Effectiveness of Lumbar Support in Management of Low Back Pain: A Systematic Review

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Citation

Abstract: Background: The lumbar support belt has been used routinely in the management of low back pain. However, conflicting evidence arose as to whether or not lumbar support belt usage was more effective than usual care. This study aimed to explore the effectiveness of the lumbar support belt in reducing discomfort and improving quality of life in patients with low back pain. Methods: This study searched relevant studies by using the keywords “lumbar support, lumbar belt, back support, back belt” and “back pain, lumbar pain and backache” from PubMed, Science Direct and Scopus from January 1995 to December 2017, in order to identify the effectiveness of the lumbar support belt for reducing discomfort and improving quality of life in patients with low back pain. Inclusion studies comprised only those on the lumbar support belt and non-specific low back pain in English language publications. The outcome focused on pain intensity, quality of life and the specific functional status of back pain. Furthermore, duplicated studies were excluded. Methodologic quality assessment was performed by two independent reviewers using the Physiotherapy Evidence Database (PEDro) scales. If agreements were inconsistent, a third independent reviewer formed the consensus. The conclusion was based on high quality studies (PEDro scores ≥ 6/10) in order to report effectiveness and suggestions for clinical application. Results: Two hundred and ninety seven studies were screened for titles and abstracts. Eight studies were identified finally for systematic review; six for randomized controlled trials and two for quasi-experimental studies. Five of the six randomized controlled trials were of good quality, with all of them showing the use of lumbar support usually reducing discomfort and improving quality of life in individuals with low back pain. The prescription for wearing lumbar support for 6-8 hours per day for at least one month showed positive results. Conclusions: The support belt appeared to be as effective as additional intervention together with usual care in the management of non-specific low back pain.

Key Words: Lumbar support, Back pain, Low back pain

Introduction: Low back pain (LBP) is one of the most common musculoskeletal disorders in the general population. It is a major cause of disability that affects working performance. (1, 2) About 60-70% of the population will suffer from LBP at least once in their lifetime. (3) LBP prevalence increases and peaks between the ages of 35 to 55 years old. (3) Approximately 20-44% of LBP patients can be found in the working population, and they usually have recurrent episodes within one year. (4) There are various conservative treatments for the management of LBP such as medication, acupuncture, massage and physical therapy. Lumbar support is an additional tool, which is prescribed widely by physicians and physical therapists for treating and preventing LBP. Lumbar supports are used commonly in the management of LBP and also utilized in the workplace to prevent low-back pain injuries. (5) Lumbar supports affect the restriction of lumbar spinal movement, increase spine stabilization, decrease mechanical load on the trunk and increase intra-abdominal pressure. (6) Lumbar supports are provided as a treatment for people suffering from LBP, with the aim of decreasing impairment and disability. Previous systematic reviews (7, 8) reported limited evidence of lumbar supports being more effective than no treatment at all, and more high quality researches on the effectiveness of lumbar support are needed. However, more such researches have been published over the past 10 years. Therefore, this study reviewed up-to-date studies on the effectiveness of lumbar support. Furthermore, no information had been found on efficient clinical application (dosage) of lumbar support usage in the management of LBP. Therefore, this review was
interested in collecting suitable clinical applications of lumbar support for LBP.

The objectives of this systematic review were to explore the effectiveness and clinical applications of lumbar support in the management of LBP.

Methods

Related studies were searched through electronic databases, including PubMed, Science Direct and Scopus, from January 1995 to December 2017. The keywords used were “lumbar support, lumbar belt, back support, back belt” and “back pain, lumbar pain and backache”. The search was carried out by using individual keywords with a combination of Boolean Logics (AND). In addition, studies that were published in English only were considered for inclusion in this study.

Criteria for considering studies

Both randomized controlled and quasi-experimental trials were included for the review process.

Participants and interventions

The population of all studies consisted of subjects with non-specific LBP, and any type of lumbar support for treating LBP was included in this study. Studies that included subjects with specific LBP such as infection, cancer, scoliosis or fracture were excluded, and special types of lumbar supports for severe scoliosis and post lumbar surgery also were excluded.

Outcome measures

Studies that used related outcome measures for determining progression of LBP symptoms, such as pain intensity (Visual Analog Scale, Numerical Rating Scale), overall improvement (Numerical Rating Scale), quality of life (SF-36, SF-12), specific functional status of back pain (Oswestry disability questionnaire, Roland-Morris disability score, Quebec disability score), etc., were included in this study.

