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Autologous Tenocyte Implantation (ATI) and the Use of Collagen Scaffolds: a Case Report of a Novel Surgical Treatment for Gluteal Tendon Repair

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ABSTRACT

Background: Ortho-biological therapies such as platelet-rich plasma and autologous tenocyte implantation injections are hypothesized to introduce cellular mediators such as growth factors into tendons, promoting natural healing.

Methods: This case introduces a 63-year-old female with an extensive history of lateral hip pain and treatment refractory tendinopathy with tearing. She underwent open surgery to repair the gluteus medius tendon, using supplementary autologous tenocyte implantation (ATI) in conjunction with a Celgro (Orthocell, Perth, Australia) collagen scaffold.

Level of evidence: 4

Results: She had normal function in the hip at 12 months. MRI scans post-operatively at 12 months showed a marked reduction in inflammation, an intact tendon and a reduction in atrophic changes in the muscle belly.

Conclusion: Surgical repair of a large degenerate tear of the gluteus medius tendon, augmented with autologous tenocyte implantation in a collagen scaffold led to an excellent patient outcome and MRI findings demonstrated tendon healing with improved tendon structure and reduced inflammation.

Keywords: Lateral hip pain, gluteal tendinopathy, greater trochanteric pain syndrome, autologous tenocyte implantation, collagen scaffold.

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Background

Gluteal tendinopathy [GT] is a common cause of disability accounting for between 18% and 50% of all cases of lateral hip pain with prevalence highest amongst women aged over 40 years [1]. Up to 23.5% of women and 8.5% of men aged between 50 to 79 years are affected [2, 3]. It is considered the most prevalent of all lower limb tendinopathies [4]. GT has long been poorly diagnosed and poorly treated with no evidence-based protocol for management [1]. This case study illustrates a novel surgical treatment for gluteal tendon tendinopathy with tearing resistant to traditional conservative management.

Historically, lateral hip pain has been described as trochanteric bursitis, but radiological studies show bursitis is only present in less than 46% of cases [5]. In 1961, Gordon described that the cause of trochanteric bursitis was underlying gluteal tendinopathy [6]. Together these diagnoses are sometimes grouped under the umbrella term of greater trochanteric pain syndrome [GTPS] [2].

Gluteal tendinopathy is diagnosed clinically with the classical presentation of lateral hip pain and tenderness over the greater trochanter. Pain is often reproduceable with movement and may radiate down the lateral thigh [7]. Tendinopathy is thought to be multifactorial relating to both extrinsic and intrinsic forces. Extrinsic causes include an increase in physical load with repetitive activity a common aetiology but it can present in individuals without overuse [8]. Tendinopathy is more common in females which is thought to be due to intrinsic factors relating to pelvic biomechanics and increased adiposity [9]. The greater width of the female pelvis results in increased tension of the iliotibial band over the trochanter and increased compression of the gluteus medius tendon. The interaction of these forces results in cellular changes leading to degenerative tendinopathy described by Bhabra et al [10] as a cycle of microtrauma followed by poor healing leading to progressive tendinopathy and later to tears resulting from the structural failure of the tendon.

Radiological investigations have been used primarily in the acute setting to exclude bony or significant soft tissue injury requiring surgical intervention. Ultrasound and MRI are the predominant modalities used when investigating lateral hip pain however their value is frequently debated. The sensitivity of ultrasound to confirm GM tendinopathy has been reported as low as 61% [11]. It is often used first due to its convenience and low cost however there is significant variability based on operator experience and patient characteristics. MRI is increasingly used to assess gluteal tendinopathies. MRI can identify tendon thickening and oedema while excluding other causes of lateral hip pain [2]. It is however expensive and not readily available when compared with ultrasound.

Current management practices for gluteal tendinopathy can be categorized as conservative or surgical. Conservative approaches include non-steroidal anti-inflammatory drugs, physiotherapy including eccentric exercises routines and strategies to reduce tendon load, corticosteroid injections, extracorporeal shock wave therapy and foot orthoses [1]. Surgical interventions include gluteal tendon repair, iliotibial band release, trochanteric bursectomy and trochanteric reduction osteotomy [1].

Biological therapies such as platelet-rich plasma [PRP] injections which are hypothesized to introduce cellular mediators such as growth factors into the tendon, promoting natural healing have shown benefit in Grade II GT [12, 13]. Autologous tenocyte implantation [ATI] has also shown benefit in refractory gluteal tendinopathies [14]. This case introduces a 63-year-old female with an extensive history of lateral hip pain and treatment refractory tendinopathy who has gained significant improvements in her quality of life with the assistance of autologous tenocyte implantation [ATI] in conjunction with collagen scaffold technology.

