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Olecranon Enthesophytes Growth Rates: A Case Study

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Abstract Many older citizens are besieged with chronic ailments that are associated with becoming older. Activities conducted as a young adult can play a significant role in your condition, later in life. Olecranon enthesophytes (bone spurs) of the elbow are one of those chronic health issue that can be quite debilitating and we really have no idea how long it takes the condition to develop. This is a case study that involves dating an olecranon posterior enthesophyte (bone spur) to determine the growth rate and associated behaviors that were more likely than not, responsible for the condition. A growth rate of .11mm per month was determined as a starting point for investigating causes for enthesophyte development. With organized fitness becoming more and more a part of everyday life, understanding growth rates of enthesophytes can allow for earlier detection. Most enthesophytes are asymptomatic; until they become major alignments. Policy makers, coaches, school athletic coordinators, the military and parents can make informed decisions about participating in risk associated behaviors. Health education that focuses on prevention in our younger children and adults as they become more and more athletically oriented and susceptible to sustaining injuries, may avoid later chronic ailments.

Keywords Enthesophytes, Bone Spurs, Olecranon Bone Spurs, Growth Rate of Bone Spurs

1. Introduction

Visit any gym today and you can see workouts that rival professional athletes' programs. These gym warriors are not in training for the Olympics or aspiring for a "tryout" in the professional arena but the intensity of the workout is as strenuous. The damage that may be occurring to the elbows during these workouts could devastate this generation of fitness enthusiast beyond anything we are seeing in older adults today [1]. The aging process is, at best, difficult. The joints of the body seem particularly susceptible to "wear and tear". Aging has long been associated with osteoarthritic and other joint aliments; however, while aging is associated with this deterioration, it is not always the cause. Current sports medicine research, as stated by Buckwalter [2], indicates that, "Participation in sports increases the risk of joint injuries that can lead to posttraumatic osteoarthritis, a clinical syndrome caused by trauma-initiated joint degeneration that results in permanent and often progressive joint pain and dysfunction" [2]. In addition to osteoarthritis, this initial trauma can also lead to enthesophytes or osteophytes (bone spurs) in and around the affected joint [3].

The elbow is a particular vulnerable area. Injuries to the elbow can be very painful and slowly can develop from an acute injury to a chronic debilitating condition. Ankles and knees are usually the first consideration in longitudinal studies, if for no other reason than they limit your mobility. Later damage has long been studied in these areas. An acute injury of these limbs often is accompanied by a visit to the emergency room. Frequently, we can remember those incidents. Osteoarthritis, with no history of trauma or any kind of infectious osteoarthritis, in the ankle is rare [4]. Even the official position of the American Othopaedic Foot & Ankle Society, states "the first and foremost cause of ankle arthritis is previous trauma. Approximately 80% of arthritis of the ankle occurs secondary to such conditions. In all, it is rare to see idiopathic (cause unknown) or primary osteoarthritis of the ankle" [5]. Substantial research is also being conducted on knee injuries and later medical issues. Dr. Mininder Kocher, of Harvard Medical School, in a soon to be released paper, indicates that in excess of 50% of young athletes, who have ACL injuries, develop arthritis within 14 years from the date of the injury [6]. In contrast, you do not have to be involved in any athletics or physical training for an elbow injury to occur because this injury can be experienced with just participation in everyday life.

2. Developing a Model

Predicting possible damage, to areas of the body, will become as important as many internal maladies. Most elbow injuries have been associated with over hand throwing motion, tennis, golf or overuse that leads to an

acute condition [7]. Even dart throwers have a syndrome; Dart Throwers' Elbow [8]. Olecranon enthesophytes (bone spurs) are a condition that happens long after the accompanying activity has ceased and is the body's way of responding to stress [9]. Enthesophytes are abnormal bony projections at the attachment of a tendon or ligament. They are not to be confused with osteophytes, which are abnormal bony projections in joint spaces. Enthesophytes and osteophytes are bone responses for stress [10]. At times, this is confusing in the literature as the terms are sometimes used incorrectly; while the conditions are similar, they are not the same.

