CLINICAL DIAGNOSIS OF STRENGTH AND POWER ASYMMETRY

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Introduction

Bilateral asymmetry (BA) is a term frequently used in the fields of sports performance and rehabilitation, describing substantial deviation from normative data or muscle performance differences between limbs [Schlumberger *et al*, 2006]. Strength imbalances are examined using a variety of testing methods and modes. Surprisingly, there is no definitive criterion for the clinical diagnosis of asymmetry. Moreover, there are several issues with respect to how a 'normal' difference between limbs is determined. Studies that have compared left (Lt) and right (Rt) limbs tend to find close to zero differences in mean strength/power and rely on measures of variance between subjects as the criterion [Newton *et al*, 2006]. These do not provide a relevant measure of a 'typical' difference.

Within closed chain (CC) bilateral (Bi) tests, average (Avg.) forces over the entire force production phase are likely to mask differences in eccentric (ECC) and concentric (CON) phases and these have not been investigated.

The aim of this study is to establish true values for typical levels of asymmetry in open chain (OC) and CC, unilateral (Uni) and Bi tests and introduce the term 'absolute asymmetry' (AA).

Methods

Sixty three injury-free athletes (57 males, 6 females, mean±SD: age 22.5±4.2 years, height 180±9.0 cm and mass 83±17.5 kg) underwent a battery of tests as follows:

OC: Isokinetic strength (KinCom) of the quads (Q) and hamstrings (H) muscle groups in CON mode at $60^{o} \cdot s^{-1}$were determined.

CC (Bi): Peak forces within the movement phase and Avg forces in ECC, CON and overall movement of 3 CMJ were determined.

CC (Uni): Uni CMJ (Peak and Avg force), single leg hops (SLH) and triple hops (TLH) for distance were measured

Asymmetry was calculated using the formula:
[(Lt leg – Rt Leg)/(Max of Lt or Rt leg)] x 100.

Results And Discussion

The data presented in Table 1 can be considered as typical asymmetry scores for a range of OC and CC tests of strength/power.

Arbitrary values of 10-15% [Impellizzeri *et al*, 2007] can be considered too conservative and do not reflect the mode of test utilised. The 'typical' level of BA varies between different testing modalities ranging from 10.3% (H CON) to 0.8% (Avg. whole of Bi CMJ). It is important also to determine asymmetry in ECC and CON phases as the Avg force over the entire movement phase may balance differences out.

References

1. Impellizzeri, F *et al*, Medicine and Science in Sports & Exercise, 39(11): 2044-2050, 2007.
2. Newton, R *et al*, J Strength and Conditioning Research, 20(4): 971-977, 2006.
3. Schlumberger, A *et al*, Isokinetics and Exercise Science, 14: 3-11, 2006.

TEST	Rt Mean ± SD	Lt Mean ±SD	Avg. Asymmetry Mean ±SD (%)	AA Mean ±SD (%)
OC				
Q CON	224.7 ± 42.5	227.4 ± 38.2	-1.8 ±9.37	**8.29 ±6.43**
H CON	118.6 ± 22.6	109.8 ± 17	-3.1 ±9.87	**10.28 ±5.96**
CC Bi test				
Peak	927.7 ±198.3	965.3 ±197.2	-5.0 ±13.7	**8.37 ±11.95**
Avg. (whole)	819.5 ±170.5	822.5 ±170.6	-0.4 ±1.9	**0.79 ±1.82**
Avg. ECC	424.4 ± 89.7	427.0 ±129.5	-2.1 ±32.4	**8.47 ±6.54**
Avg. CON	774.5 ±160.6	758.1 ±169.5	1.8 ±11.5	**6.49 ±5.06**
CC Uni test				
Peak	1538 ± 297	1545 ±319	-0.5 ±7.1	**5.10 ±4.88**
Avg. (whole)	913.4 ±206.8	917.7 ±222.1	-0.4 ±5.6	**2.69 ±4.95**
SLH	169.4 ±32.73	168.1 ±32.74	0.26±11.6	**7.63 ±8.68**
TLH	558.3 ±81.22	563.8 ±89.74	-0.98 ±7.6	**5.06 ±5.67**

Table 1: Mean ± SD and AA % for the OC & CC measurements of both the Rt and Lt legs (n=63).