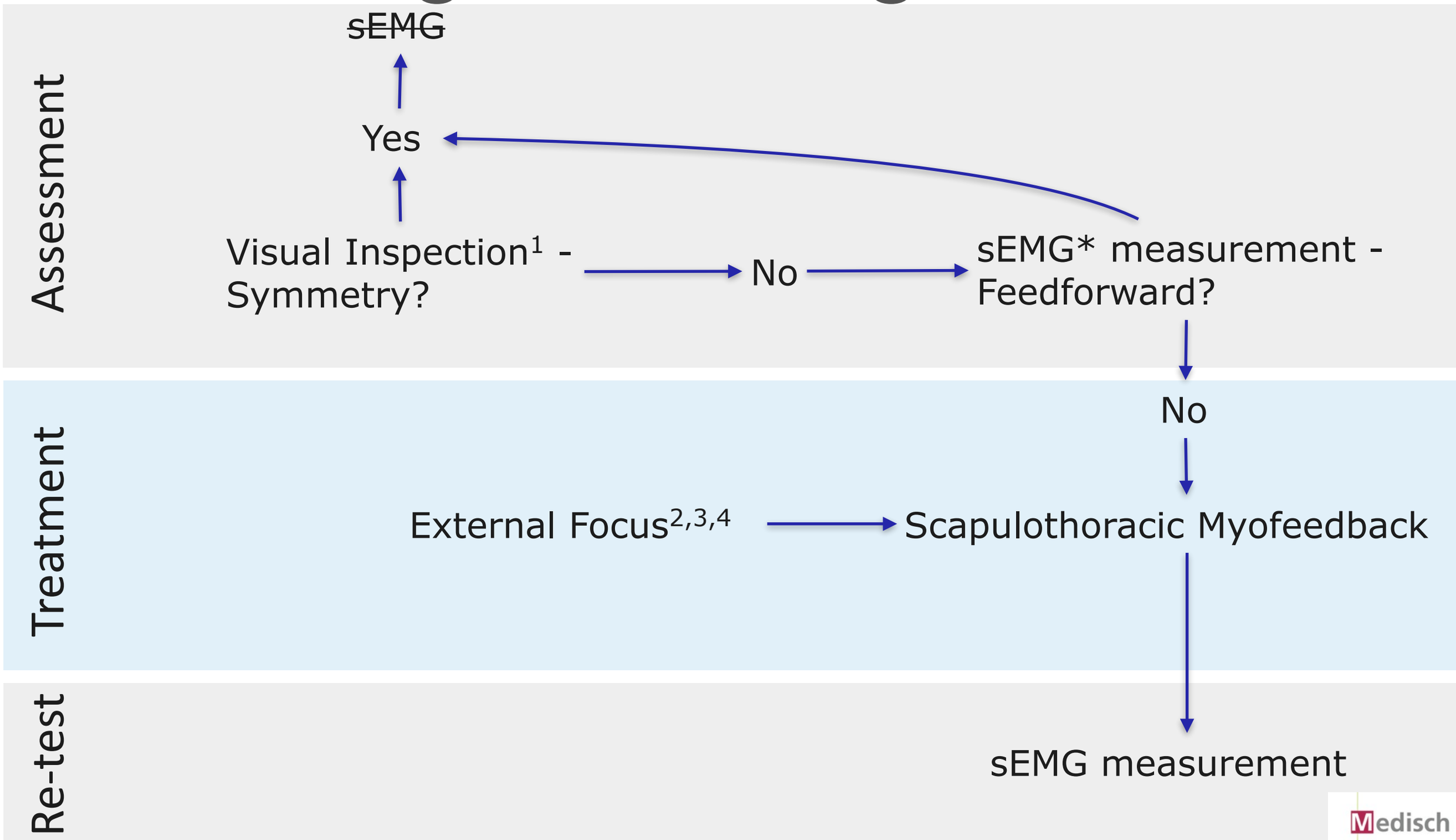
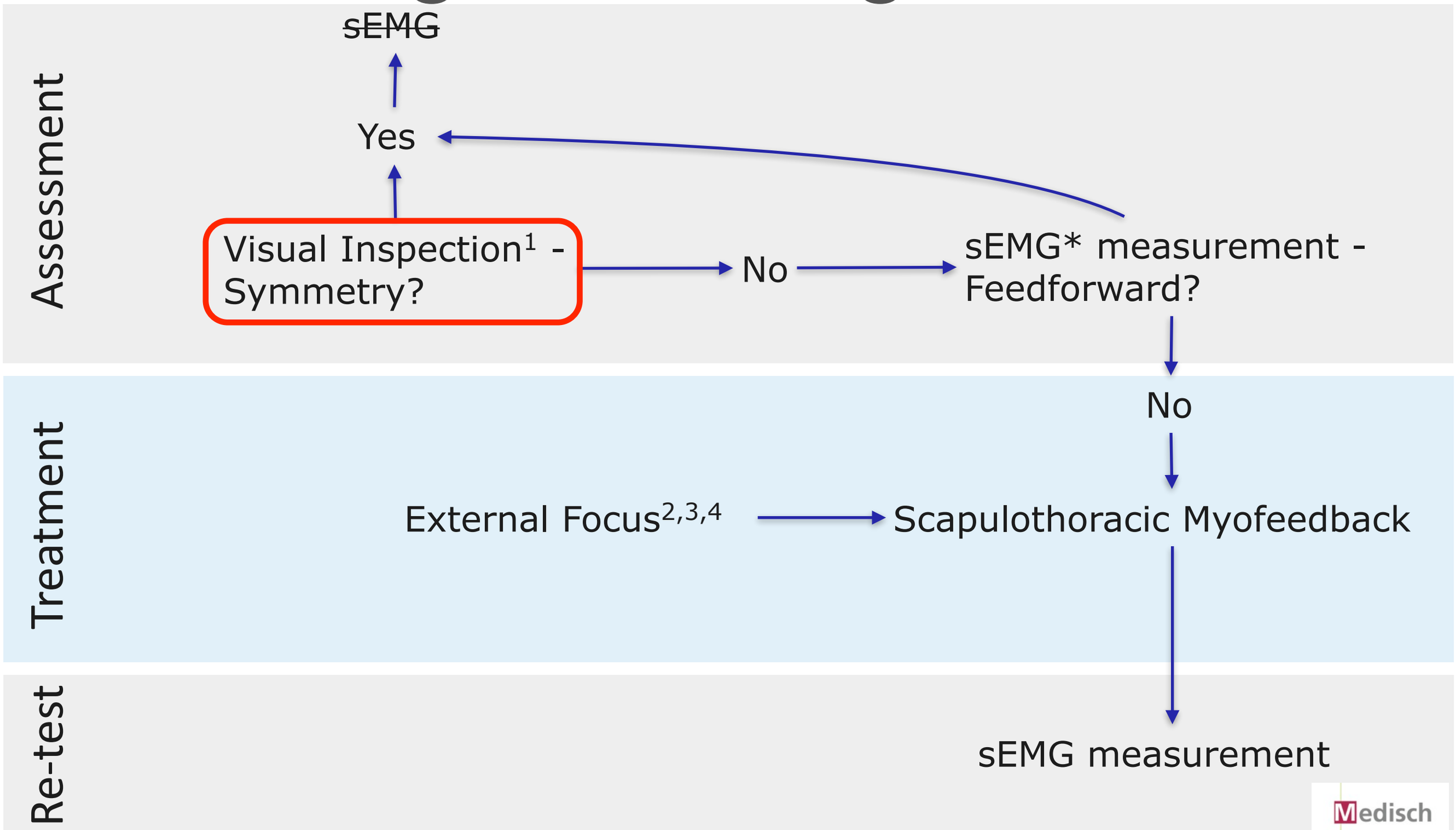
Diagnostisch Algoritme



*sEMG = surface electromyography

[1]Uhl TL, et al. Arthroscopy 2009 Nov;25(11):1240-1248.
[2]Zachry T, et al. Brain Res Bull 2005 10/30;67(4):304-309.
[3]Lohse K, et al. Journal of experimental psychology.General 2014;143(2):930-48.
[4]Lohse K, et al. Human Movement Science 2010;29(4):542-55.

Diagnostisch Algoritme

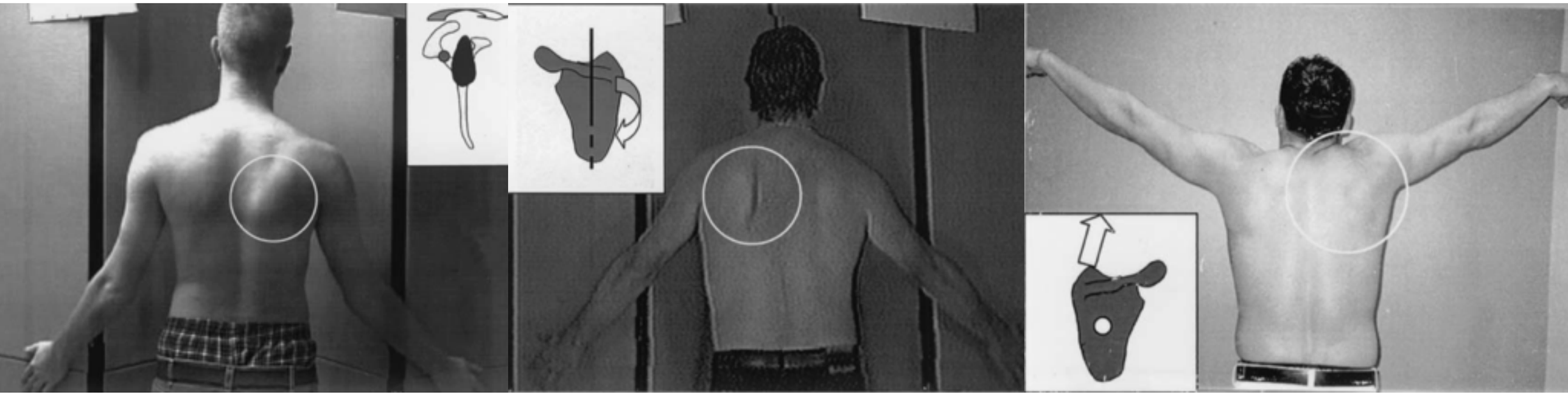


*sEMG = surface electromyography

[1]Uhl TL, et al. Arthroscopy 2009 Nov;25(11):1240-1248.
[2]Zachry T, et al. Brain Res Bull 2005 10/30;67(4):304-309.
[3]Lohse K, et al. Journal of experimental psychology.General 2014;143(2):930-48.
[4]Lohse K, et al. Human Movement Science 2010;29(4):542-55.

Qualitative clinical evaluation of scapular dysfunction: a reliability study

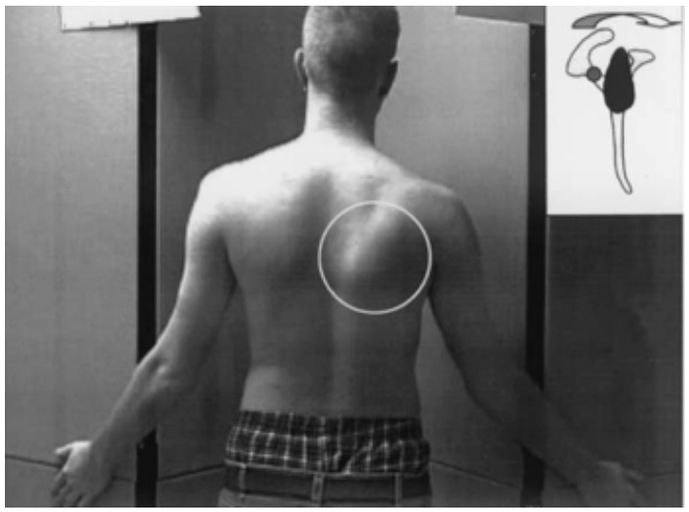
W. Ben Kibler, MD,[a] Tim L. Uhl, PhD, ATC, PT,[b] Jackson W. Q. Maddux, MD,[c] Paul V. Brooks, MD,[a] Brian Zeller, MS, ATC,[d] and John McMullen, MS, ATC[a]

