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CASE REPORT

Case Report: Neotendon regeneration and repair of gluteus tendon tear at 1-year follow-up after ultrasound guided platelet rich plasma tenotomy [version 1; peer review: 1 approved with reservations, 1 not approved]

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V1 First published: 19 Nov 2014, 3:284
<https://doi.org/10.12688/f1000research.5719.1>
 Latest published: 19 Nov 2014, 3:284
<https://doi.org/10.12688/f1000research.5719.1>

Abstract

Greater trochanteric pain syndrome (GTPS) is a common condition resulting in posterolateral hip pain typically in perimenopausal women. Gluteal tendinopathy is the underlying pathology and contributes to health care cost burden as a poorly managed tendon disorder. There is no established effective treatment for gluteal tendon pathology in GTPS. This article describes clinical, imaging and life style improvements after percutaneous tendon repair using autologous platelet rich plasma tenotomy under ultrasound imaging guidance in a case of GTPS. The improvements observed in this patient add to the call for urgent medical and economical need for more research on percutaneous tendon repair.

Keywords

GTPS, gluteal tendinopathy, tendon repair, tenotomy, ultrasound imaging

Open Peer Review

Approval Status ? X

	1	2
version 1	?	X
19 Nov 2014	view	view

1. **Nikolaos Gougoulis**, Frimley Park Hospital, Frimley, UK
2. **Jason K.F. Wong**, University of Manchester, Manchester, UK

Any reports and responses or comments on the article can be found at the end of the article.

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Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

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How to cite this article: Doss A. **Case Report: Neotendon regeneration and repair of gluteus tendon tear at 1-year follow-up after ultrasound guided platelet rich plasma tenotomy [version 1; peer review: 1 approved with reservations, 1 not approved]** F1000Research 2014, 3:284 <https://doi.org/10.12688/f1000research.5719.1>

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Introduction

Greater trochanteric pain syndrome (GTPS) is a common cause of posterolateral hip pain typically seen in peri and post menopausal women. Coexistent obesity, ilio-tibial band (ITB) syndrome, low back pain, osteoarthritis are added risk factors¹. Evaluation using imaging and histology techniques revealed degenerative tendinosis with tears of the gluteal tendons²⁻⁴. The primary underlying pathology of GTPS is a gluteal tendinopathy with or without tears of the tendon⁵. Although GTPS is widely referred to as greater trochanteric ‘bursitis’, there is no inflammation of the greater trochanteric bursa on histological evaluation of surgical specimens⁶.

The natural history of GTPS is favourable in most cases and responds to physical therapy, weight loss, non-steroidal anti-inflammatory drugs and behaviour modification¹. However in some patients the condition causes significant disability and necessitates intervention. Corticosteroid injection into the bursa and surgical repair of any torn gluteal tendons are the current common treatment options. Corticosteroid injections are controversial in a degenerating tendinopathy⁷. Corticosteroid injections carry the risk of a dampening effect and progressive worsening of tendon pathology⁸. A pioneering percutaneous treatment for all tendoligamentous and cartilage tears using autologous platelet rich plasma (PRP) tenotomy under high resolution imaging control was routine clinical management in the author’s practice. The same treatment was performed in a patient with GTPS. This report is the 1-year follow up on the clinical outcome and imaging appearance of this patient.

Case report

A 56 year old female Caucasian patient presented with 6 months of progressive left sided greater trochanteric pain syndrome. She complained of pain every day for many months, was unable to climb stairs and experienced moderate stiffness of the outer hip during early morning awakening. Pre-procedural clinical examination revealed an overweight individual with a BMI of 27, valgus knees, gynacoid pelvis, localised tenderness of the gluteus minimus and medius insertions into the facets of the greater trochanter, painful limitation of passive and active hip abduction and provocation to resisted abduction due to gluteal tendon dysfunction. She wished to be very active, commence a walking holiday and reduce her body weight. She refused both corticosteroid injection therapy and surgery. Full written informed consent to treat and publish the data was obtained from the patient. Ultrasound scan showed a 10 mm × 12 mm high grade full thickness tear of the degenerating gluteus medius tendon insertion (Figure 1) and gluteus minimus tendinopathy

