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Review article

The effects of breaks on low back pain, discomfort, and work productivity in office workers: A systematic review of randomized and non-randomized controlled trials

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ABSTRACT

The purpose of this study was to evaluate the effectiveness of breaks on low back pain, discomfort, and work productivity in office workers.

Publications were systematically searched in several databases from 1980 to December 2016. Relevant randomized and non-randomized controlled trials were retrieved and assessed for methodological quality by two independent reviewers. Quality of evidence was assessed and rated according to GRADE guidelines.

Eight randomized controlled trials and three non-randomized controlled trials were included in this review, of which 10 were rated as high-quality studies. The break programs were highly heterogeneous with work duration ranging from 5 min to 2 h and break duration ranging from 20 s to 30 min. The results showed low-quality evidence for the conflicting effect of breaks on pain and low-quality evidence for the positive effect of breaks on discomfort. When stratified by type of breaks, moderate-quality evidence was found for the positive effect of active breaks with postural change for pain and discomfort. Moderate-quality evidence indicated that the use of breaks had no detrimental effect on work productivity.

More high-quality studies are needed before recommendations can be given. Within a number of methodological limitations that are present in the published studies, active breaks with postural change may be effective in reducing pain in workers with acute low back pain and to prevent discomfort in healthy subjects.

1. Introduction

One common health problem experienced by office workers is low back pain (LBP). Approximately between 34% and 51% of office workers experienced LBP in the preceding 12 months (Ayanniyi et al., 2010; Janwantanakul et al., 2008) with the 1-year incident rate for LBP at about 14–23% (Juul-Kristensen et al., 2004; Sitthipornvorakul et al., 2015). Furthermore, the 1-year prevalence of chronic LBP has been reported to range from 15% to 45%, with a point prevalence of 30% (Manchikanti et al., 2009). Low back pain causes personal suffering, disability, and impaired quality of life and work in general, which can pose a great socioeconomic burden for both patients and society (Manchikanti et al., 2014).

Office workers are usually required to sit for long hours working on a computer while spending most of their time in a sitting position. Occupational groups exposed to poor postures while sitting for longer than half a day have a considerably increased risk of experiencing LBP (Lis et al., 2007). Subjects with LBP are likely to be in sustained postures and have large and infrequent spinal movements, rather than subtle and regular spinal movements, while sitting (Dankaerts et al., 2006; O'Sullivan et al., 2012). The prolonged postural loading of the spine while sitting can reduce joint lubrication, fluid content of intervertebral discs, and increase stiffness, which can be detrimental to back health (Beach et al., 2005; Chan et al., 2011). Prolonged muscle activation in static sitting may lead to localized muscle tension, muscle strains, muscle fatigue, and other soft-tissue damage, causing impairment of motor coordination and control as well as increased mechanical stress on ligaments and intervertebral discs (Granata et al., 2004). Prolonged sitting also induces low back discomfort (Waongenngarm et al., 2015), which is a strong predictor of LBP (Hamberg-van Reenen et al., 2008).

Breaks are recommended for alleviating the adverse effects of prolonged sitting with poor postures. Scheduled breaks can prevent the onset or progression of cumulative trauma disorders in the computerized workstation environment (Balci and Aghazadeh, 2004; Barredo and Mahon, 2007; Sheahan et al., 2016). A break is generally defined as the cessation of computer work tasks and can be either passive or active. For a passive break, operators leave their computer tasks to sit and

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relax during this period, while during active breaks, operators are required to perform specific movements, exercises, or change their posture (Nakphet et al., 2014). Previous studies compared the beneficial effects of passive and active breaks, by assessing oxygenation in muscles, muscle activity, and discomfort in the neck and upper extremity. The results showed that breaks – regardless of the type of activities during the breaks – had a positive effect on the recovery of muscle discomfort (Crenshaw et al., 2006; Nakphet et al., 2014). However, due to the impracticalities and potential impact on work productivity of breaks, it is difficult to implement the breaks in an office setting without working being continued. Thus, standing breaks while performing computer work have been recently introduced as an option to reduce discomfort and pain in the low back while still maintaining worker productivity (Thorp et al., 2014).