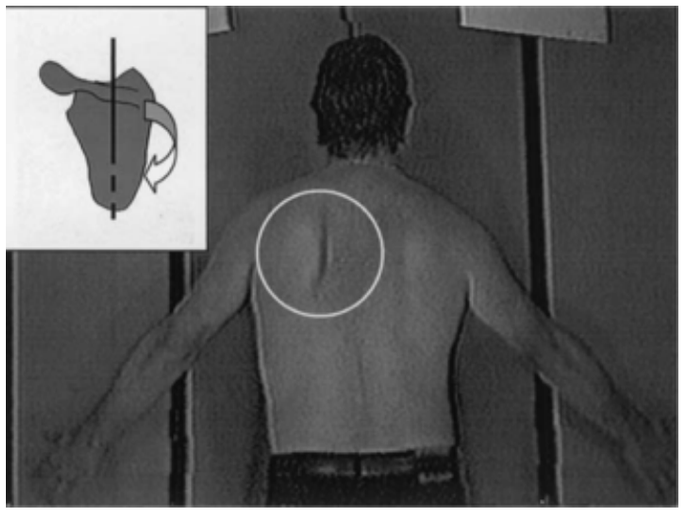


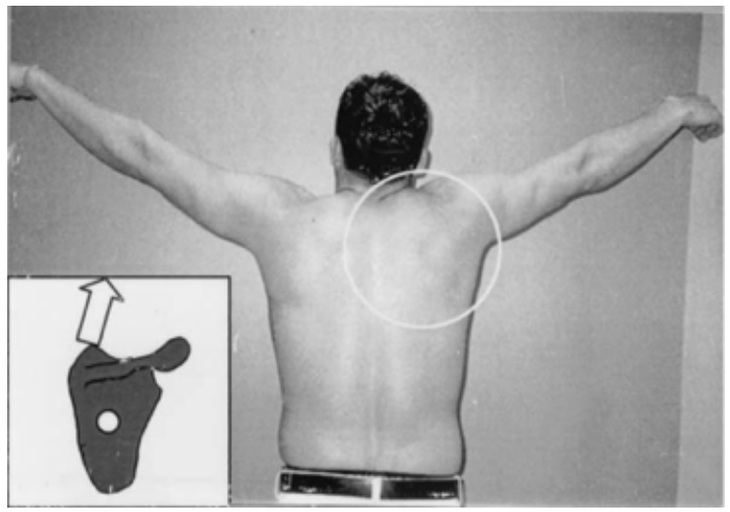
Kibler et al, J Sh Elb Surg, 2002

Qualitative clinical evaluation of scapular dysfunction: a reliability study

W. Ben Kibler, MD,[a] Tim L. Uhl, PhD, ATC, PT,[b] Jackson W. Q. Maddux, MD,[c] Paul V. Brooks, MD,[a] Brian Zeller, MS, ATC,[d] and John McMullen, MS, ATC[a]







Inter-rater agreement K=0.31 (physicians)
K =0.42(PT)

Intra-tester reliability K=0.59 (physician)
K=0.49 (PT)

MODERATE RELIABILITY

Kibler et al, J Sh Elb Surg, 2002

Journal of Athletic Training 2009;44(2):160–164

www.nata.org/jat

original research

A Clinical Method for Identifying Scapular Dyskinesis, Part 1: Reliability

Philip McClure, PhD, PT*; Angela R. Tate, PhD, PT*†; Stephen Kareha, DPT, PT, ATC, CSCS‡; Dominic Irwin, DPT, PT§; Erica Zlupko, DPT, PT‖

Inter-rater agreement

K=0.57 live

K=054 video

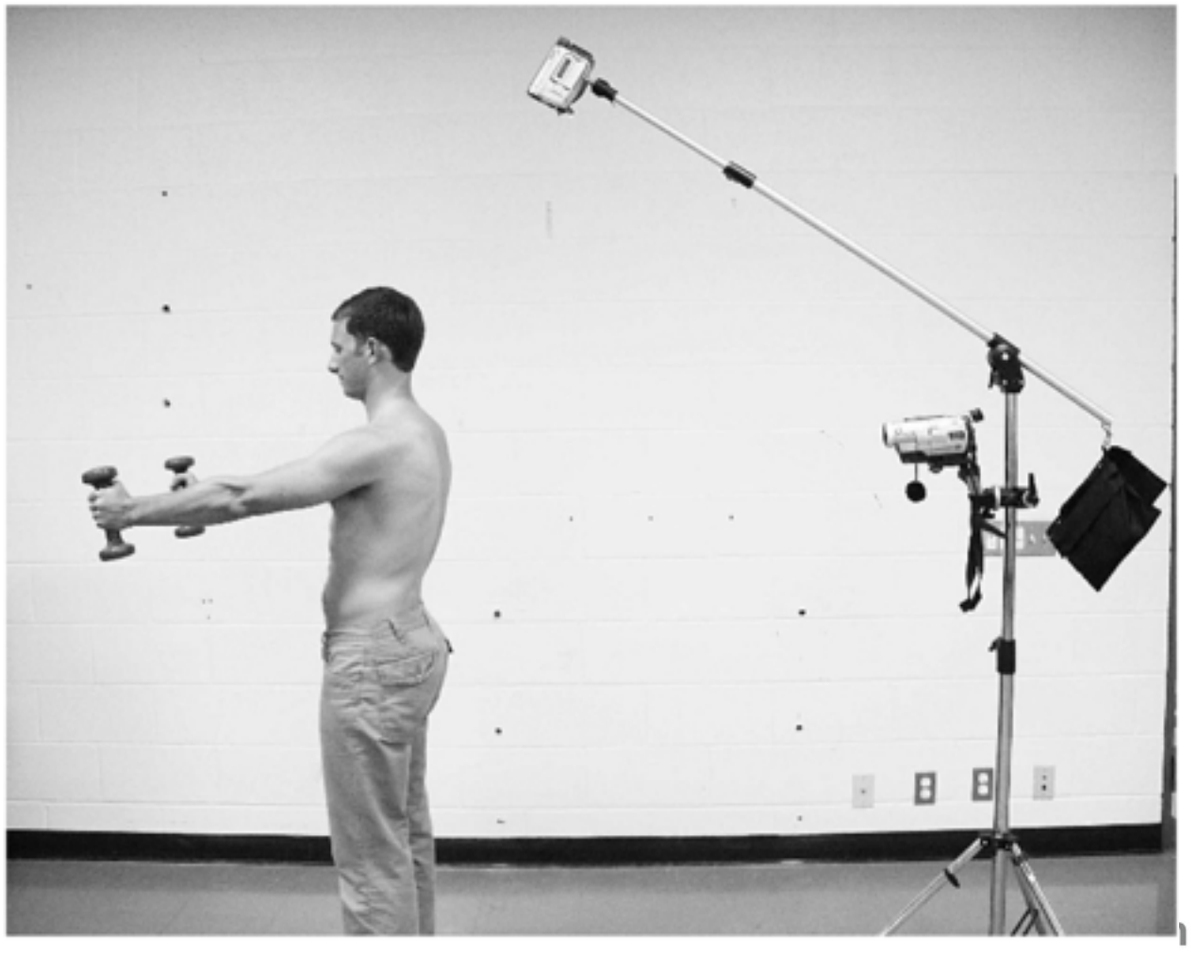


Figure 1. Set-up of participant and cameras for videotaping.

Evaluation of Clinical Assessment Methods for Scapular Dyskinesis

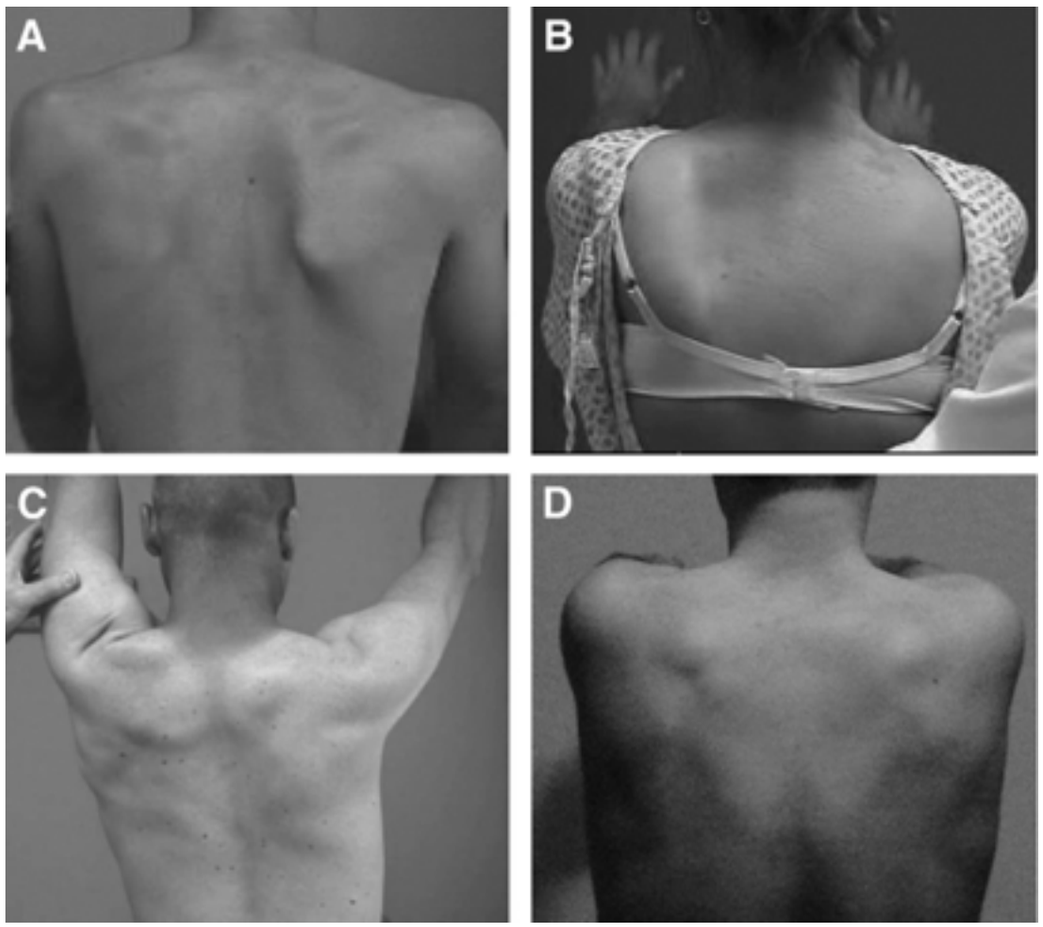
Tim L. Uhl, Ph.D., P.T., A.T.C., W. Ben Kibler, M.D., Ben Gecewich, M.S., A.T.C., and Brady L. Tripp, Ph.D., A.T.C., L.A.T.

Scaption - Flexion

Sensitiviteit 10 - 54 %

Specificiteit 62 - 94 %

Inter-rater agreement 61%



Uhl et al. (2009), Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 25, No 11: pp 1240-1248

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Evaluation of Clinical Assessment Methods for Scapular Dyskinesis

Tim L. Uhl, Ph.D., P.T., A.T.C., W. Ben Kibler, M.D., Ben Gecewich, M.S., A.T.C., and Brady L. Tripp, Ph.D., A.T.C., L.A.T.

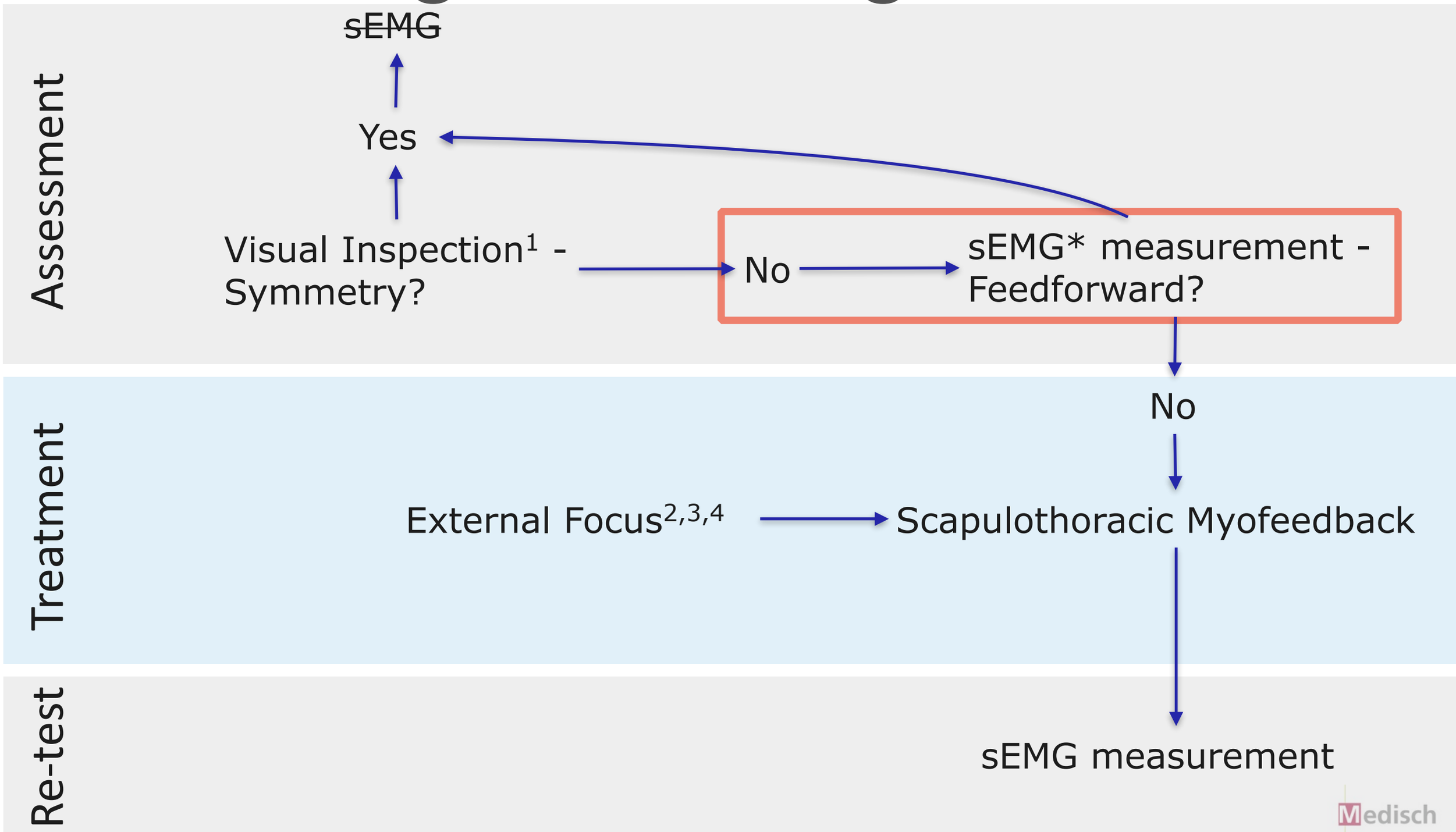
TABLE 3. *Validity of Yes/No Assessment Method of Scapular Dyskinesis Compared Against 3D Kinematic Analysis Performed During Humeral Scaption and Flexion*

