

## Good Boost Clinical Rationale for exercise recommendation

This document is for the purposes of registration of the Good Boost app on the app and play store, to highlight the clinical rationale in the selection of exercise by Good Boost's exercise selection AI.

Good Boost's exercise recommendation engine technology is registered as a Class 1 Medical Device (Ref 8727) with the Medicines and Health Regulatory Authority (MHRA) with CE status. Good Boost has been [awarded a score of 74%](#) by Orcha, the international medical-app reviewer in the bone/muscle/joint category. On the date of review this places Good Boost in the top 10% of bone/muscle/joint category app on the planet. The Orcha review process includes: clinical assurance, functions & features, data privacy, user experience/accessibility. Good Boost has completed external and independent audit of our AI exercise selection engine with the Aquatic Therapy Association of Chartered Physiotherapist. The summery report is available on the Good Boost research page.

Good Boost is one of twelve organisation selected for Microsoft AI for Good programmes, with inputs and support from Microsoft in developing our AI platform and system.

Good Boost was one of five organisations that were selected by the Institute for Ethical AI as a top performing organisations.

Good Boost's was awarded the 'Technology' award by London Sport in March 2020.

Good Boost has been funded by both the Small Business Research Initiative (SBRI) and Innovate UK to develop our technology and therapeutic exercise AI following competitive processes.



The remainder of this document includes the published research and clinical guidelines that the Good Boost system has been developed on to ensure that users receive safe, appropriate and optimal exercise for their bone/muscle/joint condition.

## Clinical Development Team

Good Boost's team are specialists and therapeutic exercise and rehabilitation for musculoskeletal conditions.

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Good Boost works with external consultant Physiotherapists and exercise specialists to ensure our clinical rationale and logic the underpin the exercise recommendation engine is safe, appropriate and optimal.

# Knee Osteoarthritis Balance Responders

## Rationale

Resistance exercise is a vital component of the treatment for some of the underlying mechanisms of knee OA, including muscle strength insufficiency, muscle activation imbalance and aberrant biomechanics and cartilage loading (Vincent and Vincent 2012). For this reason, hip, knee and general lower limb strength and neuromuscular function is integrated and focused on for knee OA.

Home exercise programmes should aim to improve muscle strength and joint flexibility rather than knee extension muscle power only leading to the inclusion of wider lower limb neuromuscular and strength exercises (Suzuki et al 2018).

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# Total Knee Replacement

## Rationale

The primary exercises aim to increase range of movement and stability, focusing mainly on functional training with strength elements (Artz et al 2015).

Dominguez-Navarro et al (2019) describe balance exercises as a convenient adjunct to conventional rehabilitation protocols and seem to add to self-reported functionality post operatively.

## Bibliography

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# Total Hip Replacement

## Rationale

Current protocols include strengthening, education on hip precautions and exercise progression, gait retraining, stairs practice, range of motion exercises (Nelson et al 2018).

Dominguez-Navarro et al (2019) describe balance exercises as a convenient adjunct to conventional rehabilitation protocols and seem to add to self-reported functionality post operatively.

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## Spine Flexion, Extension and Side-Flexion

For the responder groups, participants are prescribed exercises in the movement direction that reduces pain severity or are less painful to perform than movements in other directions.

Exercise performed in low back pain's directional preference shows significantly superior outcomes to other exercise forms and treatments across the literature.

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Long, A., Donelson, R. and Fung, T., 2004. Does it matter which exercise?: A randomized control trial of exercise for low back pain. *Spine*, 29(23), pp.2593-2602.

<https://www.researchgate.net/publication/319961504> The effects of Selective Pilates versus extension-based exercises on rehabilitation of low back pain - Moving in just one direction/extension direction inferior

Superior in extension-provoked

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6626624/> - neuromuscular control

<https://www.sciencedirect.com/science/article/abs/pii/S0031940618306527> - Slightly favour Mckn

<https://academic.oup.com/milmed/article/182/11-12/e1957/4661612> - DP > UC

<https://pubmed.ncbi.nlm.nih.gov/15564907/> - exercises matching subjects' DP significantly and rapidly decreased pain and medication use and improved in all other outcomes.

<http://www.jospt.org/doi/pdf/10.2519/jospt.2012.42.4.A1> - specific repeated movements to promote centralization in patients with acute, subacute or chronic low back pain with directional preference, Grade A evidence. SR



## Post-Surgical Lumbar Rehabilitation

Evidence supports rehabilitation in the early stages. For example, Snowdon and Peiris, (2016), found, in participants four weeks post-surgery or less, physiotherapy significantly reduced pain at 12 weeks and 12+months compared to no physiotherapy, standard postoperative care, rest, less active physiotherapy, or sham physiotherapy. Neither Physiotherapy groups saw any adverse events.

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Poppert, E.M. and Kulig, K., 2013. Rehabilitation following lumbar diskectomy. *Physical therapy*, 93(5), pp.591-596.

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Standaert, C.J., Weinstein, S.M. and Rumpeltes, J., 2008. Evidence-informed management of chronic low back pain with lumbar stabilization exercises. *The spine journal*, 8(1), pp.114-120.



## Stabilisation Exercise

Patients use postures and movements that are potentially harmful due to maladaptive processes (Moseley, 2008).

