Injury bites, but food affects the way we heal

IT IS NOW KNOWN THAT THE REPAIR OF AN INJURY IS DEPENDENT ON THE NUTRIENTS AVAILABLE IN OUR BODY. **Marcus Webb explains the nutritional science behind healing**

If you play sports, at whatever level, injury is often one of those unavoidable consequences. An injury can hit any sports person, from the weekender through to the serious athlete, but the outcomes can be serious for all, regardless of the level of training and fitness. What all sports people dread is the effects of immobility: injury normally involves some level of pain and limited function, which can have a real impact on muscle tone and strength.

While there are many physical modalities to encourage the rehabilitation and healing process, little is mentioned when it comes to the importance of food and nutrients. Keeping in mind the saying "we are what we eat", it would make sense to look to nutrition whilst injured, keeping in mind that the natural healing mechanisms may require extra support. It's truly amazing that Hippocrates noticed this connection between food and healing and famously commented "feed the patient and they'll get better" over 2000 years ago. We are only now beginning to re-appreciate the effects of nutrition on the healing process all over again.

There is also growing interest in pre-surgical nutritional support, which shows that people can optimise their healing time following surgery and reduce the risk of associated complications of poor healing following a 7-10 day nutritional boost (1,2,3). If someone reaches their expected healing time but continues to complain of pain and disability, the condition has shifted into the chronic pain scenario, with all its related problems. Nutritional factors are now thought to play a key role in healthy resolution of tissue repair following injury with special focus on key amino acids, vitamins and zinc.

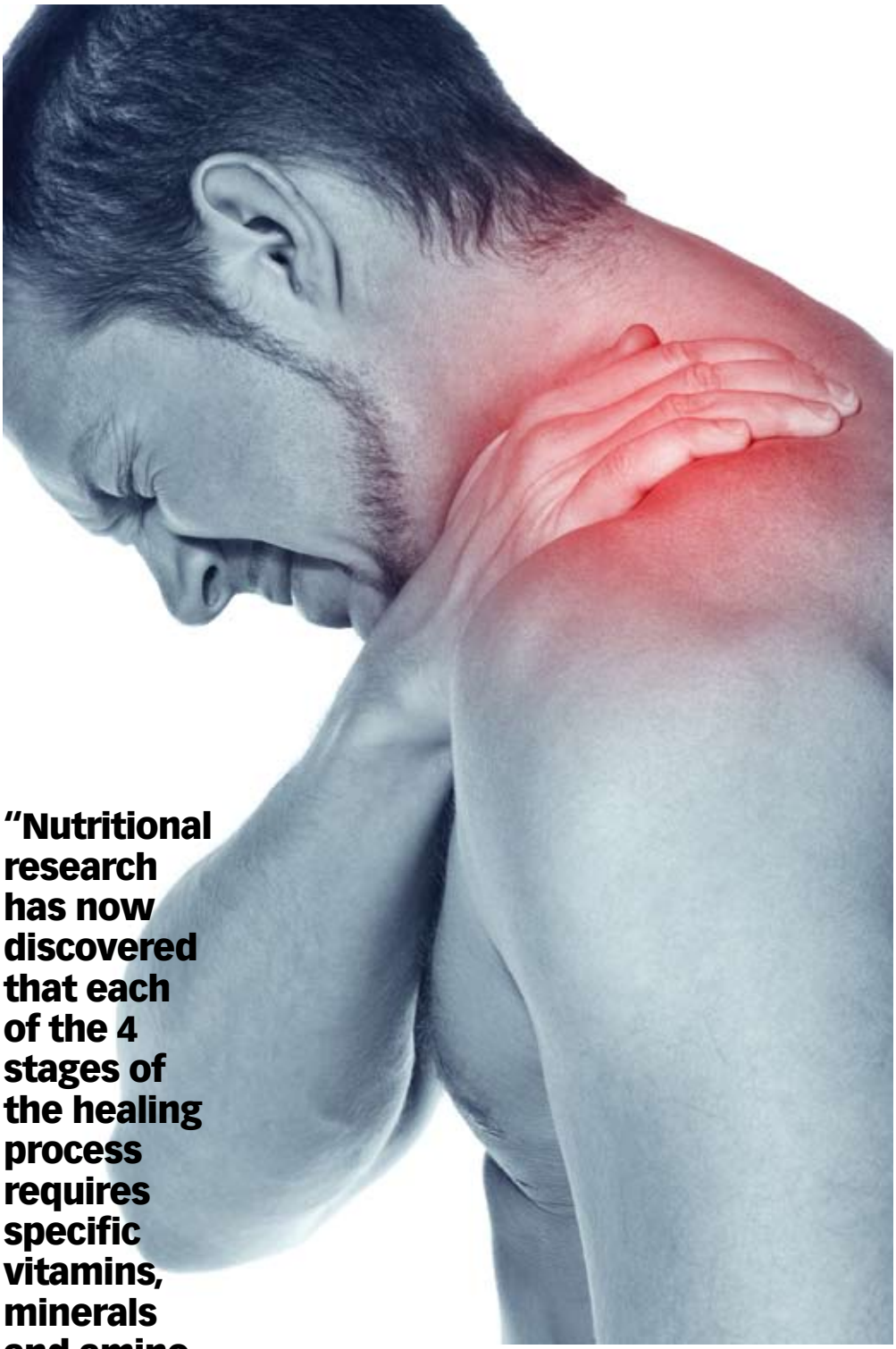
Recovery from injury should be a seamless process

The well coordinated process that is needed for successful injury healing should run a seamless pathway to healthy resolution and full restoration of function, but the process can be hindered along the way. Unless all of the nutritional factors are available at each of the 4 key points of the healing process, a weak and ineffective repair will result, nudging the problem ever closer to a chronic injury state (4). Nutritional research has now discovered that each of the 4 stages (below) of the healing process requires specific vitamins, minerals and amino acids for a successful outcome, even from relatively trivial injuries (4).