Injuries to the biceps and triceps tendons about the elbow are relatively frequent. Typically, they are traumatic events that occur as a result of a forceful eccentric contraction. Olecranon traction bone spurs are enthesophytes that develop at the distal triceps tendon, at the point of insertion into the olecranon process. They are thought to arise as a result of mechanical loading (ie, repetitive traction stress) and have been found to grow by a unique combination of endochondral, intramembranous, and ossification. An olecranon traction enthesophyte may be a source of substantial elbow pain, alone or in combination with triceps tendinopathy and olecranon bursitis. Many patients with a bony spur at the olecranon process also exhibited olecranon bursitis [11] caused by the irritation of the enthesophyte on the triceps tendon much like a pebble in your shoe [12]. As long as the olecranon traction enthesophyte remains, the condition will continue. The pain associated with the condition will also be static as the Olecranon spur rubs the triceps tendon whenever the elbow is moved. Early recognition of these injuries and prompt intervention are the cornerstones to a successful outcome. George S. Athwal, MD and Jay D. Keener, MD, [13] came to similar conclusions in finding that "Bone spurs are often found on the tip of the elbow bone in patients who have had repeated instances of elbow bursitis".

The prognosis is not optimistic as there are few reports of surgical treatment to address a painful enthesophyte at this site, and there is sparse outcome data [14]. The purpose of this investigation is to propose a growth rate for olecranon traction enthesophytes through a case study, proposing a standard growth rate model for early detection and possible prevention.

3. Materials and Methods

The subject of the case investigation is a Caucasian 65-year-old male that has had a physically stressful career (U.S. military for 20 years) as well as a less physically stressful occupation (20 years public school teacher and administrator). At 65 in 2017, he sought treatment for a swollen and painful left elbow. After examination by an orthopedic physician he was diagnosed with "obvious olecranon bursitis". AP and lateral views of his elbow showed a very large enthesophyte off the posterior olecranon. He had limited motion and ability to extend his arm. He also reported numbness in his ring and little fingers of his left hand. There was no reported specific activity, within the past few years, that might have been the cause but it had progressively gotten worse over the course of the last 10 or 15 years.

Pathology of the Condition

Since there was no acknowledgement of a recent injury, the current state of the enthesophyte (bone spur) must be determined. The location of the enthesophyte is an indication of the kind of activity that would be associated with the body's need to "strengthen the bone" in this area. Posterior indicates that the enthesophyte is located at the Distal Triceps Tendon insertion of the Olecranon process. When the triceps are contracted, the forearm extends and the elbow straightens; if the triceps are relaxed and the biceps flexed, the forearm retracts and the elbow bends. This would indicate that either a continuous motion activity occurred or one that involved heavy loading at the extension position of the triceps was experienced to damage at the insertion.

Figure 1. Subjects' Left Elbow Lateral View

To investigate when an incident may have occurred, the total length of the enthesophyte must be examined. The base of the enthesophyte takes the longest to develop and for this reason the subject's spur appears more than a traction enthesophyte (Figure 1). The literature is relatively sparse in estimating enthesophytes growth rates. Most spurs are asymptomatic in the beginning. Even with an

acute injury to the elbow, medical authorities would not be able to say that an enthesophyte would develop later in life. Most people simply do not know they have a bone spur. In one case surgeons did remove an Olecranon Traction Enthesophyte from an individual that later participated in a follow up exam almost 7 years later. The spur had grown back to 10 mm [14]. This allows for calculating a rate of growth at .128 mm per month (10mm/78 months).

Figure 2. Cadaver Ulnar bone

Accurate measurement is difficult, however, applying a consistent methodology of calculating an enthesophyte length, allows for a more precise measurement [10]. Figure 2 demonstrates an accurate measure of a Cadaver Ulnar bone with an enthesophyte [10]. Examining the subject's most recent X-rays (Figure 1) the length of the enthesophyte is measured to be approximately 35mm. Using the previous studies enthesophyte growth rate [14], and calculating an approximate timeline, a search was conducted for injuries that would be consistent with the development of the Olecranon Traction Enthesophyte. The timeline would be in excess of 23 years. It is accepted that growth rates are subject to many variables. The age of the patient at the time of the injury, diet, and individual internal response to growing extra bone are just a few unmeasurable variables.

