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Road bike cycling and lower back pain - a literature review

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Abstract

Introduction and Purpose

This literature review endeavors to provide a current synthesis of the available literature regarding the relationship between road bike cycling and lower back pain (LBP). This review focuses on the aspects of bike fitting, riding position, preexisting LBP, cycling injuries and predisposing risk factors among others.

Brief Description of the State of Knowledge

Road bike cycling is a popular sport considered to be low-impact physically and easy to start with. So goes the proverb - „it's as easy as riding a bike". However, the truth may be more complicated. There are many positive effects associated with this sport, such as overall health improvement and the ecological impact, and they are generally well-researched. However, it is more difficult to find data regarding the dangers. Improper training program, incorrect bike fit, or suboptimal riding position are all factors that can lead to lower back pain (LBP) connected with road bike cycling. Previous injuries and spine health should also be taken into account.

Summary

In consideration of the gathered evidence, it is important to consider the above-mentioned interventions to prevent or stop lower back pain (LBP) from emerging. This literature review struggles to provide a starting point for both cyclists and physicians alike who encounter such a problem. The bike fit, adjusting the bike in accordance with the body of the cyclist, analyzing the cycling position and the training program should be principal points to provide for a pain-free road bike cycling. Further research is needed to determine the long-term effects of such actions and their ability to prevent or stop LBP while/after road bike cycling.

Key words: cycling, road bike, lower back pain, riding position, bike fit, Union Cycliste Internationale;

Introduction and epidemiology - the scale of the problem and possible approaches

Cycling today plays a role of a healthy recreational activity, a crucial commute method or at a professional level a wage-paying passion. Cycling is shown to reduce the risk of all-cause mortality.

Road cycling is understood to be cycling on asphalted, well-marked roads instead of gravel, mountain or off-road terrain. Usually, it is also understood to include a specific type of a bike - a road bike. The defining road bike characteristics include an aerodynamic frame geometry, smooth thread 700c tires and a specific handlebar type (most commonly drop bar, but also bullhorn or aero).

Lower back pain can be understood to be a continuous or intermittent pain in the lower back / lumbar area - the article endeavors to focus on the spondylogenic pain - pain arising from the spine.

Cycling in general is considered to be a low-impact sport, however research has indicated that many cyclists suffer from back pain. In an observational cross-sectional study of 1274 amateur Italian cyclists conducted by Battista et al. (2021), 55.1% reported lower back pain (LBP) overall, whereas 26.5% reported LBP in the last 12 months. According to a quantitive cross-sectional study of 141 cyclists in Malaysia by Purushothaman et al. (2023), 55.3% reported LBP overall and 35.5% reported LBP in the last 12 months. A study that interviewed 51 top-level road cycling athletes from UCI tour teams by De Bernardo et al. (2012) reported that overuse injuries compromised 53 (51.5%) of the reported 103 cycling-related injuries, and of those overuse injuries, spinal problems compromised 14 (26.5%). A study focusing solely on overuse injuries affecting professional-level road cycling athletes conducted by Clarsen et al. (2010) that interviewed 109 cyclists showed that 71 (65%) of them reported a lifetime incidence of LBP, with 63 (58%) having LBP in the last 12 months. The data above suggest that LBP is a common problem affecting both the amateur and professional road cyclist. It has been reported that a multitude of factors can be seen to influence LBP among road bike cyclists. They include but are not limited to: Schultz and Gordon (2010) researched the relation of LBP to training characteristics in one study and to the riding poison in another; Silberman et al. (2013) attributed LBP to stem height and/or length; Van Hoof et al. (2015) suggested that LBP is related to maladaptive lower lumbar kinematics.

Knowing how common and severe the problem described can be, and how many different factors can play a role it is vital to identify them and, if possible, to find risk factors, reliable countermeasures and prevention methods. This review struggles to achieve just that,

analyzing original research based on cyclists from different countries both amateur and professional.

Methods

Search Strategy

A comprehensive literature search was conducted using the PubMed and Google Scholar databases to identify relevant peer-reviewed studies, which focused on epidemiology, mechanisms, risk factors, prevention methods, types of injuries in relation to lower back pain connected to road bike cycling. The search strategy included the following key terms: „road cycling", „road bike", „lower back pain", „cycling injuries", „bike fit". To refine the search, articles were filtered to include only original research.

Inclusion Criteria

The inclusion criteria for this literature review were based on the PICOS criteria (study design) and included original research articles analyzing lower back problems among road bicycle users both professional and recreational. The review focused on studies analyzing specific aspects of road bike associated lower back pain such as, but not limited to: training characteristic, riding position, saddle angle, stem height and length, lumbar kinematics, pelvic tilt, overuse injuries.

