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“Gymnast Wrist”

When looking at the clay fractured hand I made, we can apply the science of bone growth and injury to understand what might have happened. I used clay because bone and clay might seem very different, but they share a very important similarity. Both clay and bone can crack when force is applied repeatedly, especially if they are still developing or not fully hardened. In young athletes, especially athletes like gymnasts and cheerleaders, this idea is seen clearly in a condition called “gymnast wrist” or scientifically known as Distal Radial Physeal Stress Fracture. This is the type of fracture that comes from repeated stress on the growth plate of the distal radius. By understanding “gymnast wrist,” we can also identify why the clay piece I created might show signs of stress and fracturing.

To start, it helps to understand the parts of a bone. Long bones such as the radius have three major regions, the epiphysis, the metaphysis, and the diaphysis. Between the epiphysis and metaphysis lies the physis, which is also known as the growth plate. The growth plate is the part of the bone that produces new bone tissue as a child grows and develops. Since the growth plate is made of softer cartilage instead of hard mineralized bone, it is the most vulnerable part of the bone in young athletes.

To understand even more clearly why the physis is vulnerable, it helps to understand how bones develop. This process is known as endochondral ossification. During childhood, the

skeleton is made mostly of cartilage that slowly turns into bone. New cartilage cells, chondrocytes, are produced in the growth plate, then line up in columns, mature, and eventually die as minerals deposit around them. Blood vessels then move into this area bringing osteoblasts, bone forming cells, that replace the calcified cartilage with bone tissue. This process repeats continuously until the end of puberty. Because the physis is always active and full of rapidly changing cells, it is structurally weaker than mature bone. Repetitive stress and loading, like the constant wrist compression in gymnastics, disrupt this cycle leading to widened growth plates, microscopic cartilage breakdown, and slowed bone elongation. Just like my fractured clay hand when it was still wet, the physis bends and deforms more easily because it simply has not finished its "hardening" stage.

The article *Wrist Pain, Distal Physeal Injury, and Ulnar Varience in the Young Gymnast,* describes how young gymnasts regularly place extremely high stress on their wrists, which sometimes is twice their body weight during movements like handstands (Difiori et al., 2006). Because most young athletes train before reaching skeletal maturity, their wrist growth plates bear the weight of this training. Over time, the distal radial physis develops stress changes such as widening, cystic changes, and irregularity, which indicate the area is being overloaded. These early changes represent a physeal stress reaction, which is basically the beginning of a small internal crack in the wrist.

This can be compared to the clay piece I created. I bent, pressed, and stressed the clay while it was still soft to form the shape of bones. When I tried to remold the clay that was slightly dry but not fully dried, cracks began to form. The clay couldn't handle the applied force I was putting onto it before it was fully hardened. The growth plate of a young athlete, or more

specifically a gymnast, behaves in the same way. When repetitive stress outpaces the rate of repair, damage starts to build up, which eventually leads to pain, slowed bone growth, or even changes in bone shape.

The second article, *Overuse Injuries and Burnout in Youth Sports: A Position Statement from the American Medical Society for Sports Medicine,* explains more broadly that these kinds of problems occur because young athletes often face overuse injuries, which is a result of repetitive loading without the proper amount of rest for healing (DiFiori et al., 2014). During growth spurts, the physis is especially vulnerable because the cartilage is weaker and the bone is changing rapidly. The article points out that high training, early specialization, and intense repetitive movements increase the risk for physeal stress injuries such as gymnast wrist.

Putting it all together and in conclusion, the fractured clay piece can be explained using the scientific understanding of bone anatomy, bone growth, and the stages of bone repair. “Gymnast wrist” shows exactly how repeated stress leads to cracks and deformity in the wrist. Just as soft clay can’t handle force before it has fully hardened, a young athlete's wrist can’t handle excessive load without causing injury or a fracture.

Citations

- DiFiori, J. P., Benjamin, H. J., Brenner, J., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2014). Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *Clinical Journal of Sport Medicine*, *24*(1), 3-20.
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