1. Vascular Reaction: The initial phase following an injury is characterised by the rapid constriction of blood vessels, closely followed by a more prolonged phase of blood vessel dilation. Over this phase, the involved vessels become leaky. This allows various components of the blood to seep into and collect around the injury site. With its complement of immune cells and inflammatory chemicals, the fluid starts to clear away the damaged tissue and cells and prevent secondary infections.

2. Inflammation: Heat is a typical sign of injury and represents the outward effects of the inflammatory process, which causes an increased blood supply with swelling and an activated pain response. The purpose of inflammation is to deliver fresh blood to the injury site. The blood delivers all the elements of the immune system to the site of damage to prevent infection, along with a myriad of specialist healing cells that initiate the next phases of the repair process.

3. Proliferation: This phase is characterised by a high level of cellular activity devoted to the production of the vital protein-based framework that needs to be laid down. This is the biological scaffolding onto which new tissue will be deposited as the region is



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repaired (4,5).

4. Remodelling: In most cases, basic tissue healing is up to 70% complete after four weeks, but the process of remodelling can in some situations, continue for up to two years (5). Just as an artist may paint over parts of his original work in order to refine the final picture, so too does the body. Remodelling involves the subtle laying down, breaking down and re-laying of healing tissues until the injured region has been returned to its pre-injury state. In most cases this process may be fairly flawless, but repeated injury to the same area tends to result in less than perfect remodelling each time the region is exposed to the injury cycle.

The basic raw materials for healing

Nutrition and healing has been a rather neglected aspect of science, but several key nutrients appear to play a vital role; these include vitamin C, vitamin A, zinc, L-Arginine and L-Glutamine.

Vitamin A is needed for the formation of strong and effective collagen fibres that prevent wounds from breaking down prematurely: this is especially evident in skin injuries (6). Along with its collagen strengthening function, vitamin A is also necessary for an effective immune response. If the immune function is low or sub-optimal, any ensuing infection can delay and seriously disrupt the entire healing process (7). The non-toxic water soluble form called beta-carotene can be used safely in those who have not had a history of smoking-related lung cancer (previous research has cautioned against beta-carotene use in lung cancer patients). Normally, in good health, the body can convert beta-carotene into retinol as needed without the worry of toxicity. Foods that are colourful tend to owe their colours to the carotenoid group of compounds of which beta-carotene is just one. To get your fix of carotenoids, make sure you select from a variety of foods such as carrots, spinach, kale, apricots, papaya, mango and tomatoes.

Vitamin C is another important nutrient needed for the production of strong collagen. While scurvy (a gross deficiency state) is unlikely today, an optimal amount of vitamin C is still essential for the healthy resolution of an injury. Vitamin C is needed for the normal functioning of many immune cells as well as for the strength of blood vessel walls. Collagen, the very glue that holds us together, is dependent on adequate vitamin C levels, a lack of which is associated with fragile and poorly healed injuries (8,9,10). It is interesting that we all tend to associate oranges with vitamin C, but it is sweet red peppers that actually →

boast the highest amounts. Broccoli is another Vitamin C-rich food: cooking it releases more bioavailable vitamin C than eating it raw. Also consider eating more 'greens', sprouts and tomatoes to boost your vitamin C intake from foods.

Zinc deficiency is known to result in a delayed or poorly healed injury because it is needed to increase internal and external scar strength. Biological demands and requirements of zinc are thought to be at their highest from the time of injury, especially during the early inflammatory phase (12). Getting a good boost of zinc from your diet can present vegetarians with a dilemma; the highest amounts are found in oysters (around 77mg per serving), followed by beef, crab, pork and lobster! However, baked beans (1.7mg per serving) and cashew nuts (1.6mg per serving) offer fair amounts when eaten on a regular basis. Keeping a supplement dose to around 15mg a day for a few months is a reasonable thing to do over a phase of injury when your zinc needs are higher than normal, but be aware that zinc toxicity can potentially become an issue with higher intakes.

Arginine and **Glutamine**, within the important role that protein plays during healing, are two key amino acids that appear to be essential for soft tissue regeneration and repair. Arginine has a surprising immune-stimulating function in addition to enhancing the protein matrix essential for the formation of new body tissue (13), whereas glutamine is utilised primarily by fibroblasts as an energy source during the healing process. Fibroblasts are healing cells that are central to the balanced deposition of fibrous scar tissue. Using supplements of these important amino acids has been shown to enhance repair and healing (14).

Balancing the proteins in your diet is normally the best way to obtain a broad spectrum of well-absorbed amino acids. Foods such as parsley, raw spinach, fish, meat and beans boast a high glutamine content, with chocolate (yes chocolate!), coconut, dairy products, meat, oats, nuts, raw cereals, peanuts, soybeans and walnuts serving as good sources of arginine. To be on the safe side, those suffering from viral infections and pregnant or lactating women and those with schizophrenia should avoid taking over 30mg of arginine per day while those with liver or kidney diseases, Reye's syndrome or other disorders resulting in the accumulation of ammonia in the blood, need to avoid excessive glutamine intakes.

It's all a matter of balance

While some injuries are unavoidable, poor fitness and over-training represent two ends of the injury spectrum. No manner of nutritional support can replace a sensible training plan and sufficient rest time to mend the micro-traumas associated with all exercise and sports. However, healing is a natural process that can be enhanced with good dietary choices, specific supplements when needed and the careful use of physical therapy and rest. FSN

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