Exclusion criteria

The exclusion criteria were non-English-language articles that did not satisfy the PICOS criteria or for which the full-text article was not available. Studies involving cyclists younger than 18 years were not included.

Search Results

The initial search yielded 79 articles on PubMed and 16 articles on Google Scholar. Each article was screened with the inclusion criteria in mind. Then, the selected 49 articles were analyzed fully. Of them, a total of 7 original research studies were selected and included in this

review. What follows will be a comprehensive overview of the selected research (oldest to newest) totaled with a synthesis and summary.

Riding position

When reaching the handlebars cyclists usually adopt either a „flat-back" or „round-back" pose which could affect the lower back kinematics. Schultz and Gordon in an 2010 article titled „Riding position and lumbar spine angle in recreational cyclists: a pilot study" researched with the help of an inclinometer the lumbar spine angle at 2 points in time (zero and after 10 minutes of cycling) and at 3 different riding positions: hands on handlebars, brake levers or drop bars. The measurements were compered for 2 groups: 4 participants without lower back pain (LBP) and 9 participants with LBP. The study confirmed that the lumbar spine angle flexes the most in the drop bar position compared to the brake levers position and the lumbar spine flexes more in the brake levers position than in the handlebars position. The study also confirmed that with 10 minutes cycling time the lumbar spine increases its flexion: mean flexion increase between 2° and 3°). While the number of the participants in the study was small (13) and there was no clear indication to the effect of the lumbar spine angle on the LBP, the study provides a starting point for further research with a bigger group and a bigger emphasis on the impact on the LBP.

Training characteristics

Another 2010 study by Schultz and Gordon titled „Recreational cyclists: the relationship between low back pain and training characteristics" questioned a total of 66 recreational cyclists with no lower back pain (NLBP) and with lower back pain (LBP) on a variety of aspects regarding their training characteristics: pace, terrain, riding events per year, cycling experience, distance cycled per week, cycling frequency per week, number of gears on a bike and riding position. Only one of these aspects had a p-value<0.05 and constituted statistically significant findings - distance cycled per week. The median distance cycled per week for NLBP participants was 150 km, whereas for the LBP participants in was 250 km. After a further analysis of the data the authors found that cycling more than 160 km per week significantly increases the risk of LBP. The above findings constitute a major possible recommendation for cyclists affected by LBP.

Overuse injuries affecting professionals

Clarsen at el. in a 2010 paper „Overuse injuries in professional road cyclists" researched the scope of the problem for professional cyclists interviewing 109 athletes from 11 teams partaking in UCI (Union Cycliste Internationale) tour events. The goal was the establish an epidemiological group for further studies and interventions. The most prevalent medical problems found were lower back pain (LBP) and knee pain. While it was the LBP that was more prevalent with 71 (65%) athletes reporting ever having symptoms and 63 (58%) reporting having LBP in the last 12 months, it were knee problems that caused missing training and competition more often than LBP. LBP appears to be a critical problem to solve for both recreational and professional cyclists.

Cycling injuries affecting professional athletes

De Bernardo et al. researched injuries most commonly affecting professional cyclists. In a 2012 study „Incidence and risk for traumatic and overuse injuries in top-level road cyclists" after retrospectively analyzing medical interventions affecting 51 cyclists, they found that of the total 103 cycling-related lesions both traumatic and overuse injures accounted for roughly half of them (48.5% for the former and 51.5% for the latter). Of the traumatic injuries the most common lesion was the clavicle fracture (11 reported injuries, 11% of all lesions). Of the overuse injuries the knee was most commonly affected (17 reported injuries, 16.5% of all lesions), followed by the spine (14 reported injuries, 13.5% of all lesions). The above data while slightly differing from the finding of Clarsen et al. (2010) also concludes that lesions affecting the spine and the knee are among the 2 most common overuse injuries affecting professional cyclists.

Lower lumbar kinematics

In a paper „Low back pain in cycling: does it matter how you sit?" Van Hoof et al. (2015) analyzed the lower lumbar kinematics in cyclists unaffected and affected by lower back pain (LBP). After compering 9 asymptomatic pain-free riders with 8 cyclists affected by LBP, they found that the LBP group adopted a significantly more flexed (at the lower lumbar spine region) position. While the study group size remains small, this research is in accordance with

findings of Schultz and Gordon (2010) that an intervention targeting the lower lumbar flexion could play a significant role to remedy the cycling associated LBP.