Methods:

This research has been conducted ethically according to international standards and as required by this journal [15].

Clinical history and background

After an extensive history of ongoing hip pain over a period spanning more than 15-years, a 63-year-old female underwent open surgery to repair the gluteus medius tendon, using supplementary autologous tenocyte implantation [ATI] in conjunction with a Celgro [Orthocell, Perth, Australia] collagen scaffold.

This 63-year-old woman had had right sided hip pain since 2002. She had a complex past medical history including recurrent pulmonary embolism, iron deficiency, psoriatic arthropathy, obstructive sleep apnea, inflammatory bowel disease, ischemic heart disease, sciatica, osteoarthritis and obesity. She had an extensive period of conservative intervention and rehabilitation from 2002 including physiotherapy of more than 12 years duration, multiple corticosteroid injections both blind and under ultrasound guidance, load modification and strength work. She had oral steroids as well as periods of use of non-steroidal anti-inflammatory drugs. She developed right hip osteoarthritis and had a right hip replacement and Iliotibial band release and bursectomy.

Between 2012 and 2016 she had multiple presentations for hip pain complicated by low back pain with imaging showing multi-level disc degeneration, spondylolisthesis, bony foraminal stenosis formation with neural compromise. Her back pain was successfully managed conservatively but the lateral hip pain persisted.

In 2016 she was referred for an MRI with protracted lateral hip pain. This was reported as showing a full thickness tear [rupture] of the gluteus medius from the insertion at the greater trochanter, a partial thickness tear of the gluteus minimus and muscle belly atrophic changes in the proximal musculature. Given the failure of conservative treatment including physiotherapy, load management, platelet rich plasma and corticosteroid injections, it was decided to proceed with tendon repair via open surgery. A decision to utilize a repair technique augmented by ATI and Celgro was made due to the atrophic and degenerative changes in the damaged tendon and the history of systemic inflammatory pathology. The CelGro collagen patch does not provide a structural graft, but rather, is a means to introduce living tenoctytes into the area of tendon-tendon, and tendon-bone healing, with the expectation that this will lead to better tendon healing, and improved long term outcome.

Results

Open surgery was performed in April 2017. A direct lateral approach was made to the proximal femur. The gluteus minimus tendon was seen to be intact and no surgery was performed on this tendon. The gluteus medius tendon was seen to be detached from the greater trochanter and was noted to be atrophic and moderately degenerate. The gluteus medius tendon was retracted and scarred and had to be mobilised to allow it to be repaired to its normal position on the greater trochanter. The muscle was noted to be apparently healthy and with no evidence of macroscopic fatty degeneration.

The greater trochanter cortical bone bed was prepared by partial decortication, to provide a bleeding bony surface. The gluteus medius tendon was anatomically repaired using a series of five trans-osseous, non-dissolving stitches, and a supplementary continuous dissolving stitch to approximate the torn tendon edges. A collagen patch [CelGro], acting as carrier and scaffold for cultured autologous tenocytes was then sutured over the repaired tendon: see Figure 1, Completed surgical repair. The side of the patch with the cultured cells was placed facing the repaired tendon. Additional cultured tenocytes in suspension were injected deep to the tendon in the space between tendon and bone.

The procedure was complicated by superficial wound inflammation which occurred one week later. Being superficial, this was thought to be due to a local reaction to the wound suture

material. As a precaution, the superficial wound was debrided but healed well. There were no organisms grown from the swab taken.

Outcomes and follow up

Over 12 weeks the pain settled, and this patient was progressed from toe touch weight bearing to partial weightbearing and then full weight-bearing as tolerated. She had extensive physiotherapy aimed at strengthening the hip girdle. Over 6 months her pain had settled and she was walking without a limp. She had normal function in the hip at 12 months. MRI scans had been done pre-operatively [see Figure 2 MRI hip 2016 pre-operative] and post-operatively at 12 months [see Figure 3 MRI hip 2018 post-operative] showing a marked reduction in inflammation, an intact tendon and a reduction in atrophic changes in the muscle belly.

