REVIEW

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Physical Activity, Training and Exercise in the Prevention of Low Back Pain: a Focus Review with Special Emphasis on Motor Control

Training und körperliche Aktivität zur Prävention von Kreuzschmerzen: Ein Fokus-Review unter besonderer Beachtung neuromuskulären Trainings

Summary

› **Rationale:** This focus review aims to describe the current evidence on training and exercise (with a special focus on motor control) in the primary prevention, chronification prevention and recurrence prevention of low back pain.

› **Methods:** Two investigators independently performed a systematic literature research in MEDLINE (PubMed). Studies on participants who currently had, or had ever had at least one episode of non-specific low back pain or their respective control cohort were included. Only trials adopting an intervention that consisted of exercises without additional specific treatment with the aim of primary prevention, prevention of chronification or prevention of recurrences of low back pain were considered eligible.

› **Results and Discussion:** For primary prevention, exercise alone and (probably even more effective) exercise in combination with education are able to reduce the risk of acute low back pain occurrence. Considering the amount of exercise needed to be effective, an inverted u-shaped association is probable. For chronification prevention, early onset physical activity after the non-specificity diagnosis of the back pain may be helpful. Moderate evidence supports the relevance of exercise programmes after primary care for recurrence prevention. Motor control exercises might also be able to reduce the recurrence risk.

KEY WORDS:
MiSpEx, LBP, Sensorimotor, Neuromuscular

Zusammenfassung

› **Problemstellung:** Ziel dieses Fokus-Reviews ist es, einen systematischen Überblick der Evidenz zur Relevanz von Training und Bewegung (mit einem besonderen Fokus auf Sensomotorik) in der Primärprävention, Chronifizierungprophylaxe und Rezidivprävention von Rückenschmerzen zu geben.

› **Methoden:** Zwei Personen führten unabhängig voneinander in MEDLINE (PubMed) eine systematische Literaturrecherche durch. Eingeschlossen wurden alle experimentellen Studien und Sekundäranalysen, die Probanden mit aktuell mindestens einer Rückenschmerz-Episode bzw. ihre jeweilige Kontrollkohorte eingeschlossen hatten und die eine Intervention ohne zusätzliche spezifische Behandlung mit dem Ziel der Primärprävention, Prävention der Chronifizierung oder Prävention von Rezidiven von Rückenschmerzen durchgeführt oder diskutiert haben.

› **Ergebnisse und Diskussion:** Körperliche Aktivität und Sport allein sowie (wahrscheinlich noch effektiver) Bewegung in Kombination mit Patientenedukation kann primärpräventiv das Risiko der Entstehung akuter Kreuzschmerzen senken. Hier ist eine umgekehrte U-förmige Assoziation zwischen dem Umfang der Bewegung und dem präventiven Effekt wahrscheinlich. Zur Chronifizierungsprophylaxe kann eine frühe körperliche Aktivität direkt nach der Diagnose der Unspezifität der Rückenschmerzen hilfreich sein. Zur Rezidivprophylaxe unterstützt moderate Evidenz die Relevanz von Trainingsprogrammen und in geringerem Maße auch von sensomotorischen Trainingsprogrammen im Anschluss an die Primärversorgung.

SCHLÜSSELWÖRTER:
MiSpEx, CURS, Sensomotorik, Neuromuskulär

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Introduction

The majority of persons in industrialized countries suffer from acute nonspecific low back pain at least once in their lifetime (1, 18). In this population, pain-level decreases and pain-associated function increases in more than half of the cases within one month after the first incidence (1, 18). In contrast, more than half of the persons concerned are not yet completely pain free after one year (1, 18). Overall, up to 10% of acute (<6 weeks of duration) back pain incidences chronify (>12 weeks) (6). Depending on the source consulted, 24% to 87% of the symptom free persons suffer from a relapse in the year following an acute back pain episode (12, 16).

The burden for both the individual and the health care system calls for adequate preventive strategies in a three-fold manner. First, primary preventive

measures to prevent acute back pain episodes are conceivable. Beyond that, strategies to prevent chronification during acute back pain and, after acute back pain release, strategies to prevent a recurrence are crucial.

Against this background, it is important to target risk factors for the onset, chronification and recurrence of back pain. All of these risk factors are considered multifactorial biopsychosocial. Known psychosocial risk factors are depression, fear, excessive demands on themselves, self-esteem deficits, fear-avoidance-beliefs, dissatisfying employment and mobbing (6, 9). Beyond these, a multitude of neuromuscular and structural deficits are discussed to be aetiologically relevant in the context of acute back pain, its chronification and subsequent recurrences (4, 5). With valuable impact on these factors and the back pain itself, target-oriented movement training is of increasing relevance in this preventive triad (20, 22). Whilst a plethora of studies describe the relevance of physical activity and movement therapy in the therapy of nonspecific low back pain (22), its effectiveness for prevention has been investigated to a much lesser extent. With this review on systematic reviews and original data publications, we aim to describe the actual evidence of training and exercise (with a special focus on motor control) in the primary prevention, chronification prevention and recurrence prevention of low back pain.