Lower back pain in the context of a large cycling population

„Prevalence, Characteristics, Association Factors of and Management Strategies for Low Back Pain Among Italian Amateur Cyclists: an Observational Cross-Sectional Study" published by Battista et al. in 2021 constitutes a thorough investigation regarding the lower back pain (LBP) in an Italian cycling population. Compiling the answers from an internet survey from 1274 cyclists, the prevalence of LBP in life reached 55.1%, 26.5% in the last 12 months and 10.8% in the last 4 weeks. Among the statistically significant ($p<0.01$) negative association factors for the LBP were pedalling training and being supervised by a couch. Efficient pedalling technique could provide for a more even distribution of force in the lower extremities and hence play a stabilizing role. The authors supposed that proper increase of training loads and adequate programs could reduce the onset of LBP. Battista el at. (2021) concluded that while the prevalence of LBP among cyclists may seem to be high, the numbers are actually below the estimated prevalence for the general population.

Purushothaman et al. (2023) research titled „Survey on low back pain among cyclists: prevalence, risk factors and knowledge of injury prevention strategies" was conducted in a similar manner to Battista et al (2021). With the help of a questionnaire completed by 141 cyclists, Purushothaman et al. (2023) established the lower back pain (LBP) lifetime prevalence at 55.3%, with 35.5% reporting LBP in the last 12 month. However, no statistically significant association was found between researched risk factors (such terrain, warm-up, smoking and such) and LBP. It has been stipulated before that smoking could be a risk factor for LBP in athletes and this area warrants more studies. The surveys returned demonstrated a low level of knowledge regarding the possible LBP management strategies (such as seat adjustment, saddle tilt, riding position, training distance), which could be a starting point for further analysis.

Discussion

This review offers a thorough analysis of identified aspects of road bike cycling and lower back pain (LBP). A crucial point observed is the scope of the problem - lifetime prevalence reached 55.1-55.3% for general groups of cyclists with as much as 65% for

professional cyclists. Similarly, high number were recorded for LBP in the last 12 months - 26.5-35.5% for general groups of cyclists and 58% for the professional athletes group. The above is supplement by finding of De Bernardo et al. (2012) that spine injuries constitute the 2nd largest injury group for professional cyclists. It is important to point out that recreational cyclists have been found to have an annual training load of around 7000 km while a professional UCI touring athlete has a yearly training load of around 25000 to 35000 km. It is therefore important to remember that the overuse injury mechanism could be significantly different among the 2 group and that more research is needed for proper comparison.

While it has been researched before that general fitness and physical activity (when compared to inactivity) reduce the risk of LBP, it must also be said that cycling seems to be associated with higher LBP prevalence rates than other sports, for example running.

When it comes to risk factors, many where analyzed: riding terrain, smoking, supplementary exercise, warm-up, cool-down, sex, work type and others. Among them, Purushothaman et al. (2023) found none with statistical significance, while Battista et al. (2021) found that pedalling training and couch supervision provided for a statistically significant negative connotation with LBP. This could, if researched further, provide valid management strategies. While no association was found between LBP and cycling terrain by both Purushothaman et al. (2023) and Schultz and Gordon (2010), it has been found that cycling uphill requires a different cycling position - this area also warrants more studies.

In regard to managing LBP and possible interventions that could be recommended it has been identified that the introduction of an anteriorly tilted saddle (between 10° and 15°) could provide relief. Schultz and Gordon (2010) also found that cycling more than 160 km per week was associated with a significant increase in the risk of LBP.

Another important aspect of cycling associated LBP are the lower lumbar kinematics. Van Hoof et al. (2015) found that riders with LBP had a more flexed (at the lower lumbar spine) position. Association of the lower lumbar flexion while cycling with LBP was also researched by Schultz and Gordon (2010) and while the lower lumber flexion was found to increase after 10 minutes of cycling there was no clear effect found on the LBP. This is clearly an area that warrants more investigation.

Summary

This review summons the most up-to-date knowledge points regarding a fairly unresearched area of study regarding road cycling. Emphasis was put on the analysis of the

scope of the problem and the severity of its impact on both recreational road cyclists and professional athletes. Knowing that the problem touches upon a majority of the cycling population, it has a profound impact. Key areas were investigated: cycling terrain, bicycle fit, riding position, saddle angle, number of gears on a bike, couch supervision, pedalling training among others. Most perspective among them were identified. Crucial management strategies were identified, with areas requiring more data outlined.

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