LOW BACK PAIN IN SPORT: BIOMECHANICS AND INTERVENTION

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Considering the large number of peer-reviewed papers that have been written on sports injuries, relatively few intervention studies have been conducted. This is especially the case for the problem of low back pain (LBP) in sport. With the few intervention studies that have been conducted in this area, positive clinical outcomes have been infrequent. This may be due to the lack of individualized approaches which tailor intervention for the athlete according to the presence of known risk factors. Two recent studies conducted in 1) elite male fast bowlers in cricket and 2) schoolgirl rowers have attempted to address this issue. It is recommended that more work is needed in this area to try and improve clinical outcomes.

KEYWORDS: Low back pain, biomechanics, intervention, technique,

INTRODUCTION: Despite the past 30 years of research into low back pain (LBP) in sport, the incidence and impact of LBP in sport has not decreased. Athletes suffering from LBP may lose training time as well as having reduced performance in competition. Also of clinical significance is the fact that the biggest risk factor for LBP in the future, is a previous episode of LBP. LBP in athletes is typically considered a patho-anatomical problem with disc degeneration and spondylolysis being the focus of previous investigation. However, approximately 85% of all LBP is considered to be non-specific in origin (ie. the patient has pain present but are no abnormal radiological findings).

According to van Mechelen's and associates (1992) injury prevention model, to decrease the prevalence of an injury; 1) injury surveillance is needed 2) the mechanism of injury needs to be examined, 3) preventative efforts need to be designed, then 4) the effectiveness of the preventative effort needs to be assessed. This model was then extended by Finch (2006) to form the Translating Research into Injury Prevention Practice (TRIPP) framework. Two extra steps were added to the van Mechelen model to form the TRIPP framework, they being; 5) the intervention needs to be described in the correct context to inform implementation strategies and also 6) re-evaluation of effectiveness measures need to occur in the implementation context.

Interestingly, in a study examining 12000 papers on sport injury (Klugl et al., 2010), only 11% of these manuscripts had attempted any form of preventive efforts in sports injury research (ie. TRIPP model steps 3-6). Of these studies, there have been very few that have examined LBP. Previous studies have attempted to use multi-segment core stability approach (Cusi et al., 2001; Nadler et al., 2002) and an approach that involved improving the co-activation of transversus abdominus and multifidus (Harringe et al., 2007). Regardless of the approach used the results have been less than promising. This may due to the complex and multi-dimensional nature of LBP (O'Sullivan, 2005).

Sub-classifying LBP patients and tailoring treatment accordingly has been put forward as a way to improve clinical outcomes (O'Sullivan, 2005). To put this into a sporting context, athletes should not be considered as a homogeneous group. Specifically, athletes in various sports may differ with respect to factors such as; spinal loading patterns, training volume, differing goals and ability levels, their LBP history, physical preparation levels and individual resilience. Hence, it would seem logical that interventions attempting to address the problem of LBP in sport, should also be tailored to the individual (or at least the sub-group). As stated in the TRIPP framework, risk factors for a particular sport or sporting activity should be identified prior to designing intervention studies.

The most serious of all injuries in cricket is the stress fracture to the lower back in fast bowlers (Elliott et al., 1992; Ranson et al., 2010) as the time lost from training and match play with this injury is significant (Ranson et al., 2008; 2010). Previous research has shown the existence of risk factors for back injury in fast bowling in cricket. Firstly, the use of a mixed action with large magnitudes of shoulder counter rotation in the delivery stride (Foster et al., 1989; Elliott et al., 1992; Ranson et al., 2008) has been associated with injury. It has been hypothesized that this may not be due to shoulder counter rotation itself, but it may be the associated end-range rotation, side flexion and/or extension which may contribute to increased spinal loading (Burnett et al., 1998; Burnett et al., 2008). Secondly, bowling workload may also be an important factor (Dennis et al., 2005; Orchard et al., 2009; Hulin et al., 2014). Finally, inadequate physical preparation of the bowler has been considered as a risk factor (Foster et al., 1989).

A recent intervention study (Ranson et al., 2009) investigated whether the amount of shoulder counter rotation could be decreased in elite-level fast bowlers over a two-year period. In this study, intervention on specific aspects of bowling technique was only conducted if it was deemed to actually require change. In this study 14 elite young fast bowlers (18.5±2.3 years) were recruited and their bowling action was assessed using three dimensional motion analysis before, and after, the two-year intervention. This was an interesting study for two reasons 1) at the time of testing these bowlers would have had well developed bowling actions which may not be amenable to change and 2) despite the claims of biomechanical intervention changing sporting technique – this has rarely been proven in the peer-reviewed literature. The coaching interventions when applied resulted in a more side-on shoulder alignment at back foot contact as well as there being a decreased magnitude of shoulder counter rotation. Other monitoring of bowlers over an intervention period should also be considered. For example, if financial resources are available, the existence of acute bone stress could be viewed on MRI, and used as a warning sign of a future stress fracture (Ranson et al., 2010). Furthermore, bowling workload should be tracked over time using a method that does not rely on self-report (eg. Hulin et al., 2014).

