

The “BONE ANCHOR SIGN:” Sign of Failure of Bunion Surgery

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Technology has been a wonderful boon to the assumed conveniences of daily life and as practicing surgeons, we are inundated daily with the latest and greatest innovations for the practice of surgery. One such innovation has been the bone anchor or suture anchor. This device allows for the attachment of soft tissue to adjacent bone with limited invasiveness and ease of surgical effort. These devices come in a variety of sizes and designs that allow for application to a varied assortment of surgical procedures. This discussion identifies a particular application and will try to assess its usefulness in regard to hallux valgus surgery.

Hallux valgus is a complex multiplanar deformity of the first metatarsophalangeal (MTP) joint that may vary considerably in severity from patient to patient. Surgical management generally involves a combination of soft tissue procedural components as well as osteotomies.

Over the last few years a number of new products have been marketed to surgeons. One such device is the tight-rope product. The tight-rope is a minimally invasive attempt at performance of a sling-like procedure a la Joplin or Mauclair. These procedures attempt to bring or hold the first metatarsal closer to the second metatarsal. Like anything else in life, all is not without pitfalls. A high incidence of second metatarsal stress fractures have been noted associated with placement of the drill hole in the distal second metatarsal and subsequent postoperative weightbearing (1). Another not inexpensive surgical device that may be utilized is the bone anchor. Bone anchors have been used as an adjunct to soft tissue repairs, particularly of the medial capsule of the first metatarsal. The origin of this technique is attributed to John Gould and recommended in an effort to limit early loss of hallux valgus correction due to the soft tissue correction associated with capsulorrhaphy (2). Our present discussion involves the use of bone anchors in hallux valgus.

BONE ANCHORS

Bone anchors are devices that are implanted during the procedure that allow for secure attachment of soft tissue, tendon, ligament, or joint capsule. Bone anchors are available in metallic or bioabsorbable designs and come in a large variety of sizes that allow surgeons to use their imagination in how to utilize this surgical implant for a particular location and surgical procedure. Bone anchors are generally an adjunct to a surgical procedure and provide an expedient and efficient manner to achieve a repair.

Hospitals generally have a large stock of these devices on hand and as a result these devices are readily available for routine use. The anchor may be available with a variety of sutures, typically nonabsorbable.

HALLUX VALGUS

Hallux valgus is an extremely common foot pathology with an estimated greater prevalence estimated in females, with the frequency increasing with age. A 2010 systemic review and meta-analysis of 78 papers (76 surveys; US 37%, UK 28%, Australia 10%, Germany 5%) revealed pooled prevalence estimates of 23% in adults, ages 18-65 years (3). The female prevalence (26.3%) was more than three times that estimated for males (8.5%). Pooled prevalence estimates increased in the elderly, (patients ages >65 years) to 35.7% with female to male prevalence of 36% and 16%, respectively. Treatment is generally surgical in the symptomatic individual. Surgical management of hallux valgus is commonplace. A 2003 study estimated that 209,000 people undergo some type of bunionectomy in the US each year.

Procedural selection is generally based on radiographic and clinical criteria with consideration of age, rehabilitation potential and comorbidities. Most bunionectomies involve some type of osteotomy or fusion combined with capsule tendon balance procedures. It is this soft tissue release and repair or capsule tendon balance procedures wherein bone anchors are generally utilized or their utilization proposed. Generally during a bunionectomy, the first MTP joint capsule is dissected from at least the medial aspect of the first metatarsal head thus allowing resection of the medial “bump.”

Capsulorrhaphy includes the soft tissue correction obtained generally through capsulotomy (lenticular, inverted-L) and imbrication of the joint capsule during the capsular repair with the toe held in a straight and neutral position. Difficulties may be infrequently encountered in a patient with poor quality of the capsular tissues, making capsulorrhaphy ineffective. Generally there is very good capsular tissues in the majority of patients undergoing hallux valgus surgery although this may be influenced by the quality of the surgical dissection. Gould recommends “anchor-enhanced capsulorrhaphy” to minimize the early loss of hallux valgus correction in the immediate postoperative period (2). This discussion will illustrate their utilization on individual patients and then try and assess the efficacy of their use.

CASE 1

Patient 1 is a 69-year-old woman who presented with a symptomatic bunion deformity with history of prior surgery (Figure 1). Clinically, she exhibited quite a severe bunion deformity with abduction of the great toe. The second toe was medially deviated and overlapping the hallux. Clinically, a dorsal medial bunion prominence was apparent despite her history of previous bunion surgery. Radiographs illustrated resection of the medial eminence with significant abduction of great toe and hallux adductus angle of 50° . The intermetatarsal angle measured 20° . The second toe showed dorsal and medial subluxation of the second MTP joint. Two metallic bone anchors were noted along the medial eminence first metatarsal head. Radiographs did not illustrate any apparent osteotomy performed during the prior bunionectomy. Her hindfoot architecture, clinically and radiographically were essentially normal with good range of motion and no pain or crepitus on motion.