Methodological quality checking

Methodology quality was assessed by two independent assessors (DD and AP). A consensus method, with the agreement of a third independent assessor (PS) was used to resolve disagreements concerning the methodological quality assessment. Methodological quality of the studies was assessed by using the Physiotherapy Evidence Database (PEDro) scales, which are the listed criteria for the quality assessment of randomized controlled trials. Ten checklist items were considered for quality of the studies. The scales assessed randomization, allocation concealment, comparability at baseline, blinding of subjects, blinding of therapists, blinding of assessors, measurement of at least one key outcome obtained from more than 85% of the subjects initially allocated to groups, intention to treat analysis, between-group comparison tested statistically for at least one key outcome measure, and point and variability measures provided for at least one key outcome measure. Each criterion was scored as either positive or negative according to the definitions of the criteria. Validity items were scored as positive when available information regarding that item did not reveal any bias; and negative when no information was provided regarding that item, or the available information revealed bias. The PEDro scores were considered as excellent (9-10), good (6-8), fair (4-5) and poor (<4). (9)

Data extracted and analyzed

Data were extracted on characteristics of the study population (i.e. pathology, and stage of LBP), characteristics of the studied intervention (i.e. types of lumbar support, number of hours per day in which the subjects wore the lumbar support, and duration of the intervention period), adverse effects due to intervention, and final results from measuring the effectiveness of lumbar support in each outcome. The levels of evidence were analyzed using an updated method of the guideline for systematic reviews proposed by van Tulder and colleagues. (10) The method of assessing accounts consistent of strong findings from multiple high quality studies; consistent multiple low quality studies or one moderately high quality study; and one limited low quality study; and inconsistent and conflicting findings among the studies. Drawing a conclusion was based on high quality studies that reported the effectiveness of and suggestions for clinical application. Moreover, the details of related studies were clarified in tubular form.

Results

Study selection

The electronic database search resulted in a total of 297 studies; 88 were identified in PubMed, 28 in Science Direct and 181 in Scopus. After excluding duplicated studies, 162 were used to screen titles and abstracts, after which, 11 potentially relevant studies were assessed for the eligibility criteria. Finally, 8 studies were included in the review (Figure 1).
Methodological quality

Methodological quality of the selected studies was assessed by using the PEDro scales. Two reviewers (DD and AP) initially agreed on 77/88 (87.5%) items on the PEDro scales. All differences in the PEDro scales were resolved after discussion and consensus among the reviewers. The results of the quality scores, which ranged from 3/10 to 8/10, are shown in Table 1. Five studies (11-15) demonstrated good quality, two (16, 17) showed fair quality and one (18) had poor quality.

Study characteristics

Study characteristics are summarized in Table 2. Of the eight studies, six (11-15, 17) were randomized controlled and two (16, 18) quasi-experimental.

Table 1: Methodological quality of studies on the effectiveness of lumbar support

<table>
<thead>
<tr>
<th>PEDro items</th>
<th>van Poppel et al., 1998</th>
<th>Oleske et al., 2007</th>
<th>Roelofs et al., 2007</th>
<th>Calmels et al., 2007</th>
<th>Roelofs et al., 2010</th>
<th>Sato et al., 2012</th>
<th>Morrisette et al., 2014</th>
<th>Saito et al., 2014</th>
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<tbody>
<tr>
<td>1</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>2</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>N</td>
<td>Y</td>
<td>N</td>
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<td>Y</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>11</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Total</td>
<td>5/10</td>
<td>8/10</td>
<td>6/10</td>
<td>6/10</td>
<td>7/10</td>
<td>3/10</td>
<td>7/10</td>
<td>4/10</td>
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</tbody>
</table>

Note: Item 1 related to the external validity (as the Pedro criteria did not include the total score)
Effects of lumbar support

