USE OF ISOKINETIC STRENGTH RATIOS TO DISCRIMINATE BETWEEN MAXIMAL AND FEIGNED SHOULDER EXTENSION MUSCULATION EFFORTS

Catherine Smallman¹, Sivan Almosnino¹,², Joan Stevenson¹,²

¹School of Kinesiology & Health Studies, Queen’s University, Kingston, Canada, 9cs68@queensu.ca
²Human Mobility Research Centre, Kingston General Hospital, Kingston, Canada

INTRODUCTION
Occupational injuries of the shoulder joint are of growing concern due to work time loss, as well as increases in medical and restitution expenses [1]. The assessment of shoulder musculature strength may assist in decision making regarding the effects of interventions, as well as possible readiness to return to work. Current practices related to the use of strength scores for such purposes are based on the assumption that the patient exerted optimal effort during trial performance. In this context, an approach proposed for determining the type of effort recorded using isokinetic dynamometry is based on the ratio of eccentric and concentric strength scores [2]. The supposition of the method relies on the moment- angular velocity relationship obtained in recordings of maximal efforts, whereas concentric strength declines as a function of increases in angular velocity, eccentric strength scores remain relatively unchanged [2]. The eccentric to concentric strength ratio, therefore, is greater than 1 irrespective of the angular velocity employed. In performance of submaximal or feigned efforts, it has been shown that there is a significant increase in the value of this ratio, and that it is more pronounced as a function of the increase in the angular velocity employed. The purpose of this investigation was to assess the ability of two indices utilizing this phenomenon, termed the DEC and SEC, to distinguish between maximal, submaximal, and feigned isokinetic shoulder extension efforts.

METHODS
Using a commercial isokinetic dynamometer (Biodex System 4, Biodex Medical, Shirley, NY, USA), Nine participants (6 males) performed 2 sets of maximal and feigned concentric and eccentric shoulder extension efforts at angular velocities of 30°sec⁻¹ and 120°sec⁻¹. The DEC and SEC indices were calculated as follows:

DEC = (PM Ecc / PM Con)¹²⁰ – (PM Ecc / PM Con)³⁰
SEC = (PM Ecc / PM Con)¹²⁰ + (PM Ecc¹²⁰ / PM Con)³⁰

Where PM Ecc and PM Con are the peak moments obtained for each contraction mode at each of the angular testing velocities. Paired t-tests (α = 0.05) were calculated to discern group differences between effort types for each parameter To establish the accuracy of the DEC and SEC in the ability to discern between effort types for the general population of normal participants, cut-off scores were established by calculations of one-sided tolerance intervals at a level of 95% of the maximal efforts with a probability of 95% [3]. Based on these cut-off values, the percentage of false positives and negatives in the sample was determined by analyzing the parameters on a case by case basis.

RESULTS
DEC scores obtained for maximal efforts were significantly smaller than those obtained for feigned efforts, as well as exhibited smaller within-group variability (mean±SD 0.16±0.14 vs. 1.37±0.81, respectively, p < 0.05). This was also apparent in the analysis of the SEC parameter (4.10±0.44 vs. 6.20±1.06, p<0.05, for maximal and feigned scores, respectively). In terms of the classification accuracy, using the DEC and SEC cut-off scores presented in table 1, all maximal efforts were identified correctly for both parameters. However, 1 (12.5%) and 2 (25%) of feigned efforts were misclassified for DEC and SEC cut-offs, respectively.

DISCUSSION AND CONCLUSIONS
The results obtained in this investigation are comparable to other studies utilizing eccentric-concentric strength ratios for the identification of effort type during isokinetic muscle strength testing [3]. In this respect, the reasonably high level of accuracy of the cut-off scores is attributed to difficulties in controlling submaximal eccentric efforts; a contraction that is perceived to be defensive by nature, as well as requires distinct neuromuscular activation and control [2]. In conclusion, the use of eccentric-concentric based strength indices may allow effective discrimination between effort types during isokinetic shoulder extension testing.

REFERENCES

ACKNOWLEDGEMENTS
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Table 1: Parameters cut-off score performance for identification of isokinetic shoulder extension effort type

<table>
<thead>
<tr>
<th>DEC</th>
<th>CS</th>
<th>False Positive</th>
<th>False Negative</th>
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<tbody>
<tr>
<td></td>
<td>0.57</td>
<td>0</td>
<td>1/8 (12.5%)</td>
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<table>
<thead>
<tr>
<th>SEC</th>
<th>CS</th>
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<th>False Negative</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>5.41</td>
<td>0</td>
<td>2/8 (25%)</td>
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