

Stress upon the lumbar spine during shovelling tasks

Abstract

In the past, the accident insurance institutions have inconsistently assessed the loads on the lumbar spine caused by shovelling tasks in the course of their investigations of formally recognized occupational disease (BK) 2108 (degenerative lumbar disc disease). The results differed widely owing to the lack of a uniform basis for assessment. In the course of the research project presented here, biomechanical motion and force measurements were therefore conducted in order to determine the external musculoskeletal loads which arise during shovelling work. The measurements were performed upon five experienced, skilled test subjects from different areas of the construction sector, in realistic work situations and under laboratory conditions. The study concept covered five bulk products and three work tasks in terms of the throw distance and height. The associated compression forces on the lowest lumbar intervertebral disc were calculated from the measured data by means of the "Dortmunder" biomechanical model. The results of the study revealed a distinctly three-dimensional load situation in the musculoskeletal system during shovelling activity. The shovelling techniques of the test subjects differed widely. They were divided into two groups, "standard case" and "exceptional case", the latter typical for piece work performed by composition floor layers, for instance. The maximum intervertebral disc compression forces varied accordingly, at mean values of approximately $3\frac{1}{2}$ and $6\frac{1}{4}$ kN respectively. The corresponding duration of load exposure in the shovelling cycle was inversely proportional to the pace of work, falling from about 2 to $1\frac{1}{2}$ s. No generic relationship was observed between the compression forces on the one hand and the bulk product type and throw distance and height on the other.