Methods

Search Strategy

In November 2017, a systematic literature research was performed in the bibliographic database MEDLINE (PubMed). Two investigators (DN, LV) independently searched for relevant primary and secondary analyses using the following pre-defined search terms: ("low back pain" [All Fields] OR clbp [All Fields] OR lbp [All Fields] OR lumbalgia [All Fields] OR lumbago [All Fields] OR dorsalgia [All Fields]) AND („primary prevention" [All Fields] OR „secondary prevention" [All Fields] OR „tertiary prevention" [All Fields] OR chronification [All Fields] OR Recurrence [All Fields] OR relaps [All Fields] OR reappearance [All Fields] OR reoccurrence [All Fields]) AND (exercise [All Fields] OR „physical therapy" [All Fields] OR training [All Fields] OR „motor control" [All Fields] OR sensorimotor [All Fields] OR stabilisation [All Fields] OR neuromuscular [All Fields] OR proprioceptive [All Fields]))). The search was restricted to peer-review publications authored in English or German (publication date: 01.01.1900 - 20.11.2017).

Participants' Inclusion Criteria

Both male and female adults were considered eligible. We included studies which included participants who currently had, or had ever had, at least one episode of non-specific low back pain or their respective control cohort.

Study Inclusion Criteria

Primary and secondary data studies were considered eligible if they adopted an intervention that consisted of exercises without additional specific treatment with the aim of primary prevention, prevention of chronification or prevention of recurrences of low back pain. The references of all manuscripts included were screened for further sources with potential relevance for the review.

Overall, we identified 483 publications. They were screened for relevance and included into the review following a standardized procedure: for each message, the publication with the highest level of evidence (Oxford Centre for Evidence-based Medicine – Levels of Evidence) and the highest relevance was selected. The relevance rating was conducted narrative based on the special focus on motor control exercise. Overall, 19 manuscripts were included in the prevention part.

Results and Discussion

Evidence for Primary Prevention

Despite the high cultural relevance of the primary prevention of nonspecific low back pain, only sparse evidence is available in the literature. According to a systematic review, stress management, insole treatment, spinal brace, agronomical education and the avoidance of carrying heavy loads are all not able to prevent low back pain occurrence (3). Only exercise and physical activity seem promising (3). The authors conclude that compelling evidence is available for the effectiveness of a multimodal prevention training program integrating major physical activity contents. In detail, a combination of postural control, strength, muscle endurance and motor control exercises seem promising (3). Overall, the individualisation and regularity of these exercises seem to be crucial for success (6).

These results were confirmed and even expanded in a recently published systematic review and meta-analysis (23). The authors pooled the effects from 23 original data manuscripts including 30,850 participants. Moderate-quality evidence supports the hypothesis that exercise in combination with education systematically reduces the risk of low back pain occurrence (relative risk=.55). Exercise intervention only was effective, but with a much lower level of evidence and a lower risk reduction (relative risk=.65). Education alone is presumably (moderate- to very low-quality evidence) not effective in the prevention of acute low back pain. The same was seen for other interventions like back belts and shoe insoles; none of them appear to be able to prevent back pain (23).

Overall, exercise alone and (probably more effective) exercise in combination with education are able to reduce the risk of acute low back pain development. Considering the amount of exercise needed to be effective, a u-shaped association is assumed. Although conflicting evidence was found, preliminary hints indicate that such a u-shaped relation exists between the amount of exercise and low back pain incidence (11). The risk may be increased when further risk factors are present (19). More distinct is the fact that not only the amount, but also the characteristics, of physical activity and exercise are important contributing factors. Moderate to strong risk factors for the development of low back pain are found in heavy workloads and the accumulation of loads, as well as for awkward positions of the lumbar spine when loading (10). Conclusively, exercise is an important factor in the primary prevention of low back pain. Individualising the type and amount of physical activity and exercise is crucial.