### Lumbar support versus control comparisons

One good quality randomized controlled trial (RCT) (11) compared the effect of lumbar support with no intervention at all. The result showed a significant improvement in LBP and disability in the lumbar support group. There was limited evidence of lumbar support being more effective than no intervention at all. Four studies (12, 14, 15, 18) compared the effect of lumbar support with usual care. Three of them had a good quality RCT (12, 14, 15) and the other one had a poor quality quasi-experimental study.(18) Roelofs et al. (14, 15) demonstrated that lumbar support groups showed greater...
improvement in the severity of LBP and disability than the usual care group. Lumbar support also significantly reduced the number of days with LBP over a 12-month period and direct costs related health care. There was no difference in sick leave or quality of life. Morrisette et al. (12) found that receiving usual care while wearing an inelastic lumbar support significantly improved disability and patient specific activity when compared with usual care alone. There was no difference between elastic and inelastic lumbar support and usual care. Saito et al. (18) also found that lumbar support can reduce the severity of LBP more effectively than pharmacological consumption. There was strong evidence that lumbar support with usual care was superior to usual care alone. One good (13) and one fair quality RCT (17) compared the effect of lumbar support with education. Oleske et al. (13) found that both lumbar support and education could decrease pain and disability and increase physical health after 12 months of intervention. In addition, van Poppel et al. (17) reported the subgroup analysis of subjects with LBP at baseline. Lumbar support can reduce the number of days with LBP per month when compared to no lumbar support. However, both studies demonstrated no significant difference between groups in all outcomes. There is moderate evidence that lumbar support plus education is no more effective than education alone.

Comparison of different types of lumbar support

One RCT (12) and one quasi-experimental study (16) compared the effects of different types of lumbar support. Morrisette et al. (12) compared the effects of elastic and inelastic lumbar support. They found that using inelastic lumbar support for 2 weeks significantly improved functional ability, while there was no improvement in the elastic lumbar support group. Saito et al. (18) compared a new type of lumbar support (wear-type support) and the traditional one, and both types showed significantly decreased pain severity and number of days with LBP, but there was no significant difference between the two groups. There is limited evidence to show which types of lumbar support are more effective than the others.

Clinical application of lumbar support

Population

Two studies (11, 16) were performed in subacute LBP. Calmels et al. (11) found that wearing lumbar support significantly improved functional status, pain level and pharmacologic consumption. Results from Saito and colleagues (16) reported a decrease in pain intensity and number of days with LBP after wearing lumbar support. There was limited evidence of lumbar support being effective for subacute LBP. One study (18) on chronic LBP showed that wearing lumbar support can decrease its severity, but there is limited evidence of lumbar support being effective for this condition. Four studies (12-15) had mixed duration of LBP, and all of them demonstrated positive effects of wearing lumbar support. There is strong evidence that lumbar support is effective in populations with various durations of LBP. Another study (17) gave no information on the duration of LBP.

Prescriptions for wearing lumbar support

The obvious protocol for wearing lumbar support was not given in any of the selected studies. Four of them (13-15, 17) prescribed support for their participants to wear during working hours. A study by van Poppel et al. (17) reported that subjects with LBP at baseline had a reduced number of days with LBP per month, while Oleske et al. (13) and Roelofs et al. (14, 15) demonstrated that using lumbar support during working hours can reduce pain intensity and direct costs of health care and increase functional ability. Three studies (11, 16, 18) prescribed lumbar support for their participants to wear for the whole day except at bath and bed time. LBP symptoms were improved in all of the studies. One study (12) did not give any information on how long to wear lumbar support. However, three studies (11, 12, 16) demonstrated the average hours for wearing lumbar support from records of the participants, which were 8–10 hours daily. Calmels et al. (11) demonstrated that their participants wore lumbar support for 8, 6 and 5 hours per day in the 1st, 2nd and 3rd month, respectively. That study found an improvement in LBP and disability after the 1st month of follow up. Morrisette et al. (12) showed an average wearing time of 4.8 and 5 hours daily for elastic and inelastic lumbar support, respectively. Saito et al. (16) demonstrated that the average time for wearing lumbar support was 6, 5 and 4 hours per day in the 1st, 2nd and 3rd month, respectively. That study also found an improvement in LBP after the 1st month.

Duration of the intervention period

Three trials (13-15) studied the effects of using lumbar support in workers for 12 months. All of them found that lumbar support reduced pain intensity, disability and costs of health care. In addition, the rate of LBP recurrence also was lower in workers who wore lumbar support. (13) Two trials (17, 18) studied the effects of using lumbar support for 6 months. A study by van Poppel and colleagues (17) reported that subjects who had LBP at baseline and received lumbar support recorded less number of days with LBP per month. Sato and colleagues (18) also found an improvement in LBP after wearing lumbar support for 6 months. Two trials (11, 16) studied the effect of using lumbar support for 3 months, and both demonstrated continual improvement in pain intensity and functional status from the 1st month of follow up and on through each time point. Morrisette and colleagues (12) studied the effects of using lumbar support for 2 weeks, with the inelastic lumbar support group showing significant improvement in disability, but no change was shown in the elastic lumbar support group.

