CAN THE BIOMECHANICAL EXPOSURE TO THE SPINE BE ESTIMATED IN EPIDEMIOLOGIC STUDIES USING POST-INJURY MEASUREMENTS?

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INTRODUCTION

Physical exposure has recently been reaffirmed as a risk factor for low back pain and upper limb disorders. Criticisms have been expressed however that the most common study design was cross section where issues of cause and effect (temporality) are hard to determine. We have recently completed a case control study of risk factors for reported low back pain (Norman et al 1998). Briefly, a multivariable analysis of physical loading variables identified peak spinal loading, integrated spinal loading, trunk kinematics and peak hand load as independent risk factor categories. When physical and individual factors were controlled for, psychosocial variables identified included workplace social environment score, education relative to peers, job control, job satisfaction, co-worker support, and higher perceived exertion. Cases who reported low back pain had their physical loading assessed approximately 3 weeks after they returned to their pre-injury job. Was this post-injury assessment representative of their pre-injury physical loading? The purpose of this paper is to address this question.

METHODS

At the same time a case reported low back pain (N=104) a job-matched control who was not injured was selected. This person was selected so as to be performing the same work at the same rate as the case. By the end of the study 37 matched pairs were accumulated with complete biomechanical data. The twelve physical exposure measures used in Norman et al., (1998) were tested for systematic differences between the physical exposures of the uninjured job-matched controls and the cases post-reporting using matched pairs t test and intra-class correlation (ICC).

Table 1: Comparison of Cases and Job-Matched Controls (N=37) on Twelve Physical Exposure Measures.

Variable	Case Mean	Job-Matched Mean	ICC	Difference#	|%|	prob>|T|
Peak compression N	3388	3168	0.71	+220	(6.9)	0.22
Peak moment N.m	181.1	167.3	0.67	+13.8	(8.2)	0.23
Peak Reaction Shear N	464.2	488.0	0.39	-23.8	(4.7)	0.59
Integrated compression N.s x 10^6	21.9	21.3	0.28	+0.63	(2.9)	0.56
Integrated moment N.m.s x 10^6	0.58	0.57	0.44	+0.012	(2.1)	0.81
Integrated shear N.s x 10^6	1.54	1.53	0.57	+0.007	(0.5)	0.95
Average flexion velocity deg.s^{-1}	300.4	311.1	0.45	-10.7	(3.4)	0.66
Average movements min^{-1}	2.74	2.67	0.56	+0.073	(2.7)	0.82
Peak flexion velocity deg.s^{-1}	39.6	40.4	0.66	-0.81	(2.0)	0.71
Peak flexion deg	49.2	54.6	0.56	-5.36	(9.8)	0.15
Peak hand load N	21.6	20.4	0.82	+1.25	(6.1)	0.52
Usual hand load N	9.54	9.24	0.67	+0.29	(3.1)	0.82

#Difference from Job-Matched Controls

RESULTS AND CONCLUSIONS

The mean differences are small and do not show a significant difference between the pairs. Correlation coefficients ranged between 0.82-0.28. One might argue that as the two people performed the same work at the same rate, the agreement should be higher. Three factors might reduce the correlation: Firstly the measurements are not perfectly reliable, secondly the workers might have different work methods and may differ in height and weight and thirdly the injury might cause the cases to work differently. The first two factors probably introduce unbiased random variability(noise) and reduce the correlation. The third factor could introduce bias and variability. Any bias appears small and is non-significant. These results demonstrate that the post-injury assessment was representative of pre-injury physical loading with small and non-significant bias. This is very useful as it means that a case control design with a post injury assessment of physical loading is a viable way to assess the relationship between physical loading and low back pain.

REFERENCES

Norman, R., Wells, R., Neumann, P., Frank, J., Shannon, H. and Kerr, M. Clin Biomech, 13(8): 561-573, 1998.