diamond

Healthcare

CASE STUDY

Personalising alendronate therapy when treating Osteoporosis

Osteoporosis is a bone disease that affects 200 million people worldwide and contributes to 8.9 million fractures annually. The condition causes a loss of bone mass and structure which in turn leads to bones becoming weak and breaking, usually during a trip or fall.

The disease is prevalent in people over 55, and in particular women, due to the loss of oestrogen hormone during the menopause. However, osteoporosis is becoming increasingly prevalent in men who receive cancer therapies which supress testosterone levels.

Bisphosphonates are a family of medicines which are commonly prescribed to treat osteoporosis. The most common types are alendronate and zoledronate which aim to strengthen osteoporotic bones by slowing down the activity of bone cells.

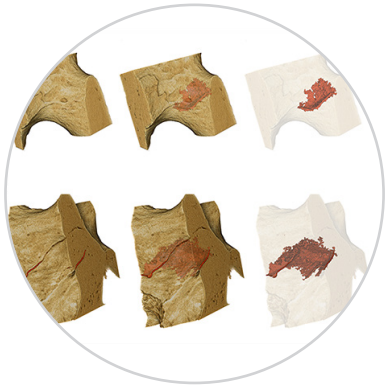
Imperial College London

The Challenge

Alendronate has been a long-established treatment for osteoporosis and perceived as very effective by many in the medical field. Therapy reduces fracture risk by about 50%. Doctors, however, had more recently started to notice rare stress fractures in elderly patients who had been taking the drugs for a long time, raising questions around its long-term efficacy.

A team led by Dr Richard Abel at Imperial College London was keen to understand how and why therapy might cause stress fractures. Initial studies demonstrated that bone from some bisphosphonate patients was actually weaker than untreated control samples. They were keen to find out why this was happening and study the effects of long term alendronate usage.

The Solution



Samples from the ball of the thigh bone were examined in both patients that had been prescribed alendronate before suffering a hip fracture, and hip fracture patients that had not received any treatment for metabolic bone disease. These were then compared with samples from healthy ageing people who had no history of hip disease or bone metabolic medication.

The research instruments at Diamond were used to scan bone tissue and look at the bone volume and structure, including microcracks at a very tiny microscopic level; tomographic images were then reconstructed to calculate microcrack density. After scanning, cores were tested to investigate the effects of alendronate on bone strength.

The Benefits

It seems as though short-term treatment with alendronates (<4-5 years) may improve the structure and density of bone, increasing the strength. However, we have found that in the longer term, the drug caused tiny micro-cracks to form and accumulate in bone. The cracks can grow and merge, causing bones to become weak and even break. The effect probably varies from person to person; hence the study shows we urgently need more research to determine how long to prescribe alendronate to individual patients.

"The amazing technology and dedicated staff at Diamond have helped us to show that there may be a crucial time point where we can optimize the effect of alendronate, so doctors can provide maximum protection against fractures by personalising the duration of treatment." **Dr Richard L. Abel - Lecturer in Musculoskeletal Sciences, Imperial College London**

For further information

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