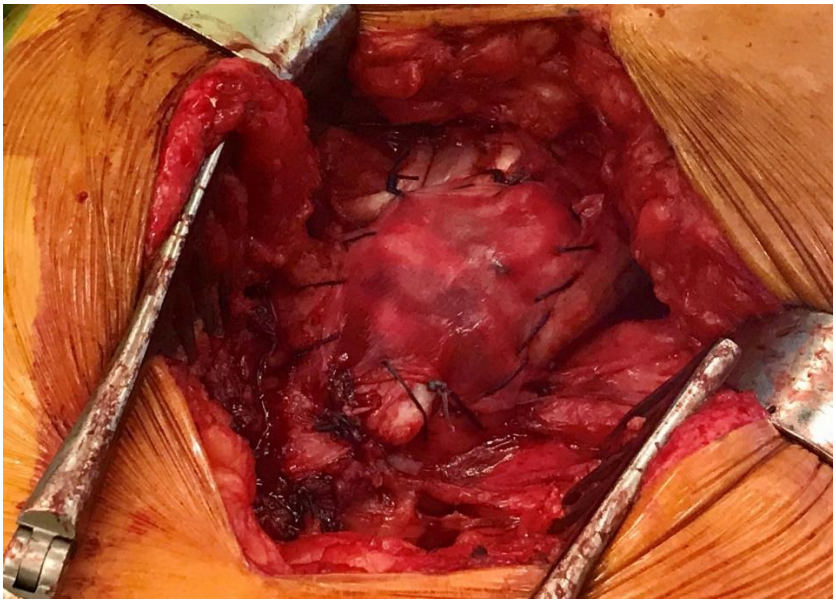

Figure 1. Completed surgical repair.