Figure 1. Ultrasound showing full thickness tear of the degenerating gluteus medius tendon insertion (10 mm × 12 mm high grade).

with partial split tears (image not shown). Under ultrasound imaging (GE Logic 9, 9MHz probe) control, 1% lignocaine 5 cc was infiltrated through a 22 G needle into and around the minimus tendon. Percutaneous tenotomy was performed into the foot print and the adjacent gluteal cuff under real time imaging guidance. 4–5 cc of autologous PRP (REGEN Switzerland, Adistem Hong Kong) was infiltrated. Repeated percutaneous tenotomy with PRP of the medius tendon was performed in a similar manner 12 days later. Routine rehabilitation with range of motion exercises, graded activity and a strengthening program was commenced. She took no time off work. Her symptoms improved within 4 weeks. At 6 months post treatment, she enjoyed a walking holiday in the hilly terrains of the Kimberly, Western Australia without limitation. Clinical and ultrasound exam follow-up at 12 months revealed a weight reduction of 6 kg with a near normal BMI of 25.1. Her daily pain had resolved, with moderate pain only on ascending stairs. There was minimal greater trochanteric tenderness and no limitation of hip abduction. Ultrasound of the gluteal tendons revealed that neotendon tissue had replaced the degenerative tendinotic tissue with obliteration of the previously known tear defect (Figure 2).

Discussion

Tendon pathologies in an ageing population contribute to a significant bulk of musculoskeletal pain syndromes resulting in a major health burden worldwide. They represent the third highest health care expenditure, costing AUD\$517 million per annum in Australia⁹. To date there are no effective treatment strategies that uniformly address the pathology of degeneration in tendinopathy⁷.

For those patients who do not respond to conservative measures, the current options for treating tendinopathy by corticosteroid injections are ineffective⁷. Corticosteroid injections may result in progression of a catabolic tendon environment with worsening of tendon degeneration, dampening of protective pain sensory feedback resulting in over-activity and tendon rupture. Surgical repair is reserved as the very last option and data on efficacy is limited to retrospective case series¹⁰⁻¹². Data from 2008 suggest that direct surgical costs and indirect costs from bone and joint disorders amount to USD 915 billion in the United States¹³. This is likely to escalate in the next few decades¹³. Therefore there is a medical and economic need to treat tendon disorders with innovative methods that will address these issues. The ideal procedure should aim to repair the tendon with minimum direct and indirect expenditure, be repeatable in a single course of treatment, reproducible across health care systems and widely available.

Figure 2. Ultrasound of the gluteal tendons showing that neotendon tissue had replaced the degenerative tendinotic tissue with obliteration of the previously known tear defect.

The search for new options should begin with an understanding of the basic anatomy, physiology and pathophysiology of tendon disorders. Tendons do not possess adequate vascular or nerve supply¹⁴. The ability of the human body to repair tendons is therefore inherently limited. The paratendon structures surrounding tendon fibrils contain neurovascular tissue that enables neuronal mediation and reparative tendon homeostasis via immunomodulatory and inflammatory molecular pathways. Dysfunctional neuronal mediation and an inadequate tendon homeostasis are the causes of chronic tendon disorders. An understanding of this inadequacy is the key to treating chronic painful dysfunction in tendon disorders¹⁴.

It is intuitive to suggest that the initial step should aim for the correction of limitation of neurovascular supply of tendons. Such a correction may facilitate neuronal mediation and improve immunomodulatory and inflammatory molecular pathways. This may pave the way for an adequate, albeit prolonged normal healing response. On this basis, biologicals that possess an anti-inflammatory/immunomodulatory effect that promote neo-tissue regeneration and neo-angiogenesis may offer a solution. The optimal biological material should facilitate neuronal mediation and tendon homeostasis.

The second step is the understanding that the macrostructure of the musculotendinous junction, the full extent of the tendon and the enthesis at the tendon bone fibrocartilage interface are implicated in chronic tendinopathy. Therefore any treatment should be aimed at correction of the entire extent of this anatomy where possible. Delivery of therapeutic material into the affected tendon should fulfill the requirement of being able to penetrate 1) through splits and tears within the substance of the tendon, 2) surrounding paratendon and the 3) fibrocartilage footprint of the insertional portion of the tendon, ensuring that as much affected tendon is treated as possible.