	Flexion	Scaption
Sensitivity	78%	74%
Specificity	38%	31%
Positive predictive value	76%	78%
Negative predictive value	40%	27%
Accuracy	66%	64%

Inter-rater agreement 79%

Uhl et al. (2009), Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 25, No 11: pp 1240-1248

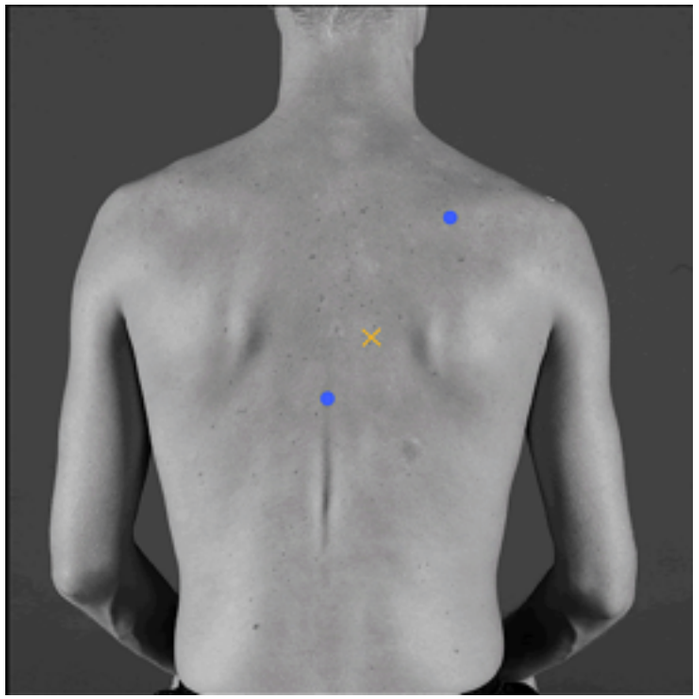
Diagnostisch Algoritme

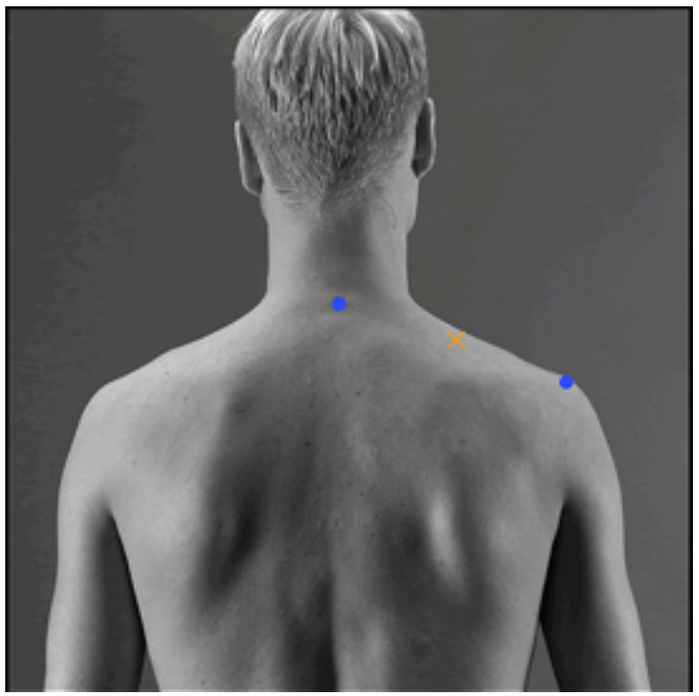


*sEMG = surface electromyography

[1]Uhl TL, et al. Arthroscopy 2009 Nov;25(11):1240-1248.
[2]Zachry T, et al. Brain Res Bull 2005 10/30;67(4):304-309.
[3]Lohse K, et al. Journal of experimental psychology.General 2014;143(2):930-48.
[4]Lohse K, et al. Human Movement Science 2010;29(4):542-55.

EMG Meting





Elektrode plaatsing

- seniam.org[1]: Upper Trapezius, Lower Trapezius, Deltoideus Anterior.
- Serratus Anterior[2]

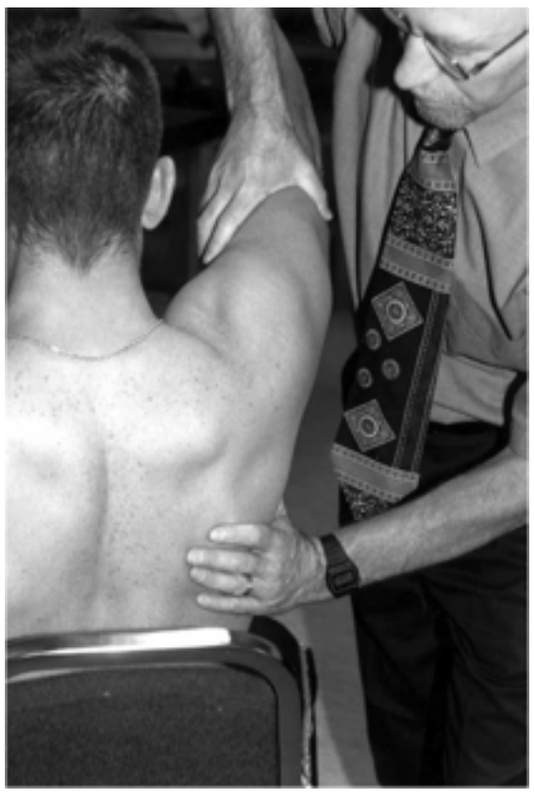
- 1-zijdig[3,4,5,6]

Afbeeldingen: seniam.org

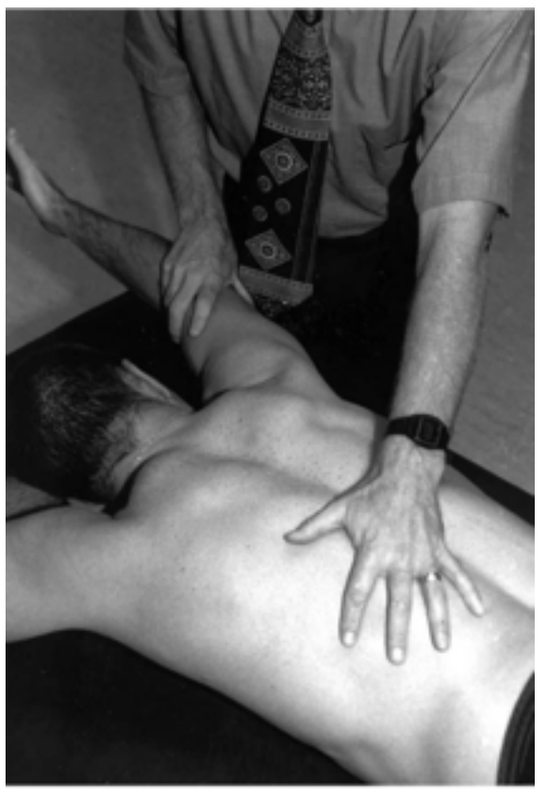
[1]Hermens HJ et al. (2000) J Electromyogr Kinesiol 2000;10(5):361-74. (seniam.org)
[2] Ekstrom R,et al. (2004) J Orthop Sports Phys Ther; 34(5):235-43.
[3]Santos et al., Manuscript Submitted
[4]Matsuki et al., Journal Shoulder Elbow Surg, June 2011, Volume 20, Issue 4, Pages 659–665
[5]Yoshizaki et al., Journal Shoulder elbow Surg, 2009 vol:18 iss:5 pg:756 -63
[6]Morais et al., Manual Therapy, 2013, 18 46-53

EMG Meting

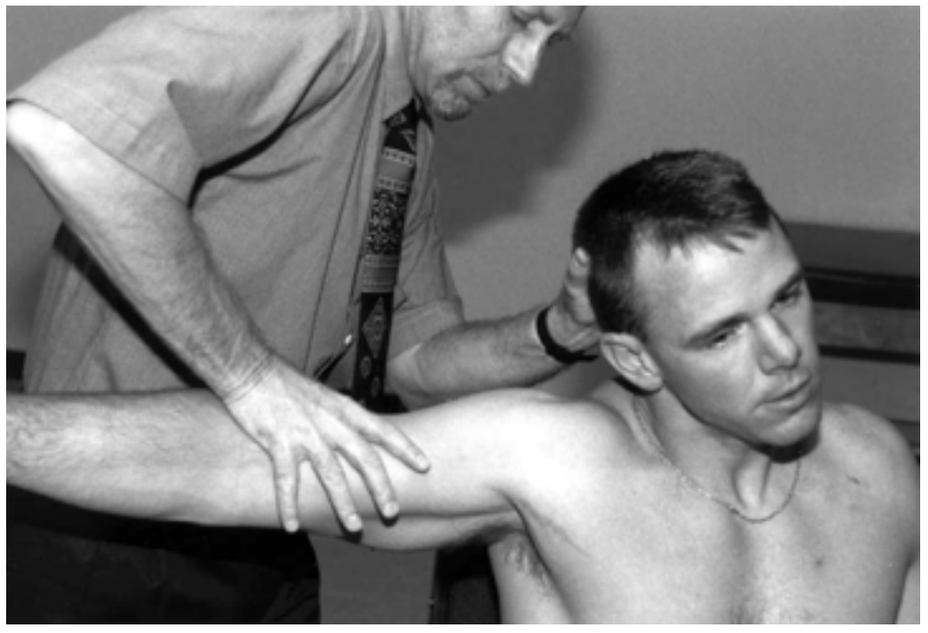
Maximal Voluntary Contraction[1,2]



SA



LT



UT

DA

Geen afb :(

afbeeldingen: [1]Ekstrom et al., Journal of Electromyography and Kinesiology 15 (2005) 418–428
Seitz & Uhl, Journal of Electromyography and Kinesiology 22 (2012) 968–974

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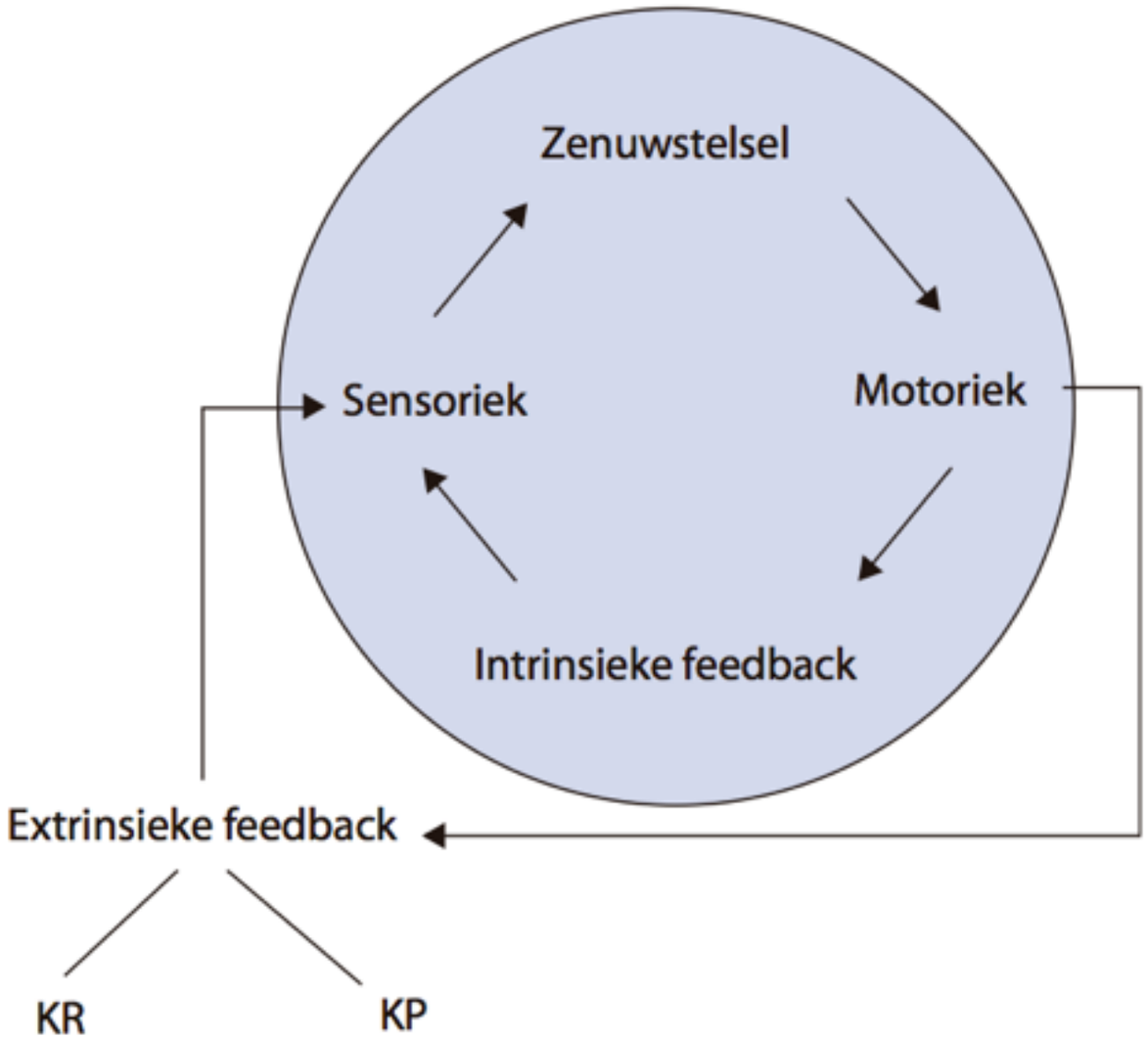
Motorisch leren