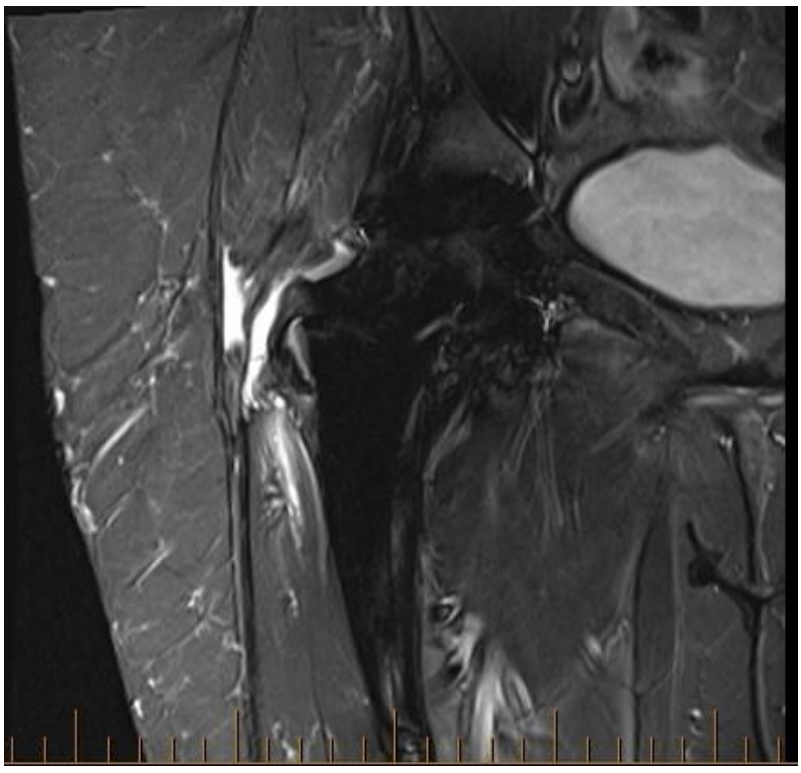

Figure 2 MRI hip 2016 pre-operative

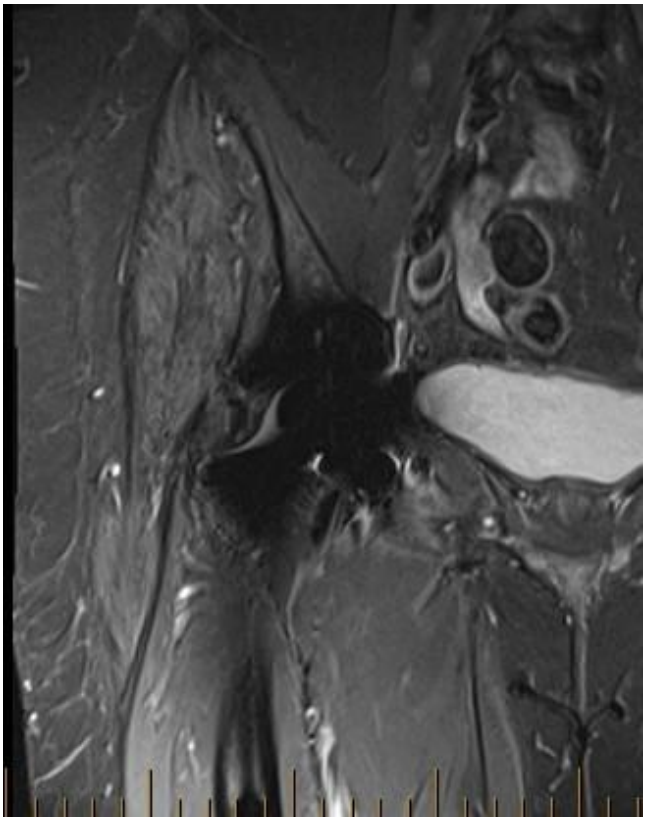

Figure 3 MRI hip 2018 post-operative

Discussion

Gluteal tendinopathy is a common cause of lateral hip pain and subsequent disability with no evidence-based protocol for management. While conservative methods have shown improvement in ninety percent of cases, the remining ten percent particularly with gluteal tendon tears represented by our patient, live a life of disability, frustration and social, emotional and financial hardship involving multiple doctor visits, numerous investigations and failed treatments.

Most gluteal tendon tears can be treated successfully by surgical repair with either open or arthroscopic techniques, however when more severe tendon damage is present results may be less predictable [16]. In these situations, traditional surgical treatment has involved either tendon augmentation [e.g. with vastus lateralis fascia], or muscle transfer such as a gluteus maximus [Whiteside transfer] [17]. ATI with a collagen scaffold was seen as a potential alternative biological solution, which aimed to restore a greatly improved native tendon.

Autologous tenocyte implantation [ATI] involves the harvesting of a small piece of healthy tendon from the patient's patella tendon. The cellular building block of tendons known as the tenocyte cells is isolated, grown in number over a period of 6-8 weeks and then implanted into the affected tissue. Animal studies have demonstrated ATI improves both the histological parameters such as tendon structure, reduced vascular hyperplasia and improved cellular morphology and biomechanical function with improved tensile strength due to improved arrangement of collagen fibers and improved collagen content [18]. This has been reproduced in human trials such as Bucher et al's prospective pilot study showing ATI in the treatment of chronic recalcitrant gluteal tendinopathy to be safe with improved and sustained clinical outcomes to 24 months [14]. This was demonstrated at a cellular level with improved local growth factor production in all cases and clinical improvement quantified by the Oxford Hip Score [OHS], with a statically significant improvement from baseline at six months.

ATI was used in conjunction with a bioderived collagen scaffold designed to facilitate and strengthen adhesion between the tendon and greater trochanter. Collagen based scaffolds for tissue support and regeneration have been used in numerous surgical and dental applications for many years. The technology used in this procedure was a resorbable acellular matrix designed to reduce the inflammatory response of the host while negating the need for removal surgery. The 3-dimensional type 1 collagen structure does not replace normal body structure but instead provides a porous structure with a high affinity for host cells promoting cellular migration, adhesion and proliferation of tissue and remodelling of tissue into mature tendon. While this device has been used to augment the repair of rotator cuff tendons, it has not been used in gluteal tendon repair previously.

Strengths and weaknesses

The strength of this study is that it represents a unique case [level 4 evidence] presenting a new technique for repair of gluteal tendons with augmentation. The weakness is that it is a single case and further research will need to be carried out to determine the efficacy in a larger population.

Conclusion

Surgical repair of a large degenerate tear of the gluteus medius tendon, augmented with autologous tenocyte implantation in a collagen scaffold led to an excellent patient outcome and MRI findings demonstrated tendon healing with improved tendon structure and reduced inflammation.

Ethics approval and consent to participate N/A

Consent for publication: The patient provided consent for publication

Availability of data and materials N/A

Competing interests JOD and JF have previously received funds from Orthocell for unrelated research studies. RF declares no conflict of interest.

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Abbreviations

ATI Autologous Tenocyte Injection

GT Gluteal Tendinopathy

GTPS Greater Trochanteric Pain Syndrome

GM Gluteus Medius

MRI Magnetic Resonance Image

PRP Platelet-Rich Plasma

References

[1]. Reid D. The management of greater trochanteric pain syndrome: A systematic literature review. Journal of orthopaedics. 2016;13[1]:15-28.