In addition, there is regional attrition of more than one tendon in any given region and any treatment should address augmentation of these regional tendons to ensure additional 'scaffolding' of a progressively weakened attritional environment. Placement of therapy through the neighbouring attritional tissues may contribute to additional scaffolding via 'neotissue' regeneration around a weakened tendon environment. For example, in gluteal minimus/medius tears, the iliotibial band, gluteus maximus interface should be augmented. As far as the author is aware, this concept of percutaneous tendon augmentation via biologicals has not been previously described in the literature.

Autologous PRP is a supra physiologic concentration of platelets containing various growth factors secreted by the alpha granules in platelets. PRP has gained increasing and controversial popularity in the past few years. Application of PRP in treating degenerative rotator cuff lesions is made on the basis of its role in the regulation of matrix gene expression and cell proliferation¹⁵. The application of PRP into the enthesis is based on the regenerative effects on meniscal cells that share similar fibrocartilage histology¹⁶. Previous reports of autologous PRP are mixed, with some showing

improvement, failure of intervention and reflect the various preparations of therapeutic material and the mode of delivery of PRP usually as an injection^{17,18}. The role of high resolution imaging control in the delivery of therapeutic material is either absent or unclear in these prior reports.

This case report is unique in the simultaneous correlation of clinical and imaging findings as part of routine clinical practice. This ensured an accurate diagnosis of the afflicted tendons and was followed by delivery of the percutaneous treatment precisely into the culprit tendon and the augmentation of surrounding tissues using high resolution imaging control. This procedure represents a unique delivery of care model where clinical evaluation, imaging confirmation and percutaneous treatment were all performed by a single treating specialist dedicated to image-guided orthopaedic intervention. On this basis, the results here shown are incomparable to other existing published studies that use a different service delivery model.

In this patient, there was a combination of clinical improvement together with imaging follow-up demonstrating neotissue tendon regeneration within the gluteus medius tendon tear. The reduction in body weight and the improved BMI are important markers for improved outcome in lower limb tendon disorders. This implies improved mobility and overall health due to life style modifications subsequent to the treatment.

The author has previously published data on neotissue regeneration in a full thickness rotator cuff tear with complete abolition of pain that lasted nearly two years post percutaneous repair in an elderly patient¹⁹. As far as the author is aware this is the second report on neotissue tendon regeneration following ultrasound guided percutaneous liquid PRP tenotomy and the first report of percutaneous repair of a gluteus medius tendon tear.

This single report cannot form the basis of routine clinical application in other dissimilar service delivery models. Clinical use of this technique should be subject to regular clinical follow-up and outcome evaluation. Further research is needed prior to routine clinical use outside these parameters.

In conclusion, the treatment of degenerative tendon tears has entered a new paradigm. In this patient, percutaneous tendon repair under imaging guidance with autologous PRP tenotomy resulted in neotissue tendon regeneration of a gluteal tendon tear. This correlated with improvement in the clinical syndrome, implementation of life style modification, reduced BMI with very minimal loss of revenue due to time off work. This suggests that percutaneous repair may efficiently address the issues of the pathology and help in minimizing a sedentary life style in an increasingly overweight population with very minimal or no loss of time from work. This in turn should reduce healthcare costs to a stretched health system, loss of revenue to the patient and the indirect costs to the community. There is an economical and medical need for more research on this new paradigm shift in tendon repair.

Consent

Written informed consent for medical treatment and publication of this anonymized report was obtained from the patient.

Competing interests

No competing interests were disclosed.

Grant information

The author(s) declared that no grants were involved in supporting this study.

Acknowledgements

The author is grateful to his referring health professionals and patients.