It is important, in developing a growth model to attempt to match current medical conditions with historical medical complaints. Backward mapping may not be as effective as a longitudinal study; however, it can provide an accurate assumption for a logically certain conclusion. In a review of the subject's medical history, one event date emerges; medical treatment was sought in September 1986 and resulted in a diagnosis of Ulnar Compression Syndrome. Ulnar nerve compression at the elbow is also called "cubital tunnel syndrome". Ulnar nerve compression is the second most common nerve entrapment of the upper extremity after carpal tunnel syndrome [15]. As the Ulnar nerve runs the entire length of the arm, there are several places along the nerve that can become compressed or irritated. This compression or irritation is known as Ulnar nerve entrapment. The ulnar nerve is particularly susceptible to compression at the elbow because it must traverse through a tight space with very little soft tissue to protect it. The compression that occurs, is the single most common cause of Ulnar nerve entrapment. The syndrome may be a result of any of the following [16]:

- an activity that causes a person to bend and straighten the elbow joint repeatedly
- leaning on the elbow for an extended period
- the Ulnar nerve slipping out of place when the elbow is bent
- fluid buildup in the elbow
- current or previous injury to the inside of the elbow
- bone spurs in the elbow
- arthritis in the elbow or wrist
- swelling in the elbow or wrist joint

This is consistent with the record entry of the subject. Approximately at the same time, an additional record entry describes a treatment plan, however, this deviated from normal conservative treatment methods. Treatment for ulnar nerve entrapment depends on how severe the entrapment is. For less severe cases, a doctor will probably recommend nonsurgical treatment options first. These may include some combination of the following [16]:

- use of anti-inflammatory medications to reduce swelling
- elbow braces or splints to keep the joint straight at night
- exercises and physical therapy to help the nerve slide through the arm correctly

The treatment given to the subject was:

- Take Aspirin x 5 days
- Ice 15 minutes before bed
- Take a jacuzzi.
- Limit use as much as practicable for 1 week.
- See neuro consultant

This does not appear to match the accepted treatment for Ulnar Compression Syndrome; however, it does match the accepted treatment for a triceps injury at the elbow. A triceps tendon injury is a problem with the tendon that connects the muscle at the back of your upper arm to the bony bump at the back of your elbow. Tendons are strong bands of tissue that attach muscle to bone. You use this tendon to straighten your arm after you bend it. Tendons can be injured suddenly or they may be slowly damaged over time. You can have tiny or partial tears in your tendon or a complete tear (called a rupture). Other tendon injuries may be called a strain, tendinosis, or tendinitis.

The activity which led the subject to seek treatment was

reported as an extensive physical training regimen and "shoveling" over the weekend. The subject reports that a few days later he experienced "falling off" the pull up bar because he lost his grip. This is also consistent with Ulnar Compression Syndrome as a weakened grip is a symptom of the condition. While this was not called a specific trauma to the elbow, injury to the Ulnar nerve can be the acute injury masking the more specific triceps tendon trauma. There is no evidence that there was a rupture, however, there certainly is evidence of a strain. The repetitive motion that preceded the clinical visit was compressed into a day or two. While this is repetitive motion, the time factor would lend this more to a trauma than an over use situation. Figure 3 displays the Ulnar nerve [17]. It is not difficult to understand how both the nerve and the tendon can be affected by one kind of trauma.

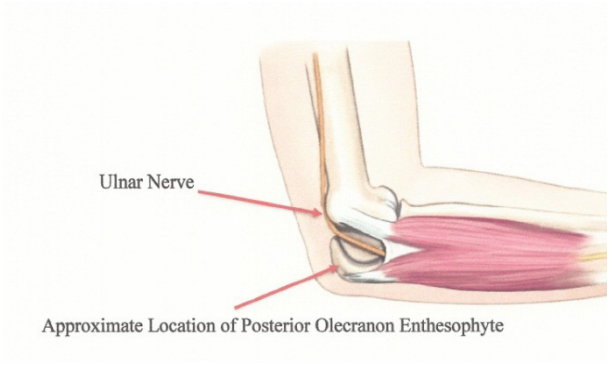

Figure 3. Ulnar Nerve

This is not a unique situation. Labors who were required to use specific tools or do actions repeatedly for extended periods of time were reported more at risk of ulnar entrapment and trauma to the elbow, that later developed enthesophytes. These two predisposing factors lead to the eventual scenario of double-crush injury of the ulnar nerve [18].

