Controversy

Over stretched

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Several years ago athletes failed to stretch adequately, leaving tight muscles that were unable to cope with the range of movements demanded from them. Recently, there has been an obsession with stretching, and some people are now beginning to fall off the other end of the stretching gradient and produce injuries purely from stretching. This is particularly so with the hamstrings where I have now seen five *de novo* hamstring origin tears that occurred purely whilst doing stretching exercises.

One hears many people talking about stretching accompanied by the warning that 'one must not bounce'. When we in sports medicine first started to talk about this, we really confined our comments to those with injuries where the healing scar was at risk, but these comments have now become gospel for prophylactic stretching. I have seen several international sportsmen who consider that they have become less injury prone once they stopped or diminished their stretching routines. Thus, I think it might be time to try and rationalize some of the stretching modalities available to us and use them with some degree of logic.

Each joint and surrounding muscles have a potential length limited only by full joint range and soft tissue abutment. The passive length is limited by antagonist relaxation and capsular/joint range; here the straight leg raise induced by the examiner would be an example.

Active length requires agonist strength plus antagonist relaxation, for example, the gymnast producing a V sit position or sitting pike position requiring strength from the hip flexors plus proportional relaxation in the hamstrings.

Functional length is the length demanded by the sport plus a leeway for mistakes, and is often a combination of both active and passive length. Thus a hockey goalkeeper might have to stretch the leg wide to stop a shot but equally well, whilst sliding the leg out, gravity will force hip abduction even further.

Stretching may be achieved by yoga-style stretching which produces a weak spindle stretch reflex, is slow to habituate and, when prolonged, produces an increased number of sarcomeres¹.

A bounce stretch produces a strong spindle stretch reflex and is rapid to habituate. Its eccentric loading increases teno-osseous junction strength and does not gain muscle length but produces muscle spasm to protect any scar or injury².

Proprioceptive neuro-muscular facilitation (PNF) may be worked in two ways: by increased agonist

power which therefore relaxes the antagonist muscles^{2,3} (resisting the quadriceps muscles will encourage relaxation of the hamstring); and by increased antagonist work which will also produce increased relaxation of the antagonist⁴ (making the hamstring work for a few seconds and then relaxing it and stretching it passively). Ballistic stretching (swinging of the foot up and down above the waist) requires increased agonist strength from the hip flexors plus antagonist relaxation in a co-ordinated fashion.

Stretching may also be enhanced by relaxation of the target gamma efferents which relax the spindle setting. Thus breathing out, or mental relaxation, during stretching may increase muscle relaxation and the stretchable length of the muscle. Heat, cold and massage do not increase the stretch of the muscle^{5,6}.

Two of my cases of hamstring tears whilst stretching were doing no more than a hurdles position stretch and at the same time trying to force down the chest not only onto the leg but to the foot when the acute tear occurred. Osterning, in a study relating EMG activity to isokinetic work, showed that there was a 25 per cent hamstring activity during the last degree of knee extension, suggesting that the hamstring acted as a decelerator of the knee joint⁵. In other words, during this method of stretching, one is trying to actually force a muscle into a longer position when in fact it is probably actively contracting against the stretch.

Methods of stretching

Stretching should aim for functional length, not potential length, as appears to be the current practice and, during warm-up, bounce stretching may be employed if the intention is to increase teno-osseous strength.

Yoga stretching with exhalation for spindle relaxation will increase muscle length. Paired stretching may increase passive length and PNF stretching will aid active length. Finally, ballistic stretching will encourage active length co-ordinated with antagonist deceleration. In other words, the hamstring is taught to decelerate over a longer range.

However, during injury, the prime stretch modalities should not include bounce stretching which habituates protective muscle spasm but should be centred around yoga-style stretching and PNF modalities with the later addition of controlled ballistic stretching. It is important that passive hamstring stretch is not forced outside the functional range as injury may occur. It must be remembered that the functional range demanded from a sprinter will be entirely different from that demanded by a footballer who may have to stretch high with his foot for an aerial ball.

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Thus, I would like to suggest that there is now a place for using bouncing and ballistic stretching alongside the well recommended yoga and PNF stretching. Its place and its reason for use must be carefully ascertained. The ultimate goal of stretching should be to achieve functional range—not potential range.

References

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- 2 Russel, K. 'Increasing joint range of movement in young athletes' Paper to the British Association of National Coaches, December 1985, Birmingham
- 3 Hartley and O'Brien, S.J. Six mobilisation exercises for active range of hip flexion *Res Quart* 1980, **51**(4), 625

Erratum

Dr Malcolm Read writes to point out our printing error in Vol. 23:2 (June 1989), page 78. The correct text should read 'Pure Ginseng is not proscribed' (not 'pre-scribed'). We apologise for this error. Ed.

Book Reviews

Determination of the Moments of Inertia of the Human Body and its Limbs

W. Braune and O. Fischer
Springer-Verlag, Berlin, 1989, DM 85,
84 pp, ISBN 3 540 18813 4

'Determination of the Moments of Inertia of the Human Body and its Limbs' has been translated from the German by P. Maquet and R. Furlong. It describes the procedures and presents the original results of the classic experiments by W. Braune and O. Fischer in 1892. The work was carried out to determine the forces exerted on and by parts of the body during walking which were prepared and subsequently published in the much acclaimed work 'The Human Gait'. This slim volume is comfortable to read in translation and is beautifully prepared and presented. It is a specialist's book and will be of

interest to serious students and practitioners of biomechanics, ergonomics, medicine and related disciplines.

W. Bell PhD

Year Book of Podiatric Medicine and Surgery 1988

Richard M. Jay
Year Book Medical (Chicago, London),
Hardback, 330 pp, £31.50,
ISBN 0-8151-4859-3, ISSN 0742-194X

Richard Jay and his contributing editors have searched the multitude of US and foreign medical journals to present us with abstracted articles and research papers in seventeen chapters of exceptional quality. Chapters cover paediatrics to arthritis, taking in biomechanics, sports medicine, traumatology and system disorders

affecting the foot, en route. Articles are well illustrated with clear X-rays and photographs. At the end of each article the editor comments on the significance and quality of the work, offering succinct criticism.

With the wealth and diversity of material contained within the book, it is perhaps best used as a reference stepping stone for those wishing to further their own study or research. As a whole the book would prove invaluable to a modern-day chiropractor/podiatrist as well as the orthopaedic or podiatric orientated physician. To a sports medicine practitioner only certain chapters would be directly relevant.

This volume is probably best suited to the shelves of a medical reference library, but certainly would not gather dust.

D. Bucklow MChS, SRCh

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