Adverse effects

No adverse events were reported in any of the identified studies.

Discussion

Selection bias

Although there is a well-defined search strategy for identifying studies on the effectiveness of lumbar support, some may have been missed in this study. Missing studies may be in other databases or unpublished sources (e.g., theses) that were inaccessible.

Methodologic quality

The methodologic quality was assessed by the two reviewers, who were not blinded to the authors or journals. Potential bias from the non-blinded assessment was expected to be low because the major reviewers (AP and PS) were professional in the field of LBP and familiar with the literature. The other one (DD) was a layperson in the field of LBP.

Internal validity criteria were used to assess the methodologic quality of the eligible studies by referring to their characteristics, which may be related to bias. The methodologic quality of the studies used seemed to be high. Five of the eight studies, which scored in the range of 6/10 to 8/10, were of good quality, while the other 3 studies scored lower than 6/10, which was considered as poor to fair quality. All of the 8 studies used the proper method of randomization. Among 6 randomized controlled trial studies, only 3 described a method of concealment. Blinding of subjects in the efficacy studies of lumbar support is very difficult. Blinding of assessors, which is an important criterion, was reported in only 2 studies. However, most of the outcome measures in the eligible studies were subjective, and blinding of assessors may not be necessary.

Effectiveness of lumbar support

Overall, this review has conflicting evidence of effective use of lumbar support in the management of LBP, which mostly agrees with previous reviews. (7, 8) However, in comparisons...
of lumbar support with other treatments, results showed strong evidence that lumbar support with usual care is more effective than usual care alone in the management of LBP. This result was different from a previous review by van Duijvenbode and colleagues (7), which reported conflicting evidence that lumbar support is effective as additional treatment. This difference may be due to recent studies that considered the effectiveness of lumbar support as an additional treatment. There is moderate evidence that lumbar support with education is no more effective than education alone, and limited evidence that lumbar support is more effective than no intervention at all. These conflicting results may be a potential effect of overestimation because of bias from subjective outcomes. Further studies may be needed to evaluate the objective outcomes and confirm the effects of lumbar support. When considering the different types of lumbar support, there is limited evidence. A small number of the studies compared the different types of lumbar support.

Clinical application of lumbar support

The results of this review showed strong evidence that lumbar support is effective for studies with mixed duration of LBP, and this may be convenient for recruiting a large number of participants. A small number of studies researched subacute (11, 16) and chronic LBP (18) with limited evidence of the effect of lumbar support for the former. There also was limited evidence of effectiveness in chronic LBP, which was from a poor quality study, and there has been no study regarding acute LBP. Therefore, it cannot be concluded that lumbar support is appropriate for a specific stage of LBP.

Three good quality studies (13-15) reported on wearing lumbar support during working hours, which averaged 5–7 hours per day. It may be assumed that wearing lumbar support for 5–7 hours daily affected improvement in pain and function. In addition, it also reduced the rate of LBP recurrence. However, compliance and duration of wearing lumbar support should be recorded by the participants. Of all the identified studies, three (11, 12, 16) demonstrated the duration of using lumbar support per day from records of the participants. After one month, the participants wore lumbar support for an average duration of 5-8 hours daily before the duration was decreased. When considering the results, the 1st month follow up showed the greatest improvement in pain and disability, followed by less change. This reduction of duration after 1-month of intervention may be associated with the improvement of symptoms.

Most of the trials identified (13-15, 17, 18) studied the effects of wearing lumbar support for a long period of time (6, 12 months) without intersection assessment. A suitable duration of wearing lumbar support for the management of LBP is unknown. Previous study (19) demonstrated that core muscle function was reduced after wearing lumbar support for eight weeks. Therefore, it may not be proper to wear lumbar support continuously for a long period of time. However, one good and one fair quality study demonstrated that pain and function can be improved at 1-month follow up.

Conclusion

The results of this study may not point out that lumbar support is superior in management of LBP, when compared to other treatments because the evidence was inconclusive. However, this review suggested that lumbar support seems to be effective as an additional intervention, together with usual care for the management of LBP.

Acknowledgments

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