CASE 2

Patient 2 is a 29-year-old woman who presented with a symptomatic left foot associated with bunion surgery that had been performed 2 years prior (Figure 2). The patient reported discomfort along the medial aspect of the first MTP joint with palpable subcutaneous hardware. Clinically, she showed relatively good correction of the bunion deformity although symptoms were associated with shoe irritation of the hardware and overlying skin. Radiographs showed prior

bunion surgery with distal osteotomy. Good position of the great toe was noted with consolidation of osteotomy. A Chevron-type osteotomy was performed with a bone anchor and Kirschner wire (K-wire) placed along the overhanging ledge of the most medial aspect of the first metatarsal shaft. The K-wire was placed from medial to lateral across the



Figure 1A. Preoperative clinical view of Case 1 showing a significant bunion deformity although postoperative prior bunion surgery. The patient felt the deformity progressively worsened postoperatively.



Figure 1B. Preoperative radiograph of Case 1. Note the 2 bone anchors within the medial aspect of the first metatarsal head and significant hallux abductus deformity.



Figure 2. Radiograph of patient in Case 2 illustrating Chevron bunionectomy with use of “anchor enhanced capsulorrhaphy.” The patient reported symptoms associated with prominent hardware. Correction of deformity was adequate.

osteotomy and buried subcutaneously, with the wire buried in an area of likely irritation. Interestingly a similar technical error was observed with a separate procedure involving the fifth metatarsal. She possessed a good range motion of the first MTP joint with no pain or crepitus on range motion and was satisfied with the correction obtained but had difficulty wearing shoes due to medial irritation of the subcutaneous hardware.

CASE 3

Patient 3 is a 76-year-old woman who presented with reports of a painful right foot associated with recurrent foot deformities. She had a history of prior foot surgery by a university foot surgeon and described that her foot was in worse condition than prior to surgery (Figure 3). Her radiographs show prior bunionectomy with retained metallic fixation, 2 screws within the proximal first metatarsal (associated, I assume with proximal osteotomy although no apparent correction could be perceived) as well as a bone anchor placed within the medial portion of the distal first metatarsal just proximal to the anatomic neck region. Radiographs showed an intermetatarsal angle that measured 16° with a hallux abductus angle of 50° . A degree of adduction of the lesser toes were noted most notably the second and third with an oblique fracture within the distal half of the second toe proximal phalanx. Flexion of the second and third toes was also apparent.



Figure 4A. Anteroposterior radiograph of Case 4 showing a more dorsal and distal placement of the bone anchor presumably utilized during the hallux valgus repair. Note the loss of first MTP joint space and varus deformity.

CASE 4

Patient 4 is a 73-year-old woman who presented with a symptomatic left foot. She presented with tenderness at the level of the first MTP joint and a history of prior surgery, (Figure 4). Clinically, adduction contractures of the hallux, second, and third toes was apparent. The patient showed a diminished range of motion of the first MTP joint, as well as tenderness on range of motion. Radiographically, there was evidence of an opening proximal first metatarsal osteotomy with plate fixation. Adduction of the hallux was apparent with a long great toe. A metallic bone anchor was noted within the distal and dorsal first metatarsal head.



Figure 3. Anteroposterior radiograph of Case 3 showing a recurrent bunion deformity despite the use of “anchor enhanced capsulorrhaphy” combined with proximal first metatarsal osteotomy.



Figure 4B. Lateral radiograph of Case 4 at presentation.

CASE 5

Patient 5 is a 54-year-old woman who presented with a symptomatic left foot with a history of multiple prior surgeries. The patient had a prior cheilectomy as well as subsequent membrane arthroplasty performed by a university orthopedic foot and ankle surgeon. She has experienced continued pain and difficulty with daily activities. Radiographs show evidence of prior surgery with the shortened left great toe (Figure 5). There has been resection arthroplasty of the great toe proximal phalangeal base with several metallic bone anchors within the substance of the first metatarsal head. Clinically, she showed limited range motion and tenderness on range of motion although no acute joint inflammation or swelling was present.

CASE OBSERVATIONS

Bone anchors are a well-accepted and commonly practiced method for reattachment of soft tissue to a particular area of bone. The utilization of a bone anchor as an adjunctive device for hallux valgus repair will be reviewed. Case 1 involves placement of 2 bone anchors as an adjunct to the medial capsular repair of a bunionectomy. The surgeon chooses not to perform an osteotomy despite an apparent significant deformity. There is obvious failure to obtain any sort of correction of the bunion deformity. Obviously, the bone anchor is not necessarily the reason for failure but perhaps the surgeon believed that use of the bone anchor might provide some type of soft tissue correction although it was not achieved.