Fitts & Posner (1967)

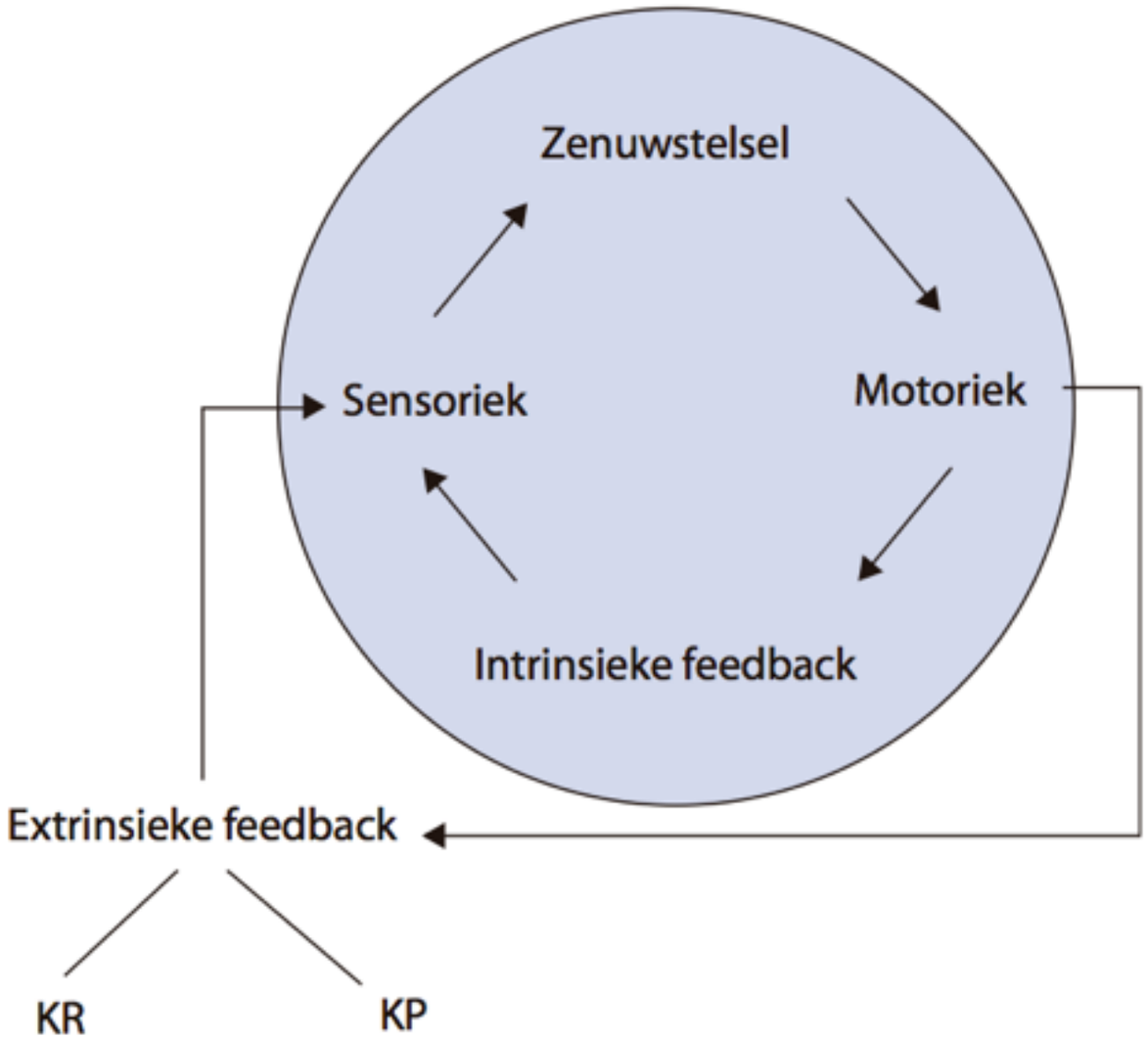
Cognitieve fase

Associatieve fase

Autonome fase



Afbeelding: Beek en Roerdink, Physios, 2012



Knowledge of Result - External Focus[1,2,3]

[1]Wulf et al, Rev Sport Exerc Psychol, 2012
[2]Benjaminse et al, Phys Ther in Sports, 2014
Afbeelding: [3]Beek en Roerdink, Physios, 2012

Decreasing landing forces: effect of instruction

Peter J McNair, Harry Prapavessis, Karen Callender

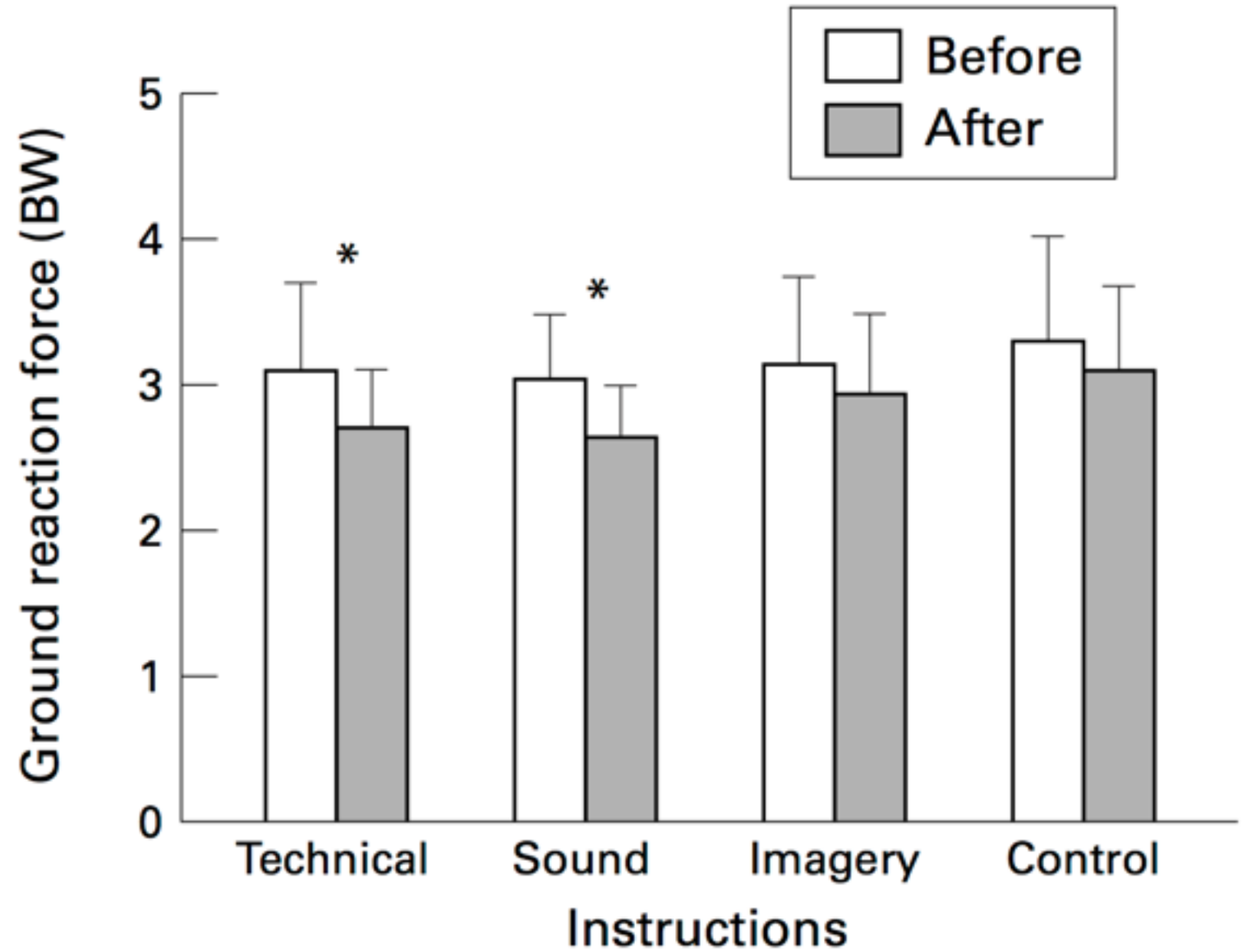
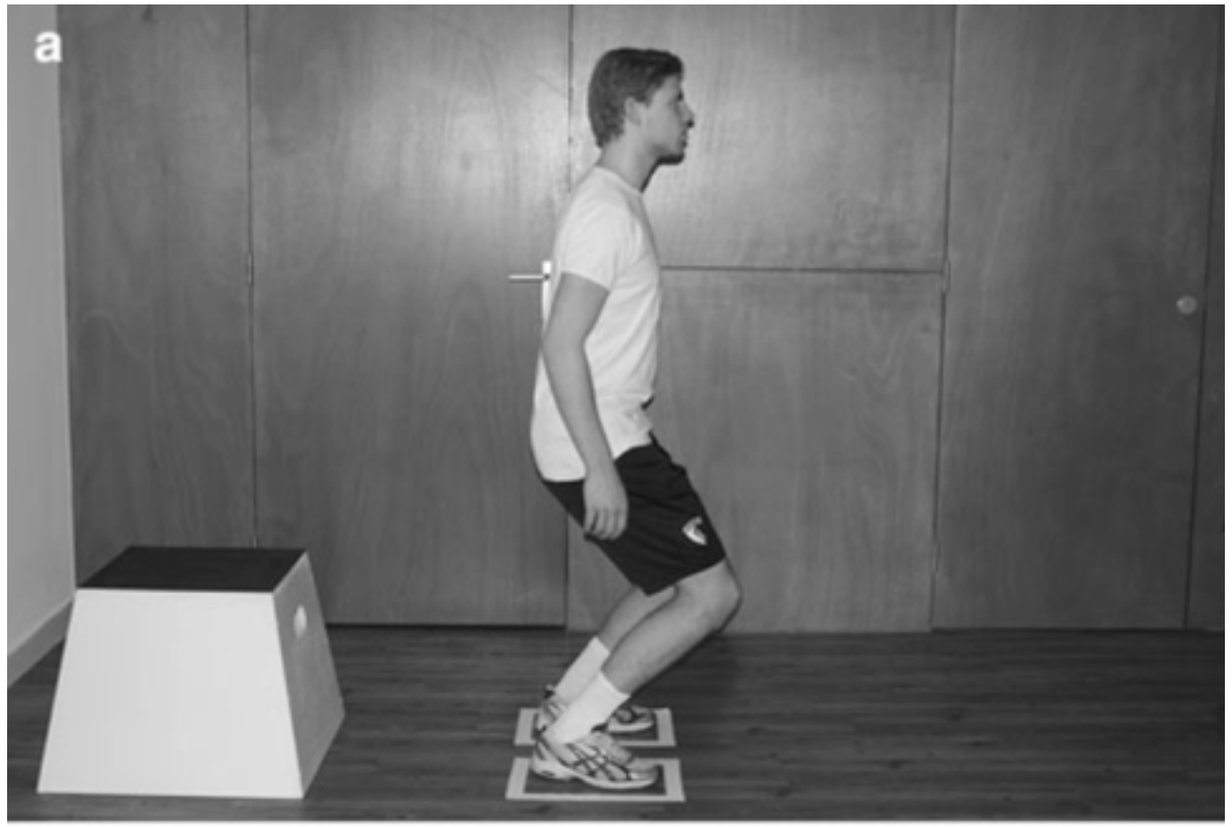


