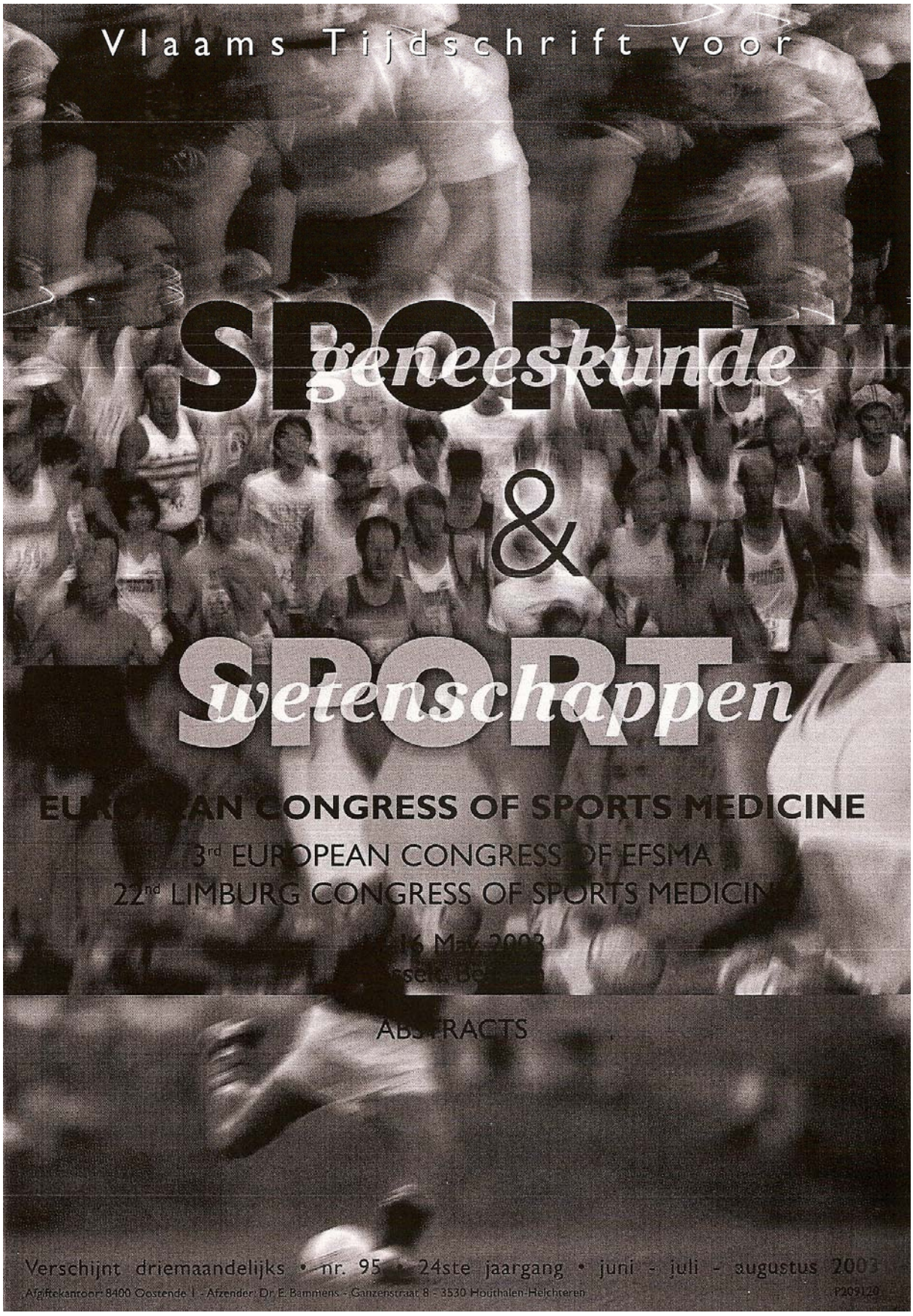

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STRENGTH IMBALANCES IN HAMSTRING STRAINS

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Hamstring muscle strains are among the most common muscle injuries in athletes. The high rate of re-injury and of persistent complaints after return to athletic activities can pose difficult problems for trainers as well as sports medicine clinicians. Factors causing hamstring muscle injury have been studied for many years. Reports have suggested such causes as muscle weakness, strength imbalance, lack of flexibility, fatigue, inadequate warm-up, and dyssynergic contraction.

In a first investigation, we had demonstrated frequent muscle strength performance disorders in the context of hamstring muscle strains with persistent discomfort(1). The results in that study suggested that recurrent injuries could be the consequence of inadequate rehabilitation after an initial injury. However, there is only sparse clinical documentation of the perplexing relationship between muscle imbalances and extremity injuries.

The aim of a second study(2) was to determine whether complete recuperation of isokinetic muscle strength levels and agonist/antagonist ratio correction could significantly reduce the incidence of injury when athletes resume practice after initial hamstring muscle injury. We determined the frequency of strength disorders in 26 athletes with a history of hamstring muscle injury and recurrent strains and discomfort. After concentric and eccentric isokinetic assessment, 18 athletes were found to have strength deficits, as determined by statistically selected cutoffs of peak torque, bilateral differences, and the flexors/quadriceps ratio. The discriminating character of the eccentric trial was demonstrated, combining a preferential eccentric peak torque deficit and a significant reduction of the mixed eccentric flexors/concentric quadriceps ratio. The athletes with muscle imbalances followed a rehabilitation program individually adapted from their strength profile. Treatment length was from 10 to 30 sessions and resulted in isokinetic parameter normalization in 17 of 18 subjects.
Isokinetically corrected subjects were observed for 12 months after return to athletics. None sustained a clinically diagnosed hamstring muscle re-injury. Subjective intensity of pain and discomfort were significantly reduced, and they all returned to their prior level of competition.

These results demonstrate that persistent muscle strength abnormalities may give rise to recurrent hamstring injuries and discomfort. An individualized rehabilitation program emphasizing eccentric training based on specific deficits contributes to a decrease in symptoms on return to sports.

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EXERCISE, IMMUNOLOGY AND METABOLISM

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Cytokines are signalling peptides, which were originally discovered within the immune system. Recent studies, however, demonstrate that cytokines also play multiple roles in regulating metabolism and muscle adaptation. Recently, we have shown that contracting skeletal muscles, independently of muscle damage, produce and release the cytokine interleukin-6 (IL-6). We have also demonstrated that IL-6 is released from subcutaneous abdominal fat tissue and the human brain during exercise.
The biological roles of IL-6 are many: 1) Activation/inhibition of metabolic genes; 2) Induction of lipolysis 3) Inhibition of insulin resistance and 4) Induced cortisol production, thereby influencing blood cell trafficking during prolonged exercise. Production of IL-6 and hence exercise-induced immune changes are highly influenced by substrate availability. The IL-6 gene is rapidly activated during exercise and the activation of this gene is further enhanced when muscle glycogen content is low. In addition, carbohydrate supplementation during exercise has been shown to inhibit the release of IL-6 from contracting muscle.
Carbohydrate loading has also been found to inhibit exercise-induced immune changes, suggesting that this effect is at least partly mediated by an inhibition of muscle-derived IL-6 and cortisol production. The clinical consequences of dietary modification of the cytokine and immune responses to exercise may include both risk of obtaining infectious diseases, training adaptation and insulin resistance.

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