Case 2 actually showed adequate correction of the bunion deformity with a combination of osteotomy and soft tissue repair. A bone anchor was utilized presumably to augment the soft tissue repair. The osteotomy was fixated with a K-wire buried along the medial aspect of the overhanging ledge of the capital osteotomy. Subsequent surgery was required to remove both the metallic bone anchor as well as the buried K-wire acknowledging that the latter most likely contributed to her presenting symptoms and need for additional surgery. Generally, the bone anchor may provide a method for placing the capsular tissues under a degree of tension to affect the soft tissue repair.

Case 3 involves another case of hallux valgus repair. This patient did undergo a proximal osteotomy but no meaningful reduction of the intermetatarsal angle can be demonstrated. The metatarsal head was “staked” and there is a very high hallux abductus angle. Soft tissue repair of the first MTP joint certainly is inadequate and the procedure as a whole is a complete failure.

Case 4 demonstrates another example of a proximal first metatarsal osteotomy this time with good reduction of the intermetatarsal angle. The radiographs illustrate



Figure 5A. Anteroposterior radiograph of Case 5, revealing the use of four bone anchors for securing placement of a soft tissue membrane arthroplasty.



Figure 5B. Lateral view of Case 5.

overcorrection resulting in a hallux varus deformity. Narrowing of the joint space is observed with degenerative changes. A bone anchor is observed, placed in a dorsal position in the first metatarsal head. The position of the bone anchor cannot be explained. The procedure is a failure although the failure cannot be attributed to the bone anchor.

Case 5 is an example of utilization of the bone anchor to secure extrinsic tissue as a membrane or interpositional arthroplasty. Four bone anchors were utilized, as well as a synthetic material. The arthroplasty did not provide the patient with relief. The patient continued to have a painful, stiff, and shortened toe with no toe purchase. This procedure also must be classified as a failure because the patient required subsequent surgery. These cases illustrate complications of the surgical procedure and poor to mediocre outcome in each instance of utilization.

DISCUSSION

Hallux valgus is a common surgical pathology. Surgery is generally successful with limited complications. Complications associated with orthopedic hardware include loosening and subcutaneous irritation. Careful placement will often negate these problems. Some surgeons may find benefit from the use of metallic bone anchors as an adjunct to medial capsular repair during the performance of hallux valgus and first MTP joint surgeries. Gould recommended the use of a bone anchor based on his 2003 study of osteotomy bunionectomies, which showed a variance in loss of correction in the hallux abductus angle of 2.8° with use of a bone anchor versus 4.6° without use of an anchor (2). Generally, utilization of these devices is not considered necessary. Most capsular repairs are performed with the toe held in a straight and neutral position while the repairs are being accomplished. In the case of large deformities and excessive medial joint capsule, excisional type capsulotomies may be performed with capsulorrhaphy that reduces and maintains correction. With more than 30 years of active surgical practice, this author has found little need to consider use of a bone anchor at the first MTP joint. Case 5 showed utilization associated with hallux rigidus surgery, an interpositional arthroplasty and placement of synthetic tissue was attempted. Multiple bone anchors were inserted in effort to maintain position of the implanted dermal substitute.

Hallux valgus surgery is commonplace and certainly requires a certain expense for materials utilized during its performance, i.e., suture material, bone fixation implants, intraoperative radiographic imaging, and the surgical facility as well as anesthesia costs. Most surgeons have some sort of financial responsibility to maintain costs of their surgery. Dr. Malay wrote “What busy surgeons need to know is how their choices of procedure, instrumentation, and implantable materials incrementally influence the cost of a

case and how the cost relates to their patients’ subjective and objective outcomes” (4).

We all wish to achieve good outcomes with our surgery without incurring unnecessary expenses. There is little to no literature supporting the use of or need for utilization of a bone anchor with routine hallux valgus surgery. In a 2012 cost-effectiveness study of biceps tendon repair with bone anchors, the authors found no reduction in operative time saved with the use of bone anchors versus standard transosseous repair (5). Obviously in the case of hallux valgus repair, a need for the use of a bone anchor has not been verified.

These cases illustrate a complication or failure of the surgical procedure in each instance of utilization. The implant itself does not appear directly responsible for most complications but certainly does not appear to contribute to a successful outcome.

In conclusion, hallux valgus repair generally involves capsulotomy with subsequent capsulorrhaphy of the first MTP joint. Rarely would most surgeons consider utilization of one or more bone anchors. Hallux valgus surgery is quite predictable without the additional expense of an adjunctive implant. Good surgical technique with soft tissue dissection and subsequent repair generally are more than adequate.

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