BREAKING CONCRETE

By Leith Darkin (June 2007)



ABSTRACT

In this article we are going to look at how the human body is capable of breaking slabs of wood, slabs of concrete, baseball bats, rocks, bricks etc, with nothing more than flesh and bone.

Bone Anatomy

Bone is metabolically active tissue consisting of living tissues such as nerves, blood vessels and collagen and non living substances (minerals) such calcium and phosphorus. The non living substances in bones are constantly undergoing a process called “bone remodelling”. Bone remodelling is where a specific group cells called osteoclasts, target a specific section of old bone and dissolve it away, after the osteoclasts have done their job, another group of cells called osteoblasts rebuild the bone by taking in calcium and phosphate ions from the blood and depositing them in the form of calcium phosphate on the collagen fibres. Between 10% and 30% of the human skeleton can be replaced by bone remodelling in a year.

The process of our bones being broken down and reabsorbed by our body will go on for the rest of our lives, ideally with an adequate supply of calcium our osteoblasts will continue to rebuild our bones, keeping our bone mass constant. They key factors which influence how bones are rebuilt are

1) Exposure to sunlight, which causes the skin to produce vitamin D (Vitamin D helps in the absorption of calcium).
2) Hormonal secretions.
3) Exercise/environmental stresses or lack of exercise/environmental stresses.

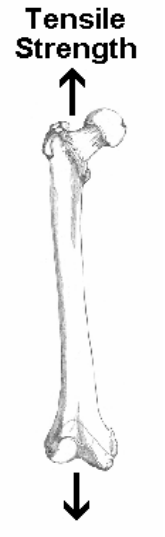
Building strong bones is no different to building strong muscles, you need to find a training stimulus/environmental stress that is greater than the bone/muscle is accustomed to, then with adequate nutrition and rest, your bones/muscles will rebuild themselves stronger and better equipped to cope with the stresses that are placed upon them. Osteoblasts will deposit calcium phosphate in proportion to the stresses that are placed on the bones (providing there is a sufficient dietary intake of calcium), this means that the greater the stress the greater the bone density, while minimal stress will result in minimal bone density and possibly brittle bones.

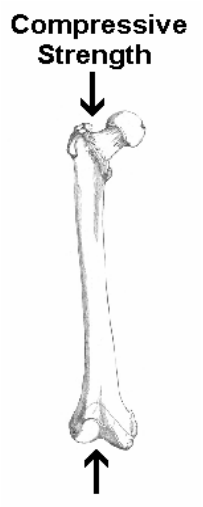
The effect of exercise on bone density is most evident in athletic kids who participate in sports that cause the highest levels of ground reaction or impact forces like gymnastics and weight lifting, and less pronounced in low impact sports like swimming. Weight lifting is interesting because it's not always the ground reaction force that creates the increase in bone density, but simply the force applied where the muscle attaches to the bone and pulls on it during the lift. For instance, if you do lots of lifting with your biceps, which does not involve impact on the ground, the bone density in your arm may show some increase. An example of this is a professional tennis player's dominant arm (the arm they play with). Typically the dominant arm has bones that are larger than the non-dominant one because the athlete swings a racket with it all the time and so there is a training effect.
(R. Weil).

Bone versus Concrete

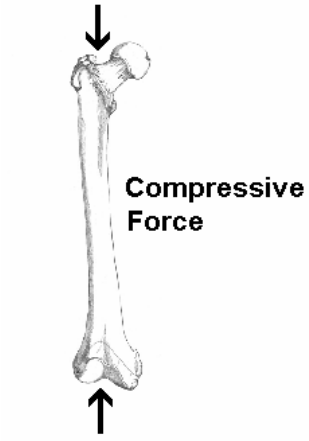


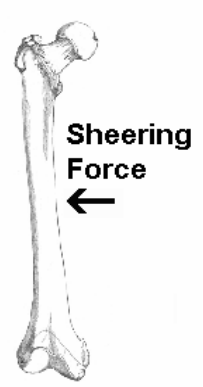
The structure of bone is simular to that of reinforced concrete, in bone it’s the collagen fibres that reinforces bone to give bone its tensile strength, while the calcium and phosphorus deposits give bones their compressive strength. In concrete it’s the steel mesh that reinforces concrete to give concrete its tensile strength, while the stones, sand and cement give concrete its compressive strength. Although bone is lighter and has less mass than concrete, healthy bone has a greater compressive strength than reinforced concrete.





Breaking slabs of wood, slabs of concrete, baseball bats, rocks, bricks etc, places an incredible amount of impact forces (generally compressive forces or sheering forces, depending on the strikes used) on the bones of the striking limb and depending on the strikes used, the bones that directly support the striking limb. These impact forces are the best catalyst for increasing bone density.





We know that healthy bone already has a greater compressive strength than reinforced concrete and when coupled with years of repetitious heavy impact striking, the end results are super human bones that are capable of breaking what would seem to be impossible.
This same phenomenon of increased bone mass to assist in striking also occurs in Muay Thai fighters, traditional Muay Thai fighters from an early age shin kick palm trees and hard dense punching bags to build up the bone density in their lower leg (the tibia & fibula), this allows them to

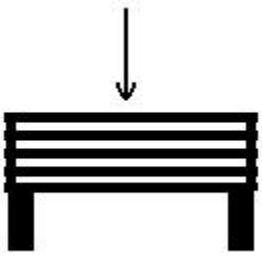
1) Check/block round kicks that have the potential power out put to break a wooden baseball bat in half.
2) Throw round kicks that can smash their way through wooden baseball bats.

Skin and Calluses

Skin like muscles, bones etc has its own unique way of coping with the stresses that are placed upon it. Whenever there is repeated friction or pressure placed upon the surface area of your skin, your skin adapts by producing thickened areas of skin called calluses. In breaking (and repeated striking), calluses form to protect the skin from splitting/tearing on impact.
Although calluses form to protect the skin from splitting/tearing on impact, they don't protect the striking limb from the sharp edges and splinters produced from breaking brittle structures like concrete, bricks, roof tiles and rocks which tend to shatter on impact (unlike wood) and produce sharp edges and splinters that can slice through skin and/or penetrate bone, this is why you see martial artists place a piece of folded cloth over the point of impact to assist in protecting the striking limb as it penetrates and passes through these types of brittle structures.

Angles and Alignment

For a successful break, the angle at which the strike meets the target should be as close as possible to being perpendicular or 90-degrees to the target; this will allow for maximal penetration and minimize the possibility of the strike deviating from its intended path on impact.



The striking limb must also be perfectly aligned so that the main support structures of the striking limb (the bones) makes contact with the target at their intended angle, otherwise the striking limb can rotate on impact which in turn can cause injury to the striking limb and depending on the strike used, the joints that surround the striking limb.

Conclusion

Training your body to break slabs of wood, slabs of concrete, baseball bats, rocks, bricks etc is no different to training your body to lift heavy weights or run a marathon, you need to find a stress/training stimulus that is greater than your body is accustomed to, then apply the stress/training stimulus through a periodized training plan. With adequate overload, rest and nutrition, your body will adapt to better cope with the stresses that are placed upon it.

References

Richard Weil
http://www.medicinenet.com
Which exercises are best for people with osteoporosis?