[2]. Grimaldi A, Mellor R, Hodges P, Bennell K, Wajswelner H, Vicenzino B. Gluteal Tendinopathy: A Review of Mechanisms, Assessment and Management. Sports medicine. 2015;45[8]:1107-19.

[3]. Fearon AM, Cook JL, Scarvell JM, Neeman T, Cormick W, Smith PN. Greater trochanteric pain syndrome negatively affects work, physical activity and quality of life: a case control study. The Journal of arthroplasty. 2014;29[2]:383-6.

[4]. Del Buono A, Papalia R, Khanduja V, Denaro V, Maffulli N. Management of the greater trochanteric pain syndrome: a systematic review. British medical bulletin. 2012;102:115-31.

[5]. Long SS, Surrey DE, Nazarian LN. Sonography of greater trochanteric pain syndrome and the rarity of primary bursitis. AJR American journal of roentgenology. 2013;201[5]:1083-6.

[6]. Gordon EJ. Trochanteric bursitis and tendinitis. Clinical orthopaedics. 1961;20:193-202.

[7]. Fearon AM, Scarvell JM, Neeman T, Cook JL, Cormick W, Smith PN. Greater trochanteric pain syndrome: defining the

clinical syndrome. British journal of sports medicine. 2013;47[10]:649-53.

[8]. Cook JL, Purdam CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. British journal of sports medicine. 2009;43[6]:409-16.

[9]. Fearon A, Stephens S, Cook J, Smith P, Neeman T, Cormick W, et al. The relationship of femoral neck shaft angle and adiposity to greater trochanteric pain syndrome in women. A case control morphology and anthropometric study. British journal of sports medicine. 2012;46[12]:888-92.

[10]. Bhabra G, Wang A, Ebert JR, Edwards P, Zheng M, Zheng MH. Lateral Elbow Tendinopathy: Development of a Pathophysiology-Based Treatment Algorithm. Orthopaedic journal of sports medicine. 2016;4[11]:2325967116670635.

[11]. Fearon AM, Scarvell JM, Cook JL, Smith PN. Does ultrasound correlate with surgical or histologic findings in greater trochanteric pain syndrome? A pilot study. Clinical orthopaedics and related research. 2010;468[7]:1838-44.

[12]. Fitzpatrick J, Bulsara MK, O'Donnell J, Zheng MH. Leucocyte-Rich Platelet-Rich Plasma Treatment of Gluteus Medius and Minimus Tendinopathy: A Double-Blind Randomized Controlled Trial With 2-Year Follow-up. The American journal of sports medicine. 2019;47[5]:1130-7.

[13]. Fitzpatrick J, Bulsara MK, O'Donnell J, McCrory PR, Zheng MH. The Effectiveness of Platelet-Rich Plasma Injections in Gluteal Tendinopathy: A Randomized, Double-Blind Controlled Trial Comparing a Single Platelet-Rich Plasma Injection With a Single Corticosteroid Injection. The American journal of sports medicine. 2018;46[4]:933-9.

[14]. Bucher TA, Ebert JR, Smith A, Breidahl W, Fallon M, Wang T, et al. Autologous Tenocyte Injection for the Treatment of Chronic Recalcitrant Gluteal Tendinopathy: A Prospective Pilot Study. Orthopaedic journal of sports medicine. 2017;5[2]:2325967116688866.

[15]. Padulo J, Oliva F, Frizziero A, Maffulli N. Muscles, Ligaments and Tendons Journal - Basic principles and recommendations in clinical and field Science Research: 2016 Update. Muscles Ligaments Tendons J. 2016;6[1]:1-5.

[16]. Davies JF, Stiehl JB, Davies JA, Geiger PB. Surgical treatment of hip abductor tendon tears. The Journal of bone and joint surgery American volume. 2013;95[15]:1420-5.

[17]. Whiteside LA. Surgical technique: Transfer of the anterior portion of the gluteus maximus muscle for abductor deficiency of the hip. Clinical orthopaedics and related research. 2012;470[2]:503-10.

[18]. Chen J, Yu Q, Wu B, Lin Z, Pavlos NJ, Xu J, et al. Autologous tenocyte therapy for experimental Achilles tendinopathy in a rabbit model. Tissue engineering Part A. 2011;17[15-16]:2037-48.