

HOW DOES CONTRACTION OF LUMBRICAL MUSCLES OF THE FOOT REDUCE THE URGE TO VOID?

Hypothesis / aims of study

Contraction of the lumbrical muscles in the feet has been used as a clinical strategy to reduce the urge to urinate in upright postures. This could be due to activation of the pelvic floor muscles (PFM) in conjunction with lumbrical muscle activity. One possible reason for such co-activation may be due to the related activity of both of these muscle groups in postural control. Recently contributions of PFM to trunk postural control have been demonstrated (1). Postural control in standing depends on a system of antigravity muscles that provide support to weight bearing joints. The activity in these muscles is continually modulated to maintain balance and equilibrium in the upright position. Co-ordinated activity has been demonstrated between some of these postural muscles, i.e. the abdominal and PFM (2) but it is not known whether a similar association occurs between the PFM and other postural muscle groups. This study aimed to investigate activity in one PFM, the striated urethral sphincter (SUS) in males, in response to voluntary activation of one antigravity muscle group, the plantar lumbrical muscles.

Study design, materials and methods

Five healthy males, aged between 25 and 40 gave informed consent to participation in this study. Electromyographic (EMG) activity of the SUS was monitored intra-urethrally using surface electrodes, made from 75 micron stainless steel wire threaded into a 6 Fr urinary catheter (3). This single-use catheter was self inserted by each subject after application of two doses of 2% lignocaine gel (Xylocaine, Astra). Correct electrode positioning, in approximation to the SUS, was determined by withdrawing the catheter from the bladder until urine flow ceased and the EMG signal registered. When the optimal signal was obtained suction via the urine ports was applied to fix the catheter to the urethral mucosa. An anal EMG electrode (Anuform, Neen) was self-inserted by each subject to monitor activity in the external anal sphincter (EAS). Muscle activity was monitored with subjects standing barefoot. They were instructed to contract the lumbrical muscles of both feet by pressing the toes into the floor, thus flexing the metatarsophalangeal joints while maintaining extension at the interphalangeal joints. The movement had been practised prior to testing and the correct action was observed during the trials. Three repetitions of the action were performed.

Data was filtered between 10-1000 Hz and sampled at 2000 Hz. Root mean square EMG amplitude was calculated over 3 s and data normalised to the EMG activity recorded during a maximal voluntary effort and amplitude. Data were compared between rest and during the lumbrical contraction for each muscle with paired t-tests.

Results

EAS EMG activity increased by 32 (22)% during the lumbrical contraction ($P<0.03$) and this occurred in all subjects. Although SUS EMG increased by 17 (9)% from rest, and this occurred in all subjects, the difference was not significant ($P=0.22$), possibly due to a small subject pool.

Interpretation of results

The findings from this study indicate that, in healthy subjects without pelvic floor dysfunction, activation of the lumbricals is associated with contraction of the PFM (particularly EAS), thus providing a possible mechanism for the efficacy of contraction of these muscle in reducing the urge to void. The data also provide evidence of a broader role for the PFM in postural control. This study was carried out in a small number of healthy subjects and the findings cannot be extrapolated to other subject groups or other postural muscles.

Concluding message

Use of this particular muscle pattern as a strategy for urge control in a clinical setting deserves further investigation.

References

1. Neurology and Urodynamics 2007 26:362-371
2. Archives of Physical Medicine and Rehabilitation 2001 82:1081-1088
3. Journal of Urology 2010 183:378-385

Specify source of funding or grant	Paul Hodges funded by National Health and Medical Research Council of Australia
Is this a clinical trial?	No
What were the subjects in the study?	HUMAN
Was this study approved by an ethics committee?	Yes
Specify Name of Ethics Committee	University of Queensland Medical Research Ethics Committee
Was the Declaration of Helsinki followed?	Yes
Was informed consent obtained from the patients?	Yes