Medical research clearly links Ulnar Compression Syndrome to elbow trauma. The trauma could be repetitive use or acute action such as a tendon tear or strain. Both of these actions also cause Olecranon posterior enthesophytes. As bone spurs follow a slow growth process, this would not have been apparent when medical care was rendered to the subject. Research supports a growth rate that is consistent with the injury in 1986 and supports the pathology of the subject's current condition, developing a new growth rate.

4. Discussion

Based on the behaviors of the subject at the time of the injury, enthesophyte's length, medical and scientific evidence, it is reasonable to deduce that the activity that started the Olecranon Enthesophyte to development was more likely than not, when the subject was diagnosed with Ulnar Compression Syndrome in 1986 while in the military. Updating the calculation for Olecranon enthesophytes' (bone spurs) growth rate we can conclude a growth rate of .11 mm per month (length in mm/number of months from injury). Again, as previously mentioned, there are many variables not considered that may be associated with enthesophyte growth.

Since Enthesophytes (Bone Spurs) usually continue to grow slowly over time, the condition can be asymptomatic for many years. Even after 10 years, a typical Olecranon Enthesophyte would only be approximately 13 mm. At this length, there still would be no likely reaction. As the spur continues to grow, the difficulty in treating the condition becomes more complicated. While there has been success at surgically removing the enthesophytes, not enough research exists to conclude that the risk versus benefits factor is acceptable. Predicting the potential length of an enthesophyte can assist in early diagnoses.

The enthesophyte, in this case, has caused limits in motion, pain and chronic bursitis. As long as the enthesophyte is present, Olecranon bursitis will also be present, a frequent cause of pain at the posterior elbow. The bursitis is associated with a soft tissue swelling caused by the Enthesophyte (bone spur) at the olecranon [19]. Had it been discovered earlier; a less risky treatment plan may have been available.

5. Conclusions

As we see from the investigation of this subject, an Olecranon Enthesophyte can take 30 years to develop to a debilitating condition. Using this case study, along with the subject, in [14] Hasham, Kalainov, Biswas, Soneru, and Cohen, a growth rate can be calculated. With a working growth rate model, programs can de designed to periodically monitor potential enthesophyte growth. Additionally, other conditions that cause acute injury, such as Ulnar Compression Syndrome, can be an early warning signal for closer monitoring. To expand the accuracy of the growth rate model, future studies could include conducting cross-sectional descriptive or cohort studies to examine the relationships between enthesophyte development and previous injuries with a larger more diverse population.

There is an abundance of "medical and scientific" peer reviewed research that links Ulnar Compression conditions, Olecranon Traction Enthesophyte and Olecranon Bursitis together. There simply is not any research that disputes this connection. Understanding the elbow anatomy and the location of an Olecranon Traction Enthesophyte leads to the conclusion that in normal activities, damage can occur without an accompanying serious acute injury.

Individuals with high risk occupation (athletes, construction workers, repetitive motion laborers and the military) should receive information on enthesophyte development. In light of the activities in today's society, the list should be expanded to include anyone who includes

full extension exercises as part of their workout regimen. Bench pressing, pushups and pullups are all potential activities that should be monitored, especially in younger children. Virtual any exercises that cause extreme loading of the triceps while the elbow is fully extended should be avoided or at the very least strictly supervised.

Prevention would seem to be a better option than trying to eradicate an enthesophyte that has had 30 years to integrate within the distal triceps tendon insertion. Policy makers, coaches, school athletic coordinators, the military and parents can make informed decisions about participation, focusing on prevention in our younger children and adults as they become more and more athletically oriented and susceptible to sustaining injuries that later become chronic ailments.

While medical care and surgical techniques are becoming more refined with less and less recovery time, the costs continue to climb making health care less affordable for many. Prevention is a solution that can be much less invasive and a lot less in cost. Knowing the possible causes of Olecranon Enthesophyte and the time it takes for the condition to become chronic can make for a safer and heathier population. Nothing in this article is meant to offer a diagnoses or treatment; only to offer a method of predicting possible conditions that result from a society trying to remain as fit as possible.

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