*Figure 1 Mean (SD) of vertical ground reaction forces before and after instructions. *Significant difference from control group. BW, body weight.*

McNair et al, BSJM, 2000



Gokeler et al, Sports Med, 2013

Increased movement accuracy and reduced EMG activity as the result of adopting an external focus of attention

Tiffany Zachry [a], Gabriele Wulf [a,*], John Mercer [a], Neil Bezodis [b]

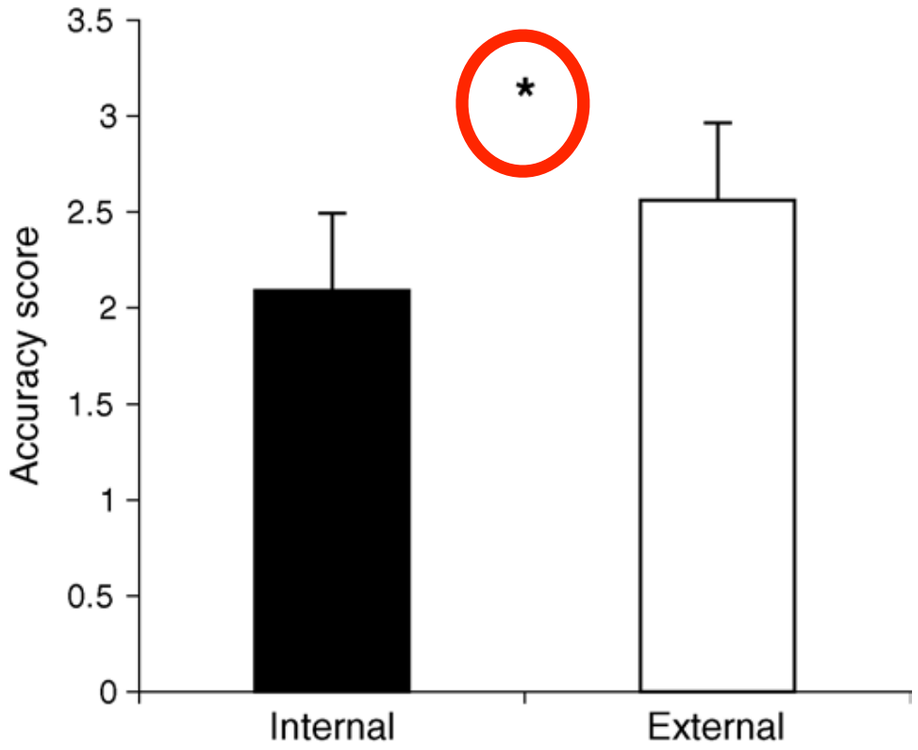


Fig. 1. Average free throw accuracy scores of the internal and external focus groups.

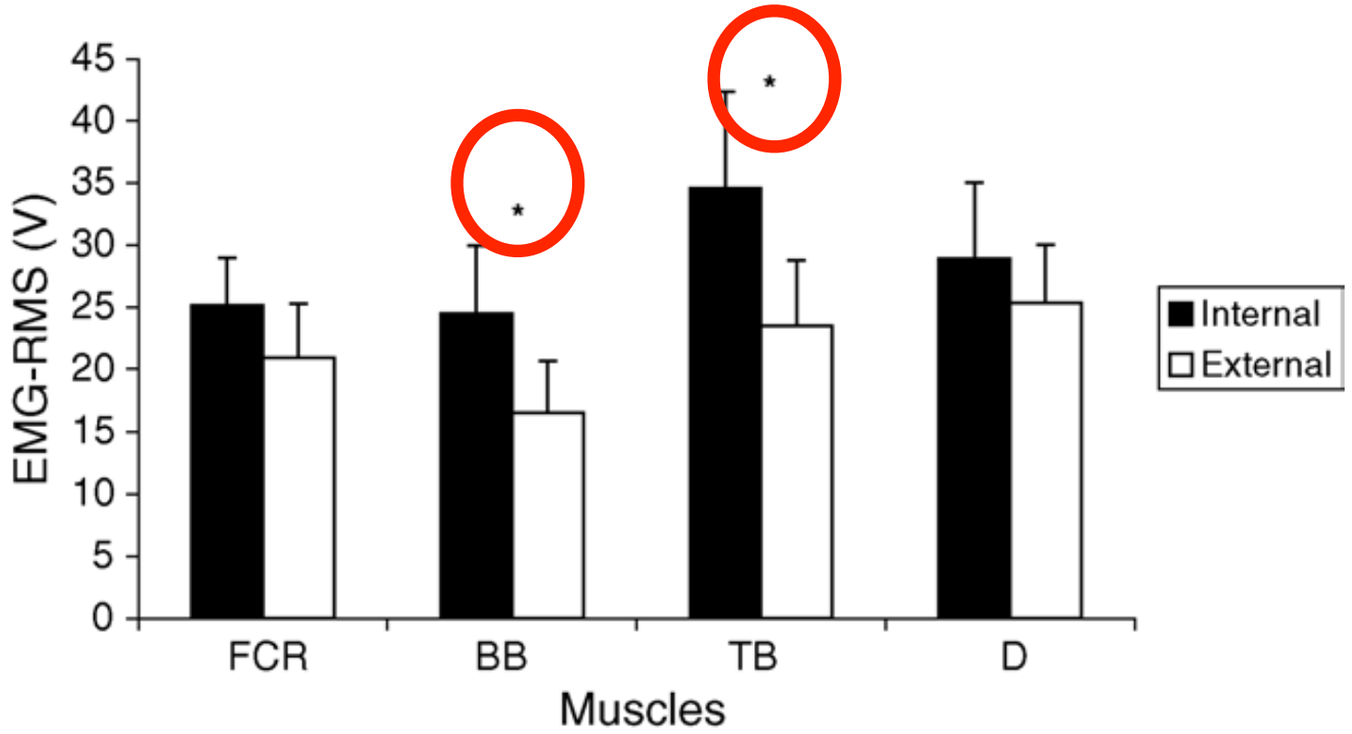


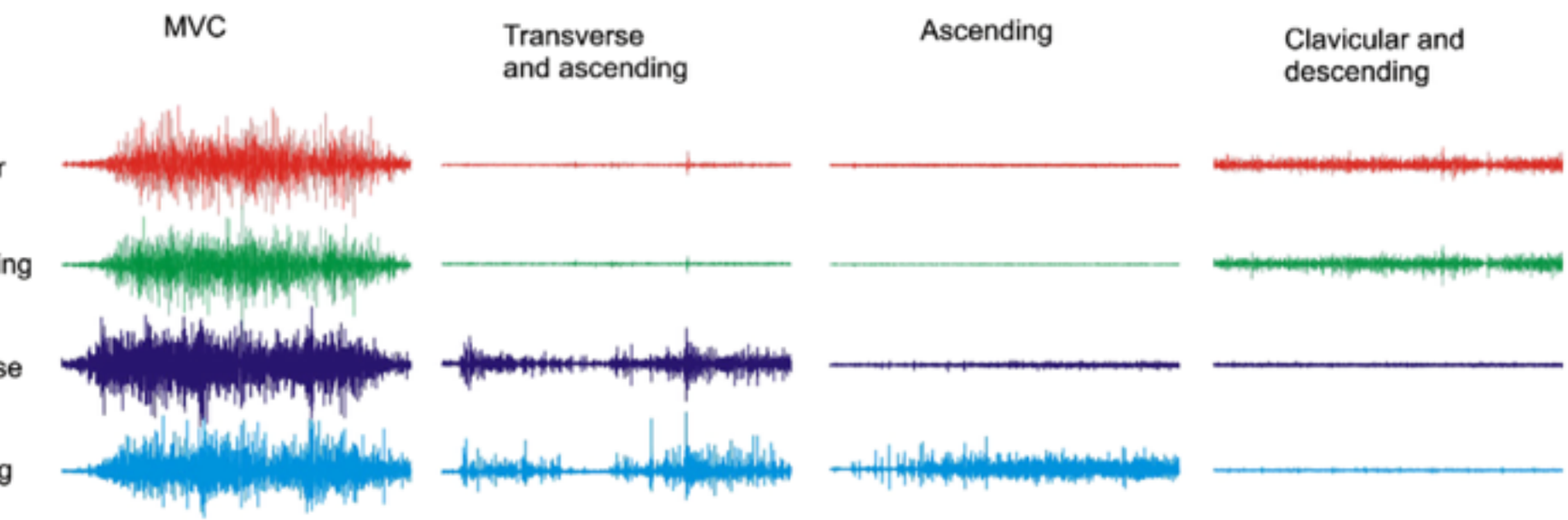
Fig. 2. EMG root mean square errors (RMSE) of the internal and external focus groups for the four muscle groups (FCR = flexor carpi radialis, BB = biceps brachii, TB = triceps brachii, D = deltoid).

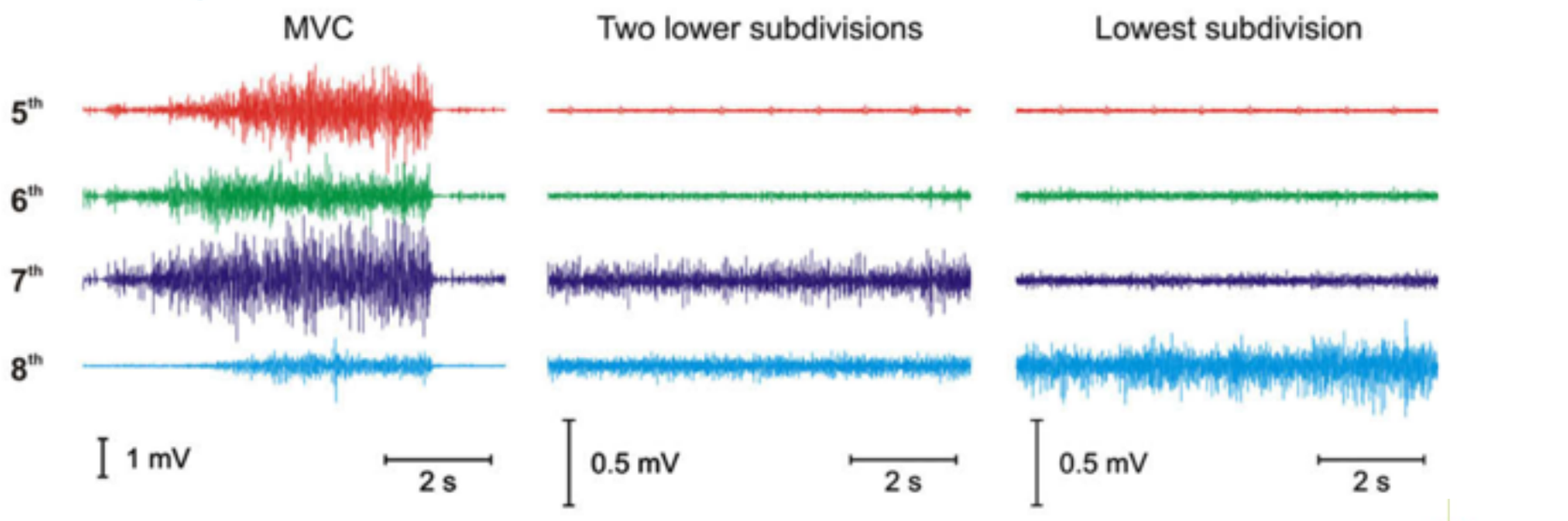
Behandeling

"Proximal stability, for distal mobility"

Kibleret al, Sports Med, 2006

Voluntary muscle control





Lower trapezius: Holterman et al, J Electromyography & Kinesiology, 2009
Serratus anterior: Holterman et al, J Electromyography & Kinesiology, 2010