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Open Peer Review

Current Peer Review Status: ? ✖

Version 1

Reviewer Report 16 December 2014

<https://doi.org/10.5256/f1000research.6114.r6745>

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Jason K.F. Wong

Institute of Inflammation and Repair, University of Manchester, Manchester, UK

I think this is a controversial area whereby it is not possible to evaluate the effectiveness of PRP specifically on the patients improvement in symptoms. We all have patients who respond in some way to a change in treatment, behaviour or management which do not work again when trialed. There are too many confounding factors here that make this observation uncertain, for example the patient could have got better without treatment, the needling could have caused the site to bleed and the clotting could have healed the defect, fluid injected itself could have caused it to heal, the US scan is not confirmation of neotendon as organised scar can have similar appearances and a biopsy would have to be performed to confirm. Many different possibilities exists that without proper study and experimental design means that this is an interesting observation which may be biased and incorrect. Based on the literature published in this field to date, it cannot be supported to change clinical practice without a proper randomised control study based on significantly higher patient numbers. I know that this practice goes on in many sports clinics at much financial gain to independent practicing sports clinicians.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 03 Jan 2015

Arockia Doss, Image Guided Therapy Clinic, Nedlands, Western Australia, Australia

I wish to thank the reviewer for his time to write a review for this case report on the repair of a gluteal tendon tear following ultrasound image guided Platelet Rich Plasma (PRP) tenotomy. It is regrettable that this reviewer has not approved this case report. Approval and indexation in Pubmed is crucial for furthering study in a new area of controversy and

interest. A similar case report on tendon repair in rotator cuff tear published in *F1000Research* was subsequently approved and indexed in PubMed¹.

The reviewer states that there is not enough evidence of efficacy data from a single patient related outcome and there is lack of evidence that the treatment actually worked. He also states that PRP procedures are performed for financial gain and his approval of this paper may result in widespread routine clinical use of PRP.

I wish to make the following points in response to this review.

Purpose of Case Reports

Case reports such as this article, serve the purpose of describing novel, innovative or new treatment options by describing the outcome in a single or series of cases. Case reports do not offer 'data' on efficacy. Case reports offer qualitative descriptions that reflect day to day clinical practice. There are many variables leading to bias in a case report. Controlling bias and proving efficacy of such a new treatment is the purpose of controlled studies and trials.

Case reports are meant to be the subject of future rigorous studies and are not meant to change routine clinical practice. This is made very clear in my article. The weight of establishing efficacy rests on future controlled studies. Until such time, ultrasound guided platelet rich plasma (PRP) tenotomy in gluteal tendon tears should not be used in routine clinical practice without audit and follow up arrangements. This is also made very clear in my paper.

Therefore, to 'Not Approve' this case report on the basis of 'lack of efficacy' suggests that the reviewer has not taken into account the very nature and purpose of case reports and has not provided due credit to the points that were acknowledged in my article anyway.

One should not forget that case reports described the first heart transplant for cardiomyopathy² and the self experimentation by Barry Marshall with *Helicobacter pylori* to prove the pathogenesis of peptic ulcers³.

Is there a need for a tendon biopsy ?

The reviewer suggests the need for biopsy to prove healing of the treated tendon tear. When patients improve after treatment of a tendon, a biopsy to prove regeneration of a healed tendon is impractical, unnecessary and may be harmful. The British Medical Journal published a case report on tendon regeneration in a case of rotator cuff tendon tear following percutaneous treatment⁴. Good clinical outcome coupled with restoration of normal tendon appearances on magnetic resonance imaging formed the basis of the conclusion of 'tendon regeneration' by the authors. Regeneration of tendon was concluded without tendon biopsy in that case report.

Why is this case report important in gluteal tendon tears?

The concept of being able to repair a tendon with a relatively inexpensive out of hospital procedure is innovative. This innovative approach has not been given due credit by the reviewer.

1. Tendon repair is currently perceived as being a surgical procedure in a hospital. Surgical tendon repair procedures are performed in private hospitals for those with private health fund insurance schemes in the Western world. This means that patients without private health cover do not have access to a hospital based surgical procedure and are left to live in pain for a long time. This leads to a sedentary life style and associated co-morbidities in a large proportion of patients.
2. Irrespective of currently available surgical or non surgical options, tendon disorders are a major cause of morbidity in the western world and any innovation should be welcome.
3. There is a move towards keeping patients out of hospital due to escalating costs and risks of infection from antibiotic resistant microorganisms in a hospital environment. This case report is timely and reflects the current trend of out of hospital procedures that may potentially offer an alternative to in hospital surgical repair.
4. Reports such as this offer proof of concept of regenerative percutaneous tendon repair procedures.