8 preselected patients with positive tests were treated with an individualised movement control exercise program and showed improvements in test performance associated with improvements in patient specific functional complaints and disability Luomajoki (2010)

Luomajoki H. Book Movement control impairment as an output of distorted body image. City; 2010. Movement control impairment as an output of distorted body image

Moseley GL. I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain. *Pain*. 2008;140:239–243. doi: 10.1016/j.pain.2008.08.001. [[PubMed](#)] [[CrossRef](#)] [[Google Scholar](#)]

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# Shoulder Instability

Unstable shoulder, strengthening is the predominant focus. As Buckhead and Rockwood (1981) assert, "Shoulder strengthening is the most commonly recommended treatment for atraumatic instability"

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Burkhead WZ, Jr., Rockwood CA, Jr. Treatment of instability of the shoulder with an exercise program. *J Bone Joint Surg Am.* 1992;74:890–896.

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Kibler WB. The role of the scapula in athletic shoulder function. *Am J Sports Med.* 1998;26:325–337

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## Humorous / Shoulder fracture recovery

Numerous authors have demonstrated or collected evidence demonstrating early rehabilitation following surgery for humeral fracture improves outcome. For example, Hodgson et al, (2007) showed immediate physiotherapy resulted in faster recovery, with benefits that were maintained, maximal functional benefit being achieved at 1 year (Hodgson et al., 2007).

Crall, T., 2016. Rehabilitation Guidelines for Proximal Humerus Fracture (Non-Operative).

Griffin, S., (2015) HUMERUS FX ORIF PROTOCOL (PROXIMAL, MIDSHAFT, or DISTAL ORIF)

Hodgson, S., 2006. Proximal humerus fracture rehabilitation. *Clinical Orthopaedics and Related Research*®, 442, pp.131-138.

Hodgson, S.A., Mawson, S.J., Saxton, J.M. and Stanley, D., 2007. Rehabilitation of two-part fractures of the neck of the humerus (two-year follow-up). *Journal of shoulder and elbow surgery*, 16(2), pp.143-145.

Izquierdo R, M.D. 2014. Non-Operative Proximal Humeral Fracture Rehabilitation Protocol



## Limited Shoulder Mobility / Stiffness

### Stiff Shoulder Justification

Literature strongly advocates the use of individualising treatment on the shoulder. Kelley et al, (2009a) advocate clinical decisions, including the nature of exercise prescription, should be based on pain irritability, as does Longo et al, (2018) in his systematic review. In their guideline Kelley et al, (2013b) strongly advocate stretches exercises, but again stress the importance of individualizing these to the patient. Page et al, (2014) labelled exercise to regain ROM active assisted and through stretching as essential in his systematic review of the literature.

Çelik D. and Comparison of the outcomes of two different exercise programs on frozen shoulder. *Ada Orthop Traumatol Turc.* 2010; 44: 285– 292

Kelley, M.J., McClure, P.W. and Leggin, B.G., 2009. Frozen shoulder: evidence and a proposed model guiding rehabilitation. *Journal of orthopaedic & sports physical therapy*, 39(2), pp.135-148.

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Page MJ, Green S, Kramer S, et al. Manual therapy and exercise for adhesive capsulitis (frozen shoulder). *Cochrane Database Syst Rev* 2014;26:CD011275.

Russo A, Arrighi A, Vignale L, et al. Conservative integrated treatment of adhesive capsulitis of the shoulder. *Joints* 2014;2:15–9.



## Shoulder Pain / Weakness

Weak shoulder exercise should focus on many body areas, but preferentially target the rotator cuff. Objective studies using instrumented testing have frequently demonstrated weakness and muscular imbalance in rotator cuff impingement (Erol et al., 2008). This is especially important in participants with weak, painful shoulders, and objective testing is recommended Ellenbecker and Cools (2010). Exercises are therefore based upon pain response to movements of the shoulder. We also analyse range of motion.

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Borstad JD, Ludewig PM. Comparison of three stretches for the pectoralis minor muscle. *J Shoulder Elbow Surg* 2006;15:324–30.

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Richardson, E., Lewis, J.S., Gibson, J., Morgan, C., Halaki, M., Ginn, K. and Yeowell, G., 2020. Role of the kinetic chain in shoulder rehabilitation: does incorporating the trunk and lower limb into shoulder exercise regimes influence shoulder muscle recruitment patterns? Systematic review of electromyography studies. *BMJ Open Sport & Exercise Medicine*, 6(1), p.e000683.

Ludewig PM, Cook TM. Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. *Phys Ther* 2000;80:276–91.



## Sub-Acromial Decompression Surgery

The positive effects of early Physiotherapy/rehabilitation is a recurrent theme in the literature shared amongst all the pathologies. Following sub-acromial decompression surgery (SAD), Hultenheim et al (2008) found participants engaging in dynamic exercises for the rotator cuff on the day of surgery had an improved Constant-Murley Shoulder Outcome Score against participants who only started dynamic exercises for the rotator cuff after six weeks.

Andersen, N.H., Søjbjerg, J.O., Johannsen, H.V. and Sneppen, O., 1999. Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study. *Journal of shoulder and elbow surgery*, 8(2), pp.99-101.

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Pastora-Bernal, J.M., Martín-Valero, R., Barón-López, F.J., Moyano, N.G. and Estebanez-Pérez, M.J., 2018. Telerehabilitation after arthroscopic subacromial decompression is effective and not inferior to standard practice: Preliminary results. *Journal of telemedicine and telecare*, 24(6), pp.428-433.

Gundersen Health System Sports Medicine; Subacromial Decompression / Acromioplasty Rehabilitation Program

South Shore Orthopaedics. Subacromial Decompression Protocol

Sports & Orthopaedic Specialists; Arthroscopic Subacromial Decompression Protocol

The Brigham and Women's Hospital