

Who's afraid of the big bad Wolff?: “Wolff's law” and bone functional adaptation

Wolff's law, developed by the German anatomist and surgeon Julius Wolff (1836–1902) in the 19th century, states that bone in a healthy person or animal will adapt to the loads under which it is placed.[1] If loading on a particular bone increases, the bone will remodel itself over time to become stronger to resist that sort of loading.[2][3] The internal architecture of the trabeculae undergoes adaptive changes, followed by secondary changes to the external cortical portion of the bone,[4] perhaps becoming thicker as a result. The inverse is true as well: if the loading on a bone decreases, the bone will become less dense and weaker due to the lack of the stimulus required for continued remodeling.[5] This reduction in bone density (osteopenia) is known as stress shielding and can occur as a result of a hip replacement (or other prosthesis).[6] The normal stress on a bone is shielded from that bone by being placed on a prosthetic implant.

Wolff's Law: What is it?

Our skeletons are constantly changing. Every time stress is applied to our bones, they remodel themselves to adapt to the stress. For example, the bones in a tennis player's dominant arm may be up to 20% thicker than the bones in their non-dominant arm. This effect is called Wolff's Law. It states that our bones become thicker and stronger over time to resist forces placed upon them and thinner and weaker if there are no forces to act against.

Wolff's Law and Injury

This principle is important for preventing injuries. A thicker bone is harder to break. Regular resistance training will thicken your bones making you less prone to injury. It is also important for anybody who is recovering from an injury. Let's say you've fractured your right ulna and have been in a cast for 6 weeks. The muscles around your ulna will have atrophied from disuse. Resistance training will not only recover muscle, it will also improve the strength of your recently mended bone which will have certainly lost some mass from being sedentary. A physical therapist can create a resistance training program that will speed up your recovery at a rate that is safe.

Bone Strength Throughout Life

Osteoporosis occurs when a person's bone mass has deteriorated causing them become weak and prone to fracture. Weight bearing physical activity is essential for preventing weakening of the bones later in life. By the age of 80 a woman may lose up to 53% of her bone mass while men may lose up to 18%. Peak bone mass is directly related to level of physical activity and most people hit there peak bone mass by the age of 30. A person who starts out with a higher peak bone mass will have more by the age of 80. Additionally, elevated levels of physical activity after peak bone mass is reached will both delay the onset and reduce the rate of bone loss.

Exercise is Important

Do you want to be the 80 year old who is in a wheelchair? Leading an active life will allow you to live a long life but more importantly, it will increase your quality of life especially as you grow older.