Rowing is a sport where the incidence of LBP is high (eg. Smoljanovic et al., 2009) and pain levels gradually ramp upwards while the athlete continues to row (Ng et al., 2008). Another example of a LBP intervention study using an individualized approach is a multi-dimensional intervention using a bio-psycho-social framework that was conducted on schoolgirl rowers (Perich et al., 2011). A previous scoping study (Perich, 2010) examined 356 adolescent schoolgirl rowers between 14-17 years of age and 496 age and socio-economic status and activity matched asymptomatic control subjects. Participants completed a questionnaire to determine the prevalence of LBP and other factors known to exacerbate LBP. The point prevalence of LBP was 47.5% for the adolescent female rowers and 15.5% in the control group. Higher levels of pain were experienced by subjects whilst rowing (5.8/10) when compared to their usual levels (2.2/10) indicating that rowing exacerbated their pain. Self reported factors considered to cause, or exacerbate LBP in rowing related activities, included; long rows in a training session (78.9% of subjects), lifting a rowing shell (69.9%) and rowing in a sweep eight (64.2%). Rowing a single scull or quadruple scull were less common factors (13.8% and 36.6% respectively). The most common reasons for LBP affecting everyday function determined by a revised-Oswestry questionnaire were sitting, lifting and standing. In the cross-sectional study that followed (Perch, 2010) 60 schoolgirl rowers (30 no-LBP rowers and 30 LBP rowers) were examined. Factors associated with LBP were reduced lower limb endurance and back muscle endurance and maintaining more erect sitting postures. Physical examination of 24 LBP subjects, conducted by a musculoskeletal physiotherapist, revealed that 19 of the girls had a clinical classification of a 'flexion' and 5 with an 'active extension' control impairment pain disorder. The intervention study was unique in that individually prescribed exercise programs (based on musculoskeletal screening) were utilised rather than the same program being utilised for all subjects. Participants in this study also underwent back management education and an off-water conditioning program. To assist program uptake, participants were involved in the same number of training hours every week. Primary outcome variables collected at start-season, mid-season, end-season and post-season included the incidence of LBP and related levels of pain and disability. Secondary outcome variables from the bio-psycho-social domain were measured at start-season and end-season in the Intervention group only. The Intervention group showed a lower incidence of LBP at mid-season and end-season (Figure 1) and also displayed significantly better results than the CTRL group for improvers and non-improvers with respect to the levels of pain and disability. The INT group following the intervention also displayed improved physical fitness levels, sat with significantly less anterior tilt of the pelvis and lumbar kyphosis when in their usual sitting posture.

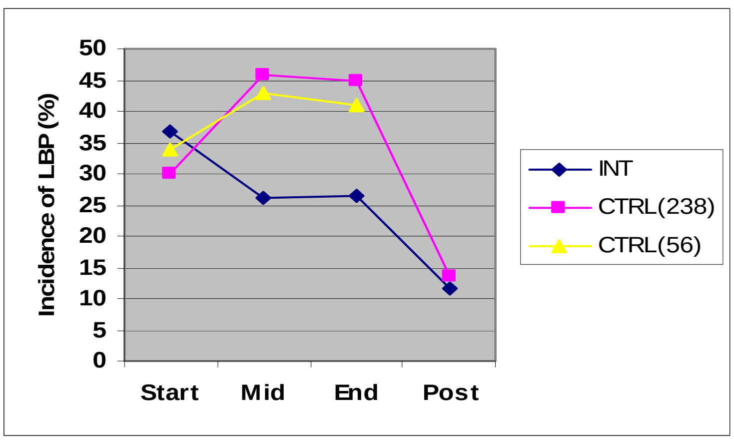

Figure 1: Incidence of LBP in the intervention and control groups in the schoolgirl rowing study (from Perich et al., 2011).

In future intervention studies, stronger experimental design factors need to be used. For example, randomized controlled trials with sufficient sample sizes should be undertaken. This presents an awkward problem in some sports where the willingness of teams and clubs to randomly allocate their players from their teams into intervention and control groups may be low.

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