To date, there have been no studies on the effects of the type of breaks on pain and discomfort in the low back as well as work productivity. Thus, the primary aim of this study was to systematically review randomized and non-randomized controlled trials (RCTs) to gain insights into the effectiveness of breaks on low back pain, discomfort, and work productivity in office workers. The secondary aim was to identify the type of breaks effective in reducing pain and preventing discomfort in the low back.

2. Methods

2.1. Search strategy

Online searches were conducted on the Web of Science, PubMed, ScienceDirect, the Cochrane Library, PEDro, and Scopus databases from 1980–December 2016. The following keywords were used: back pain, low back pain, chronic low back pain, LBP, break, pause, rest, rest break, micro-break, active break, passive break, and postural change. The search and full inclusion process was performed by two reviewers (PW and KA). After the inclusion of articles based on the selection criteria, references were searched for additional articles.

2.2. Selection of studies

The selection criteria of relevant articles were:

(1) The study design was a RCT or a non-RCT that employed the break as a primary intervention.
(2) The study population was office workers, or those working with computers, visual display units, or visual display terminals.
(3) Low back pain, discomfort, or work productivity was assessed in the study. Studies on LBP due to specific underlying pathology, such as tumors, fractures, infection, dislocation, or osteoporosis were excluded.
(4) The article was a full report published in English. Letters, abstracts, books, conference proceedings, and posters were excluded.

2.3. Quality assessment of studies

The articles were evaluated for methodological quality by two reviewers (PW and KA). Risk of bias was assessed using the Cochrane Back and Neck Review Group expanded 13-item criteria (Furlan et al., 2015). A high-quality study was defined as scoring positive in at least 50% (7/13) of the items. Disagreements between the reviewers were discussed in an attempt to achieve consensus. If agreement could not be reached, a third reviewer (PJ) was consulted to achieve a final judgment.

2.4. Data extraction

Data extraction was performed by two reviewers (PW and KA). The reviewers independently extracted the data using a standardized form, comprising the characteristics of participants, intervention parameters, outcomes, and results. The consensus method was used to resolve disagreements between the two reviewers. A third reviewer (PJ) was consulted to achieve a final judgment if disagreement persisted.

2.5. Data analysis

Conclusions were reached on the effectiveness of breaks based on the reported outcome of pain, discomfort, or work productivity using the GRADE (Grades of Recommendation, Assessment, Development and Evaluation) system, which was used to evaluate the overall quality of the evidence and the strength of the recommendations (Furlan et al., 2015). For each outcome, an a priori ranking of 'high', or 'low' was assigned depending on whether the majority of studies were categorized as randomized controlled trials or non-randomized controlled trials (Swinton et al., 2017). Five domains of quality were rated for each comparison: (1) limitations of study design; (2) inconsistency; (3) indirectness; (4) imprecision; (5) publication bias across all trials (Furlan et al., 2015; Guyatt et al., 2011). A four-point rating scale ranging from 'high quality' on one end to 'very low quality' on the other was employed. The quality of the summary of findings was rated as moderate if one, low if two, and very low if three of the criteria were not met. The following definitions of quality of evidence were applied (Balshem et al., 2011):

- High quality: We are very confident that the true effect lies close to that of the estimate of the effect.
- Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
- Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect.
- Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of the effect.

2.6. Subgroup analysis

All relevant studies were stratified by type of breaks. Breaks were classified as 1) an active break with postural change, 2) an active break without postural change, 3) a passive break, and 4) a standing break while performing computer work. An active break with postural change was defined as operators being required to change their postures (i.e. from siting to standing) and perform specific movements or exercises in the low back. An active break without postural change was defined as operators being required to perform specific movements or exercises in the low back in the sitting position. A passive break was defined as operators leaving their computer tasks to sit and relax during this period. A standing break while performing computer work was defined as operators being required to change their posture (from siting to standing) while still performing computer work.

2.7. Sensitivity analysis

Sensitivity analysis was conducted to assess how sensitive the results of the review were in relation to the way it was performed. For the results of qualitative analysis (using the GRADE approach), the effect of the cut-off point used in the methodological quality assessment for qualification as a high-quality study on the synthesized results was assessed by shifting the cut-off point from ≥ 50 to $\geq 60\%$, or shifting the cut-off point from ≥ 50 to $\geq 70\%$.