Hyperbaric Oxygen Therapy in Sports Injuries

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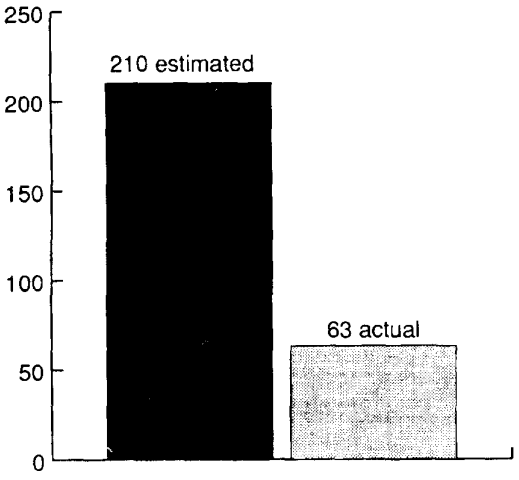
Intermittent high dosage oxygen is a well-established therapy in many countries. Experimental and clinical studies have validated the use of hyperbaric oxygen in the reduction of oedema in the compartment syndrome (Sykhar *et* at, 1986), ischaemia (Nylander *et* al, 1985), crush injuries (Mathieu *et* al, 1990), plastic surgery (Davis and Hunt, 1989) and burns (Cianci *et* al, 1988). In the UK the method is little used, possibly because there is an unfounded fear of oxygen toxicity. Plasma oxygen transport is directly proportional to the partial pressure of the inspired oxygen and can be increased to such a level that haemoglobin transport is rendered unnecessary (Boerema *et* al, 1959), and tissue oxygen studies have shown that oxygen levels remain elevated for some hours after therapy.

Football is frequently associated with minor injuries, involving joints, muscle, ligaments and tendons. A variety of therapies have been developed to reduce tissue swelling and preserve mobility. There is inevitably a compromise between early mobilisation with the risk of worsening the injury, and delaying the return to training, with loss of general fitness and, sometimes, disuse atrophy of muscle groups.

Hyperbaric oxygen therapy has been used to determine whether the expected duration of injuries can be reduced. The patients studied were all professional footballers, injured either during matches or during training. The injuries were assessed by the club physiotherapist and an estimate made of the expected time before the players could be expected to resume full training. Treatment was then instituted with the usual physiotherapy techniques, but, in addition, sessions of hyperbaric oxygen were added on a daily basis until the players were fit to resume full training. The chamber (Hyox HTU) was pressurised on air and oxygen supplied via a Scott demand-valve system with overboard dumping of exhaust gas at 2 ata.



Vertical axis is days of unfitness

Comparison of physiotherapy alone and physiotherapy with hyperbaric oxygen in recovery from 20 minor sports injuries

The figure illustrates the difference in outcome between the expected and actual durations of disability with adjunctive hyperbaric oxygen therapy in 20 simple injuries. The average saving in injury time is 70%.

Case Studies

Three patient histories illustrate the benefit obtained. No patient suffered a relapse after treatment.

Patient 1 developed Achilles tendonitis of the left ankle that was expected to take four days to resolve. A single session of hyperbaric oxygen allowed him to resume full training after one day.

Patient 2 suffered a severe sprain of the left ankle estimated to take three weeks to heal. He was able to undertake full training after four days following two sessions in the hyperbaric chamber.

Patient 3 strained the upper insertion of the left hamstring with significant localised tenderness. The estimated duration of unfitness was a week but, after two treatments, he resumed training on the third day

Conclusions

Soft tissue injury inevitably results in a disturbance of the microcirculation, with increased permeability due to the release of inflammatory mediators (Abbot *et* al, 1990). The development of oedema and the invasion of inflammatory cells with a high demand for oxygen results in hypoxia, with worsening of the oedema allowing a vicious cycle to develop.

Oxygen delivered under hyperbaric conditions allows the cycle to be interrupted by producing vasoconstriction and yet paradoxically increasing oxygen delivery to the tissues (Knighton *et* at, 1981). Mild hypoxia is a stimulus to angiogenesis, but severe hypoxia prevents all tissue growth. An experimental study (Mehm *et* at, 1988) has also indicated that oxygen tensions of about 80 mm Hg, ie double those achieved breathing air at normal atmospheric pressure, achieve the greatest rate of collagen formation. The extra oxygen available under hyperbaric conditions may have other effects, such as increasing the production of free radical scavengers (Misra and Fridovich, 1971).

The results of this study suggest that a large controlled trial should be undertaken.

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