Ellenbecker et al.
Br J Sports Med, 2010

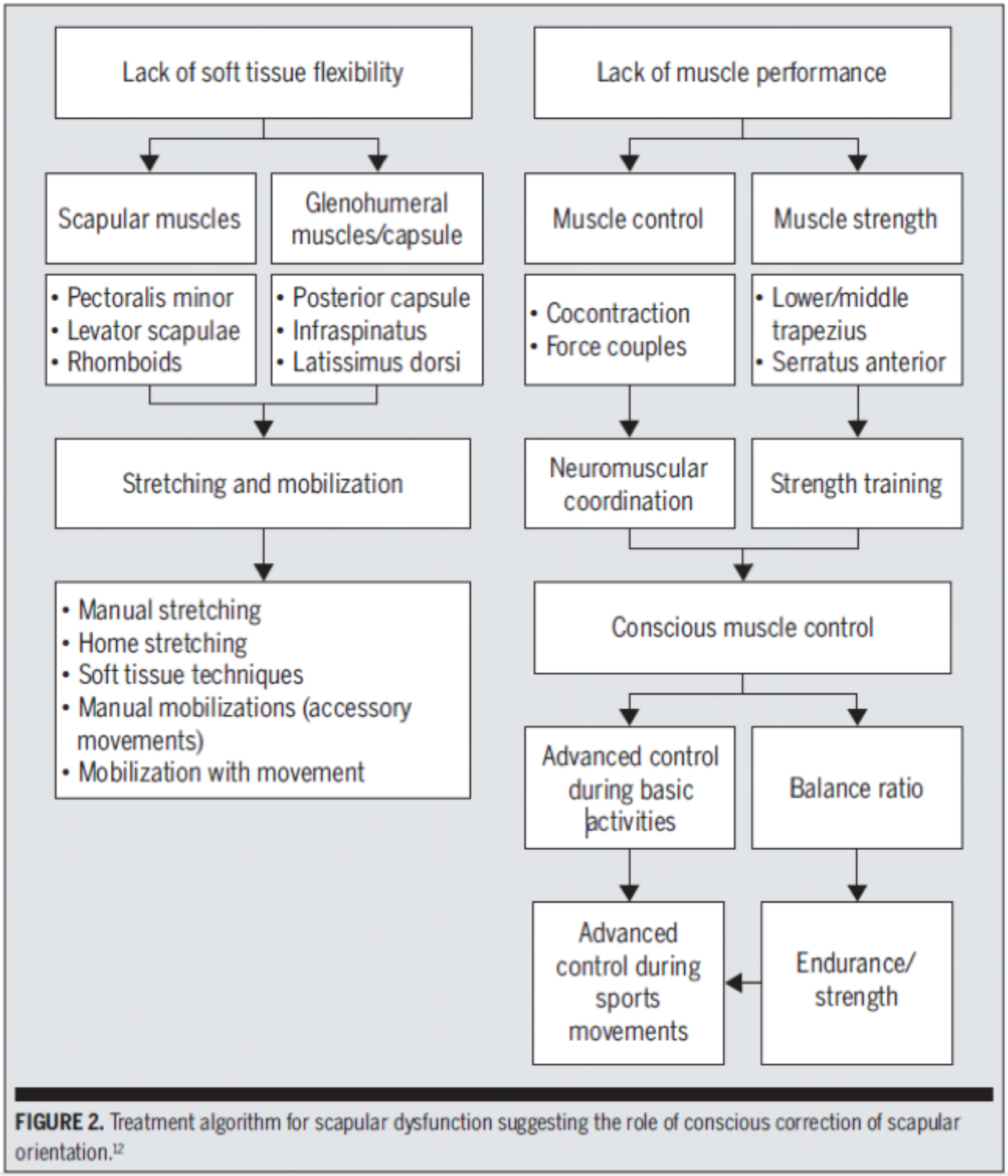


FIGURE 2. Treatment algorithm for scapular dysfunction suggesting the role of conscious correction of scapular orientation.[12]

Ellenbecker et al.
Br J Sports Med, 2010

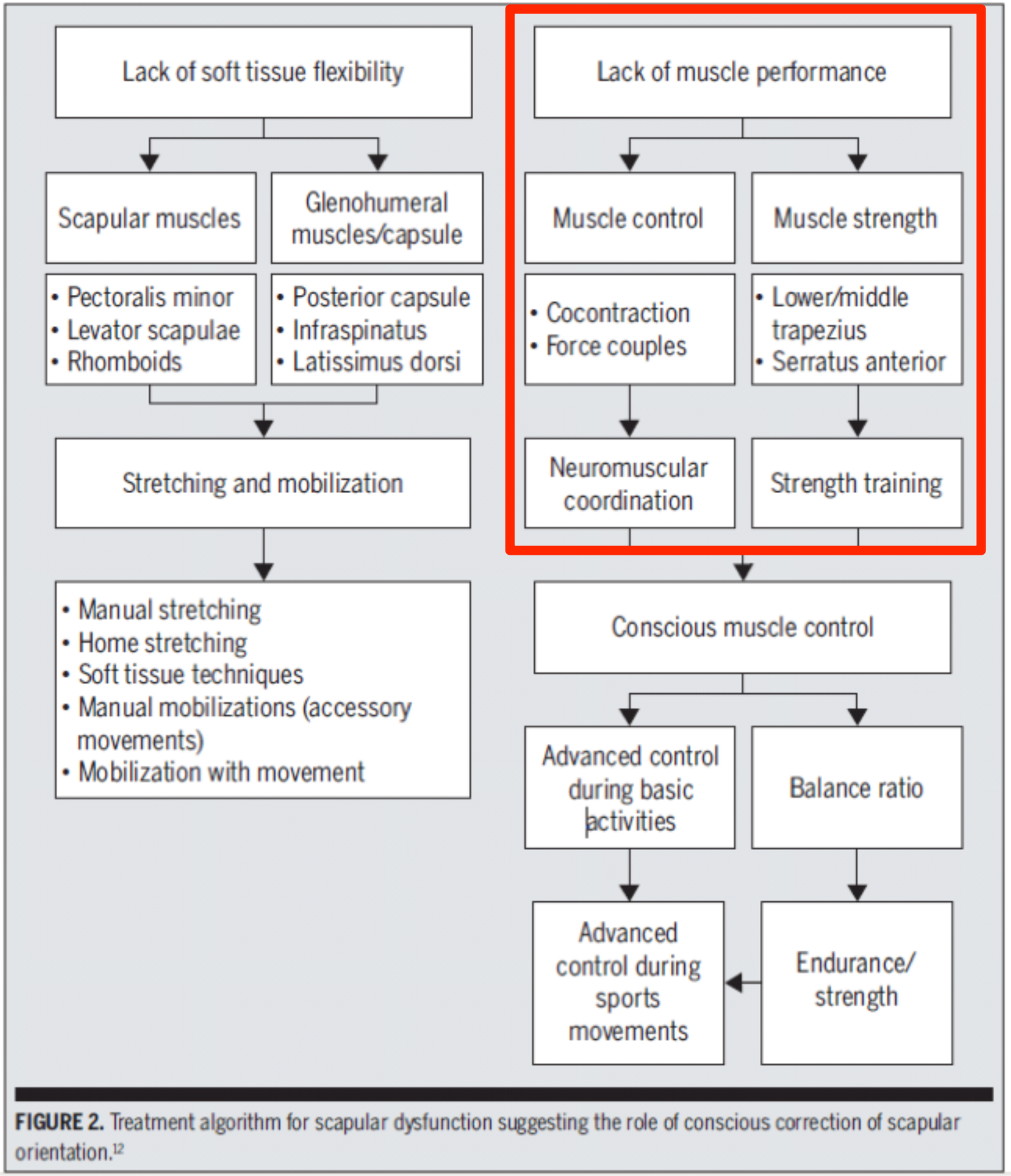


FIGURE 2. Treatment algorithm for scapular dysfunction suggesting the role of conscious correction of scapular orientation.[12]

Prone shoulder abduction
Forward flexion

Forward flexion in side-lying position
High row

Horizontal abduction

Horizontal abduction with external rotation

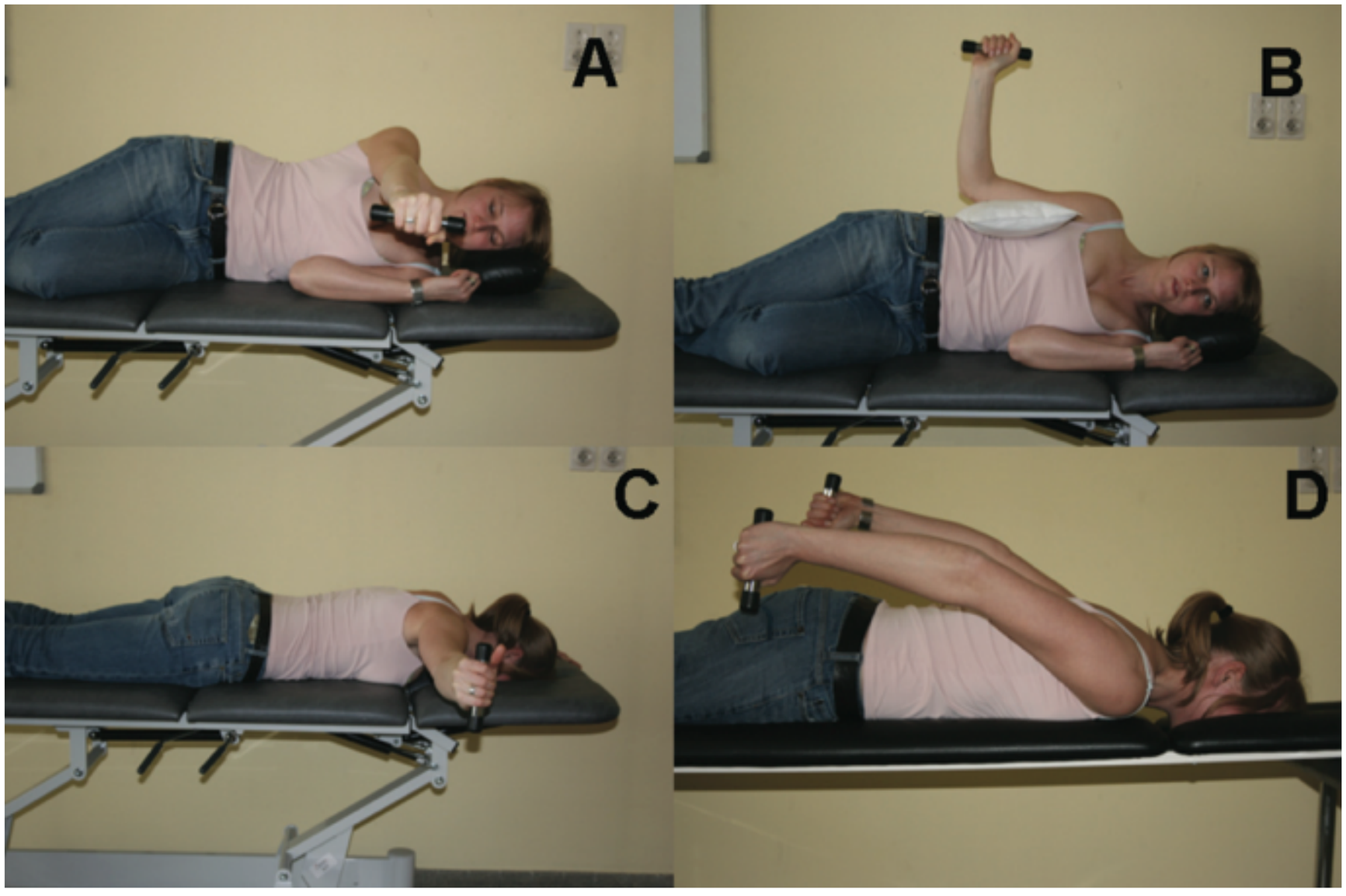
Low row (1)

Low row (2)