Evidence for Chronification Prevention

Low back pain chronification prevention is classically described as secondary prevention of the development of chronic low back pain arising from an acute episode of low back pain. Within the continuum of therapeutic approaches, it seems, as a first step, important to educate patients with acute low back pain. More specifically, to provide them with information on the harmlessness of the pain (85 – 90% are non-specific) and the excellent healing prognosis at the onset of acute pain. Considering the latter, 60–70% of patients with acute low back pain are pain free after 12 weeks and thus do not develop chronic pain (6). ›

A small but considerable amount of patients display "red flags", which are warning signs for a specific cause of the pain and a potentially serious course. If no hints for red flags were anamnestically found, then no further diagnosis should be performed and the patient should consequently be cleared for physical activity (6). Despite this good prognosis and the following evidence based therapy including physical activity, a considerable amount of patients is not free of pain after 12 weeks of treatment (6). These patients should be screened for "yellow flags", which are risk factors for the chronification of acute low back pain. Known yellow flags are often found in psychosocial limitations such as depression, fear, excessive demands on themselves, self-esteem deficits, fear-avoidance-beliefs, dissatisfying employment and mobbing (6, 9). This multifactorial genesis indicates that sole physical activity may not be enough for the prevention of chronification in low back pain. According to the current German medical guideline, it is particularly relevant to maintain the current level of physical activity (the pre-acute level) (6). Physical activity beyond that amount may not be further beneficial in chronification prevention (meta-analytical evidence) (21). Again, a u-shaped relation between the exercise amount and the chronification risk is assumed to exist.

More specifically, the fastest possible early onset of physical activity after the non-specificity diagnosis of the pain may be helpful (8). The authors found that, although only with small effect sizes, early physical activity therapy resulted in significant improvements when compared to usual care (8). If combined with educational aspects, as described above, early onset active physiotherapy and exercise may be capable of preventing chronification (21).

The potential effects of motor control exercise on chronification prevention were recently pooled in a meta-analysis (15). Including three randomized controlled trials on 197 participants, the authors found that, with very low quality evidence, motor control exercise may not provide clinically important improvements for pain or disability at short-term follow-up an in comparison to standard care integrating physical activity components (15). These findings support the one described above: additional and newly prescribed physical activity beyond the habitual amount may not be able to further prevent chronification.

Evidence for Recurrence Prevention

A majority of nonspecific back pain patients are symptom-free after treatment. However, a considerable amount of patients suffer from a relapse in the following year (12, 16). The preventive approaches used for relapse prevention are twofold: exercise therapy during treatment and exercise therapy following primary/initial treatment.

Conflicting evidence supporting the relevance of additional exercise during initial treatment exists (7). The situation is much more unambiguous considering post-treatment exercise. Moderate evidence supports the relevance of exercise programmes subsequent to primary care (7). The authors included 13 original articles on the prevention of recurrences of back pain by physical activity. Among the included studies, four trials investigated post-treatment programmes on 407 participants. Conclusively, post-treatment exercises were effective in reducing the rate and number of recurrences at a half year to two year follow-up. In a more recently published meta-analysis, the authors found comparable results (14). Here, the post-treatment exercises halved the recurrence risk at a two-year follow-up. The sub-analysis of this review further focussed on motor control exercise. Here, only very low quality evidence was found on the importance of motor control exercise in recurrence prevention (14). This conclusion was based on one single study (13). The original study provides a first hint that "exercise therapy in addition to medical management and resumption of normal activity may be more effective in reducing low back pain recurrences than medical management and normal activity alone" (13). More specifically, motor control exercise group participants showed a 30-35%, and control group participants a 75-84%, recurrence rate one to three years after treatment.

Established Motor Control Exercise Prevention Programs

A plethora of established and validated exercise programs for the therapy of low back pain are available. For secondary and tertiary prevention, the number of established programmes is substantially lower. A major part in such programs is the stratification of patients with a high non-responder and/or chronification risk by examining established risk factors. If no such factors exist, exercise, and, probably motor control exercise alone, is sufficient for recurrence prevention. A promising amendment for motor control exercise includes self or random-perturbation exercises (2). The authors found that variable and unpredictable disturbances during motor control exercises are beneficial for low back pain patients. The effect on recurrence prevention is still lacking but currently remains under evaluation within the MiSpEx network (17). In this low back pain training program, the effects of individualised perturbed motor control exercises are investigated.

Potential non-responders are additionally allocated to a biopsychosocial treatment as an add-on to the motor control exercise program (24, 25). In the latter, yellow flags are targeted to prevent chronic low back pain. If modifiable risk factors are identified, they can be treated accordingly. All of these promising approaches are nevertheless yet to be conclusively evaluated and established.

Förderung

Das MiSpEx-Netzwerk wird gefördert aus Mitteln des Bundesinstituts für Sportwissenschaft (BiSp) aufgrund eines Beschlusses des Deutschen Bundestages [Förderkennzeichen ZMVI1-080102A/11-18].

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