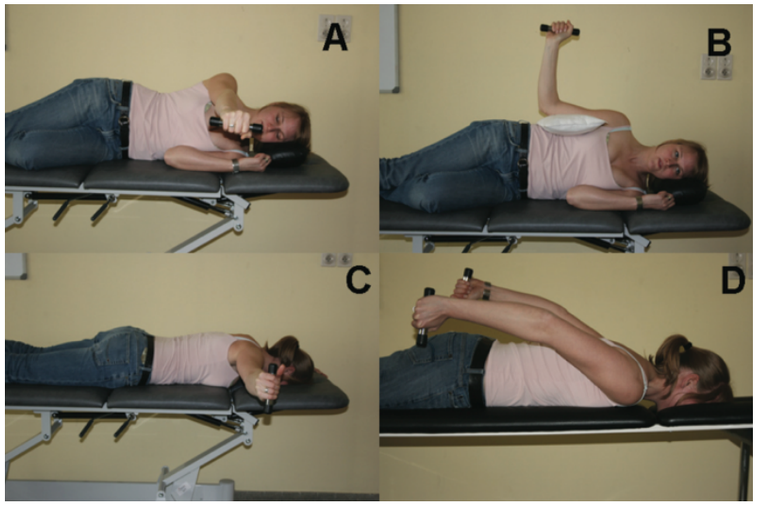
Prone extension

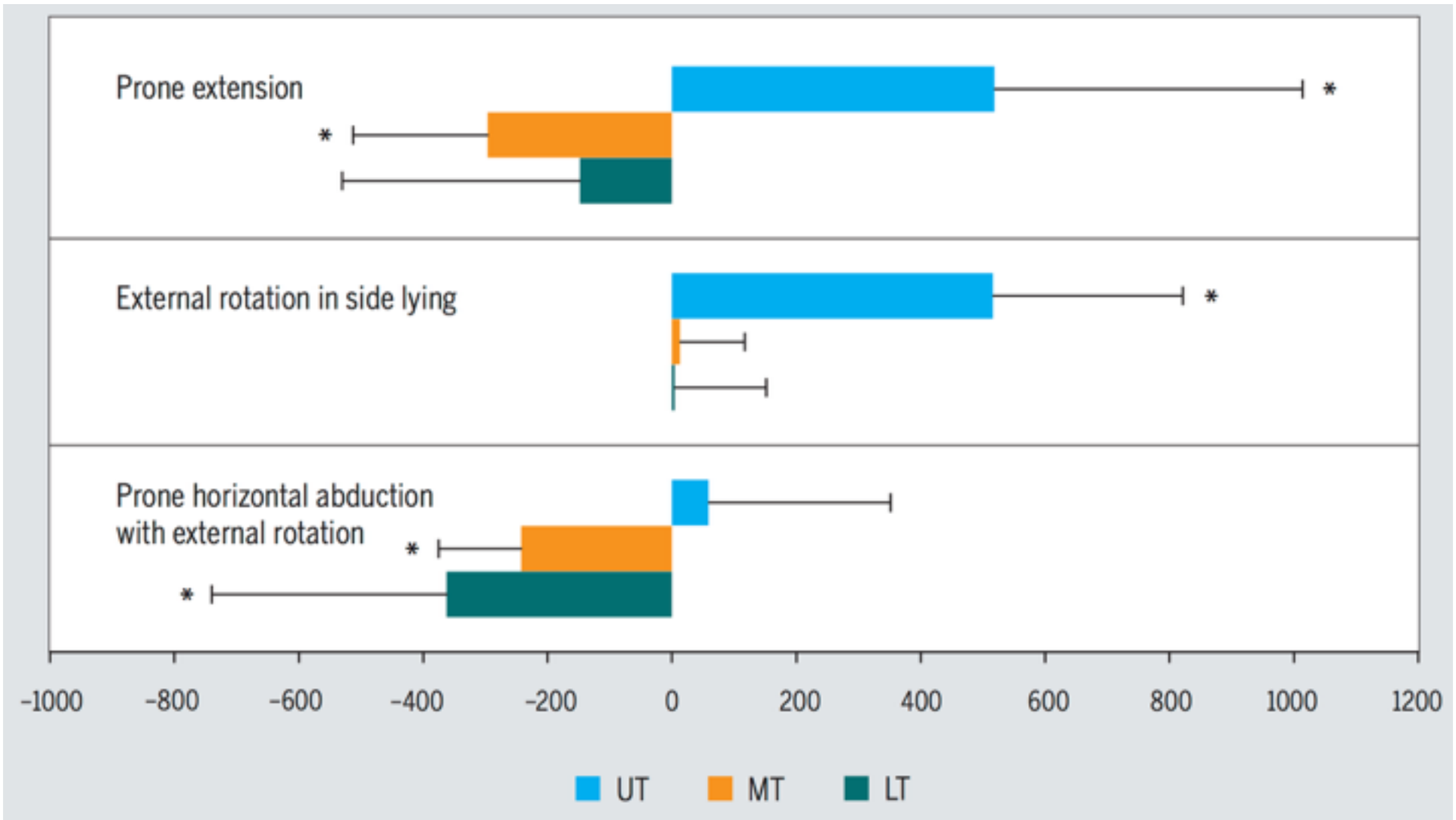
Rowing in sitting position

Scaption with external rotation
Side-lying external rotation



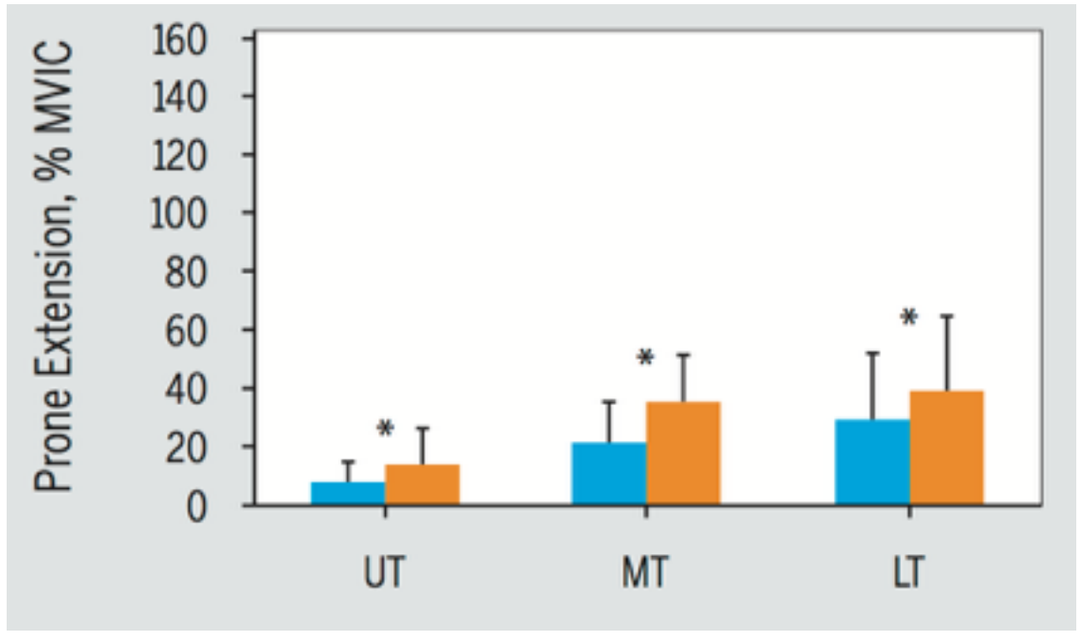
Cools et al, (2007) AJSM; Vol. 35, No. 10

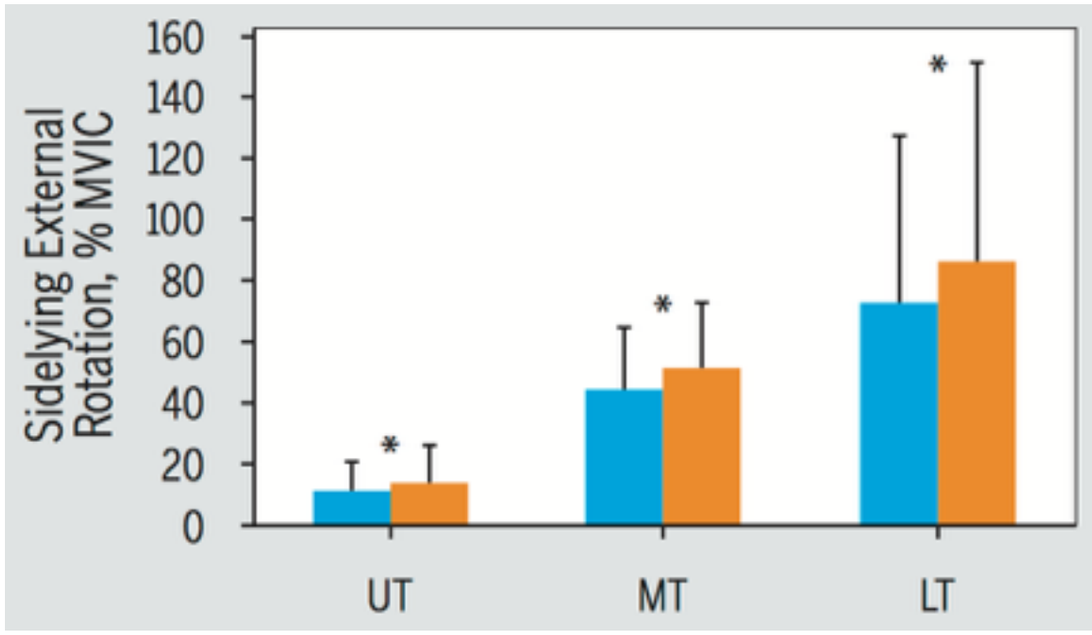




Cools et al, (2007), AJSM; Vol. 35, No. 10
De Mey et al. (2009), JOSPT; vol. 39, No. 10, 743

Conscious Control





Without conscious control of scapular orientation

With conscious control of scapular orientation

De Mey et al. (2009), JOSPT; vol. 39, No. 10, 743

Serratus Anterior Muscle Activity During Selected Rehabilitation Exercises*

Michael J. Decker,† MS, Robert A. Hintermeister, PhD, Kenneth J. Faber, MD, and Richard J. Hawkins, MD

Final order	Exercise
1	Push-up plus
2	Dynamic hug
3	Serratus anterior punch
4	Scaption
5	Knee push-up plus
6	Forward punch
7	Press-up
8	Shoulder extension

M J Decker, AJSM, 1999

Ellenbecker, Cools et al,
Br J Sports Med, 2010

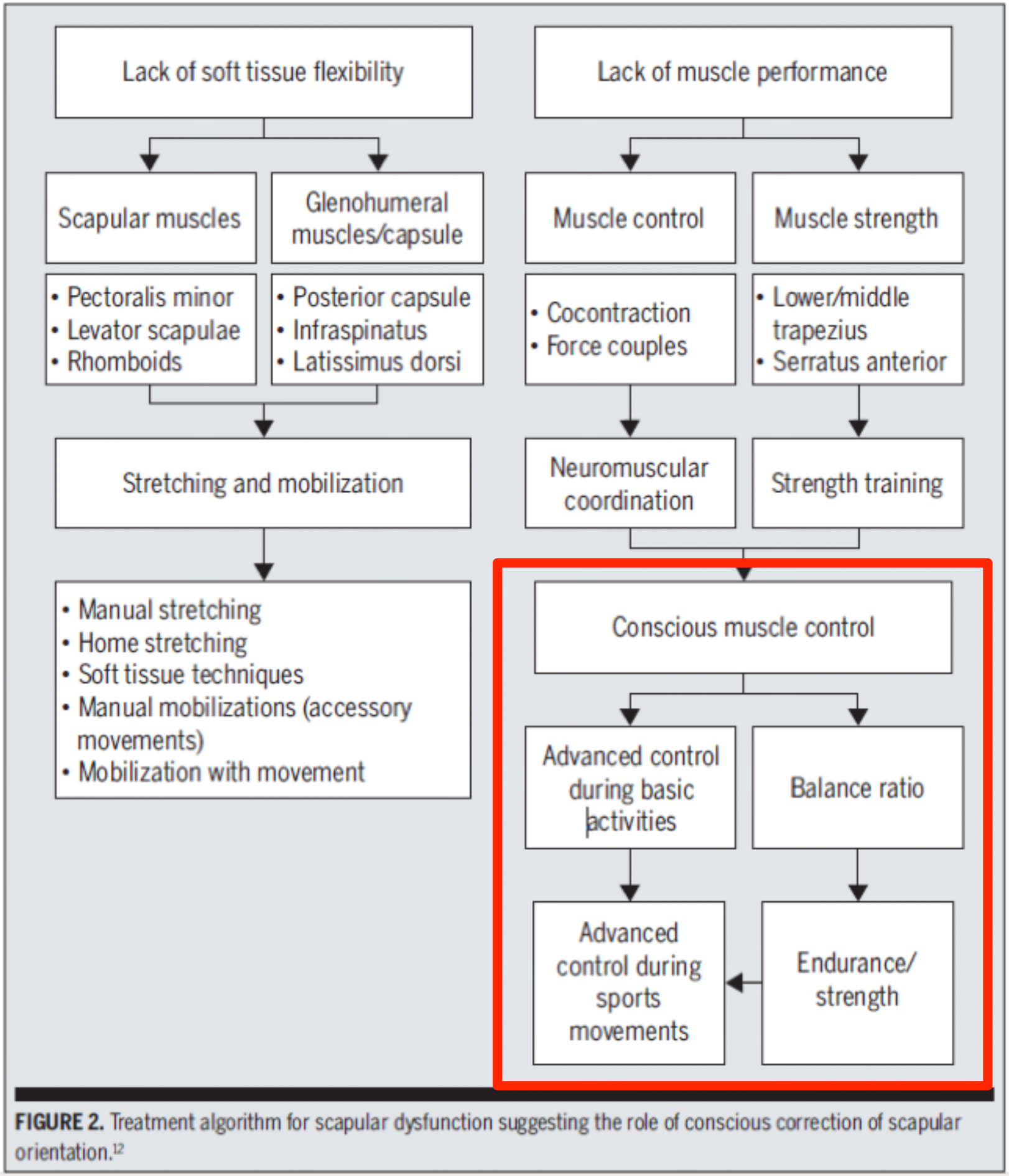
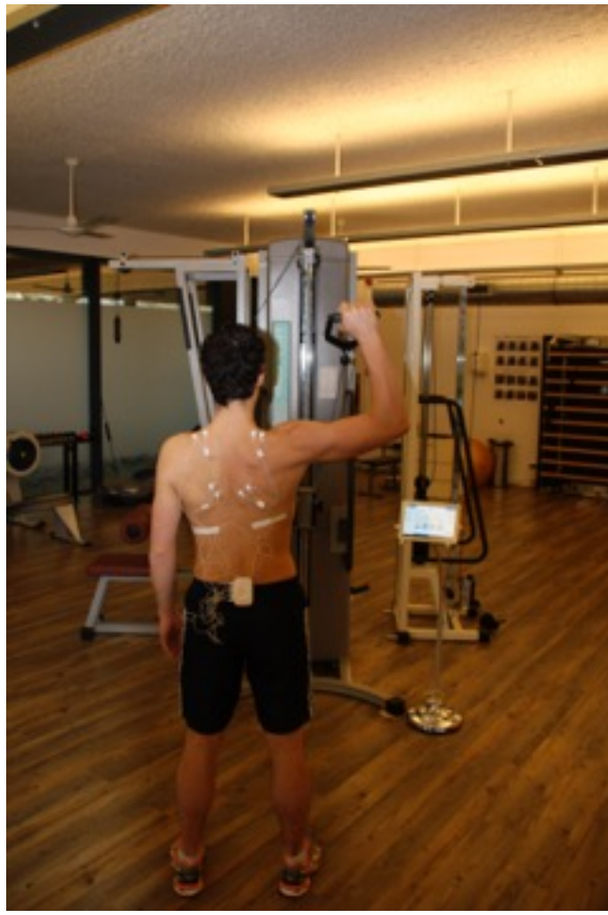


FIGURE 2. Treatment algorithm for scapular dysfunction suggesting the role of conscious correction of scapular orientation.[12]

Progressie:

- Thrower's 10 Wilk et al., JOSPT, 2010
- Escamilla et al., Sports Med, 2009
- Reinold et al., JOSPT, 2009



Exercise	Tubing force (N)	Pectoralis major EMG (%MVIC)	Latissimus dorsi EMG (%MVIC)	Biceps brachii EMG (%MVIC)	Triceps brachii EMG (%MVIC)	Lower trapezius EMG (%MVIC)	Rhomboids EMG (%MVIC)	Serratus anterior EMG (%MVIC)
Standing ER at 0° abduction	13±7	10±9	33±39	7±4	22±17	***48±25***	***66±49***	18±19
Standing ER at 90° abduction	12±8	34±65	19±16	10±8	15±11	***88±51***	***77±53***	***66±39***
Standing IR at 0° abduction	16±8	36±31	34±34	11±7	21±19	44±31	41±34	21±14
Standing IR at 90° abduction	16±11	18±23	22±48	9±6	13±12	***54±39***	***65±59***	***54±32***

Escamilla, et al, Sports Med, 2009

adapted from Myers et al, J Athl Train, 2005

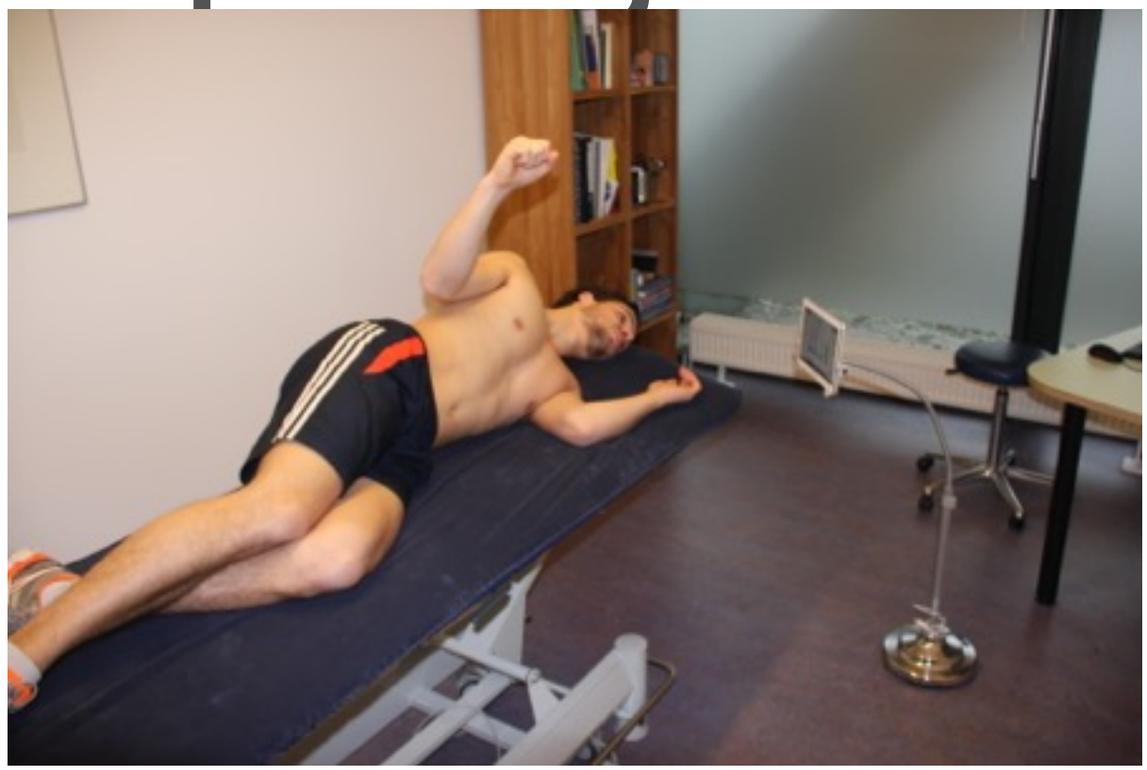
TABLE Recommended Exercises for Glenohumeral and Scapulothoracic Muscles Based on Anatomical, Biomechanical, and Clinical Implications

Muscle	Exercise	Anatomical Implications	Biomechanical Implications	Clinical Implications
Supraspinatus	1. Full can	1. Enhances scapular position and subacromial space	1. Decreased deltoid involvement compared to empty can	1. Minimizes chance of superior humeral head migration by deltoid overpowering supraspinatus
	2. Prone full can	2. Enhances scapular position and subacromial space	2. High posterior deltoid activity with similar supraspinatus activity	2. High supraspinatus activity and also good exercise for lower trapezius
Infraspinatus and teres minor	1. Side-lying ER	1. Position of shoulder stability, minimal capsular strain	1. Increased moment arm of muscle at 0° abduction. Greatest EMG activity	1. Most effective exercise in recruiting infraspinatus activity. Good when cautious with static stability
	2. Prone ER at 90° abduction	2. Challenging position for stability, higher capsular strain	2. High EMG activity	2. Strengthens in a challenging position for shoulder stability. Also good exercise for lower trapezius
	3. ER with towel roll	3. Allows for proper form without compensation	3. Increased EMG activity with addition of towel, also incorporates adductors	3. Enhances muscle recruitment and synergy with adductors
Subscapularis	1. IR at 0° abduction	1. Position of shoulder stability	1. Similar subscapularis activity between 0° and 90° abduction	1. Effective exercise, good when cautious with static stability
	2. IR at 90° abduction	2. Position of shoulder instability	2. Enhances scapular position and subacromial space. Less pectoralis activity	2. Strengthens in a challenging position for shoulder stability
	3. IR diagonal exercise	3. Replicates more functional activity	3. High EMG activity	3. Effective strengthening in a functional movement pattern
Serratus anterior	1. Push-up with plus	1. Easy position to produce resistance against protraction	1. High EMG activity	1. Effective exercise to provide resistance against protraction, also good exercise for subscapularis
	2. Dynamic hug	2. Performed below 90° abduction	2. High EMG activity	2. Easily perform in patients with difficulty elevating arms or performing push-up. Also good exercise for subscapularis
	3. Serratus punch 120°	3. Combines protraction with upward rotation	3. High EMG activity	3. Good dynamic activity to combine upward rotation and protraction function
Lower trapezius	1. Prone full can	1. Can properly align exercise with muscle fibers	1. High EMG activity	1. Effective exercise, also good exercise for supraspinatus
	2. Prone ER at 90° abduction	2. Prone exercise below 90° abduction	2. High EMG activity	2. Effective exercise, also good exercise for infraspinatus and teres minor
	3. Prone horizontal abduction at 90° abduction with ER	3. Prone exercise below 90° abduction	3. Good ratio of lower to upper trapezius activity	3. Effective exercise, also good exercise for middle trapezius
	4. Bilateral ER	4. Scapular control without arm elevation	4. Good ratio of lower to upper trapezius activity	4. Effective exercise, also good for infraspinatus and teres minor
Middle trapezius	1. Prone row	1. Prone exercise below 90° abduction	1. High EMG activity	1. Effective exercise, good ratios of upper, middle, and lower trapezius activity
	2. Prone horizontal abduction at 90° abduction with ER	2. Prone exercise below 90° abduction	2. High EMG activity	2. Effective exercise, also good exercise for lower trapezius
Upper trapezius	1. Shrug	1. Scapular control without arm elevation	1. High EMG activity	1. Effective exercise
	2. Prone row	2. Prone exercise below 90° abduction	2. High EMG activity	2. Good ratios of upper, middle, and lower trapezius activity
	3. Prone horizontal abduction at 90° abduction with ER	3. Prone exercise below 90° abduction	3. High EMG activity	3. Effective exercise, also good exercise for lower trapezius
Rhomboids and levator scapulae	1. Prone row	1. Prone exercise below 90° abduction	1. High EMG activity	1. Effective exercise, good ratios of upper, middle, and lower trapezius activity
	2. Prone horizontal abduction at 90° abduction with ER	2. Prone exercise below 90° abduction	2. High EMG activity	2. Effective exercise, also good for lower and middle trapezius
	3. Prone extension with ER	3. Prone exercise below 90° abduction	3. High EMG activity	3. Effective exercise, unique movement to enhance scapular control

Abbreviations: EMG, electromyography; ER, external rotation; IR, internal rotation.

Afbeeldingen: Reinold et al, JOSPT, 2009

In de praktijk:



EMG tijdens training

Korte Termijn 6 studies

Santos et al, Manuscript Submitted, 2015

Holterman, J Electromyography & Kinesiology, 2009

Holterman, J Electromyography & Kinesiology, 2010

Worsley et al, J Elbow Shoulder Surg, 2013

De Mey et al, AJSM, 2012

Huang et al, J Electromyography & Kinesiology, 2013

EMG parameters

Lange Termijn 1 studie

Santos et al, Manuscript Submitted, 2015

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Korte Termijn 4 studies

Santos et al, Manuscript Submitted, 2014

Worsley et al, J Elbow Shoulder Surg, 2013

De Mey et al, AJSM, 2012

Struyf et al, Clin Rheumatology, 2013

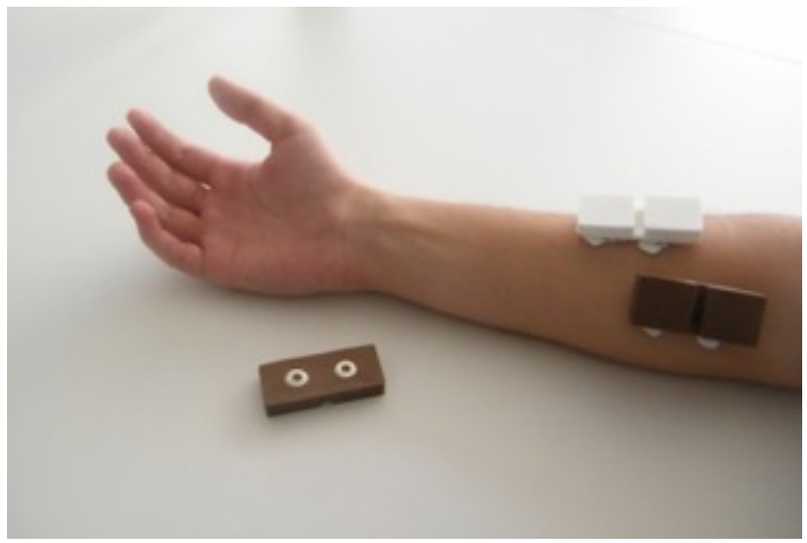
Huang et al, J Electromyography & Kinesiology, 2013

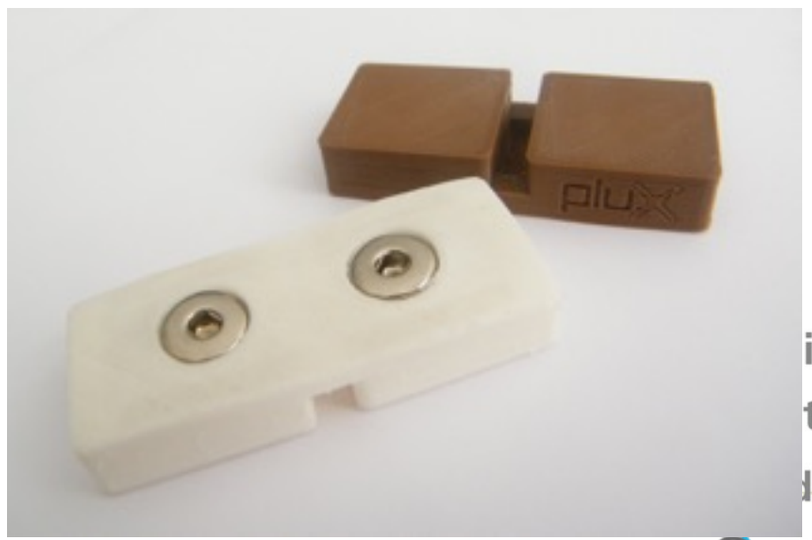
Lange Termijn 1 studie

Santos et al, Manuscript Submitted, 2015

Functie ↑ Pijn ↓

Toekomst





Take home message

- “fundament” voor verdere revalidatie
- Diagnostisch Algoritme
- oefenvormen Cools / Escamilla / Wilk / Reinold / Decker
- revalidatie duur 6-8 weken