Peer review Bias

Open access publishing with open peer review offers a platform for unbiased dissemination of articles irrespective of the source of the article - whether the article is from a small private practice or from an academic department. Richard Smith (Former Editor, British Medical Journal) describes the bias of accepting and publishing articles from big name institutions as the Mathew effect: 'To those who have, shall be given; to those who have not shall be taken away even the little that they have' ⁵.

The comment 'sports physicians performing PRP procedures with much financial gain' suggests such a bias of the reviewer against private practices. The reviewers' comment assumes that private practices perform such procedures for the revenue from such procedures. This is a regrettable and largely incorrect view. Such new procedures are offered by private practitioners or demanded by patients due to the lack of other options in an area of unmet medical need, as patients have tried existing options with no benefit. The comment implies that good medical write ups are *not* to be expected from private non academic practices.

Purpose of this review

The comment 'based on the literature published in this field to date, it (PRP) cannot be supported to change clinical practice without a proper randomised control study' suggests

that the reviewer rejects this case report on the basis of other studies and the possibility that PRP may be used widely in clinical practice. I find that such a conclusion does not serve the purpose of this review.

Conclusion

The weight of careful responsible reviews rests on all of us who have the ability to change medical practice on the basis of good evidence. Where there is no such evidence in an area of unmet medical need as seen with tendon disorders that result in a huge health economic burden, should we not provide practice based evidence? When such practice based evidence is written up, we need a review without any prejudice to the source of the article. Unfortunately this review does not help us take a forward step to reduce the health burden from musculoskeletal disorders.

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Competing Interests: I am the author of this article.

Reviewer Report 24 November 2014

<https://doi.org/10.5256/f1000research.6114.r6747>

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Nikolaos Gougoulis

Trauma and Orthopaedics Department, Frimley Park Hospital, Frimley, UK

The author presented the outcome of one case of tendon healing, followed for one year, after PRP injection. First I would like to comment on the terminology. "Tenotomy" may be a misleading term. Tenotomy means "cutting a tendon". Is this what the author did? Or just an injection. This needs clarification.

Furthermore, one cannot prove that it was the PRP that aided tendon healing, or the injection itself. There are various good quality randomized studies that showed no difference in the outcomes of PRP versus placebo injections. These should be cited in the discussion. A single case is not even indicative of the effectiveness of PRP. In theory PRPs may have anti-inflammatory and reparative properties, may have shown "promising" results in the lab, but their clinical effectiveness is questioned and controversial. Taking into consideration that their use is financially beneficial to doctors and the industry, their use cannot be widespread, unless good quality evidence is available.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 24 Nov 2014

Arockia Doss, Image Guided Therapy Clinic, Nedlands, Western Australia, Australia

First of all, thank you for your time with valuable comments and review.

Tenotomy can be performed by a percutaneous technique with multiple points of fenestrations through a tendon ([Chiavaras MM, Jacobson JA. Ultrasound-guided tendon fenestration. Semin Musculoskelet Radiol. 2013 Feb;17\(1\):85-90. doi: 10.1055/s-0033-1333942. Epub 2013 Mar 13. Review. PubMed PMID: 23487340](#)), ([Housner JA, Jacobson JA, Misko R. Sonographically guided percutaneous needle tenotomy for the treatment of chronic tendinosis. J Ultrasound Med. 2009 Sep;28\(9\):1187-92. PubMed PMID: 19710216](#)).

With a tenotomy the tendon is fenestrated subcutaneously in an attempt to change a chronic tendinopathy to an acute condition, thus allowing the opportunity to heal. This is a distinctly different procedure to an 'injection' where the needle is not moved within the tendon.

It is made clear in the paper that this single patient case report does not constitute evidence for routine application.

The purpose of this paper is to document tendon tear repair seen on ultrasound in conjunction with clinical improvement. This should form the basis of future rigorous studies on efficacy of a combined technique of PRP tenotomy, PRP alone or tenotomy alone, versus

placebo.

Such case reports offer practice based evidence rather than evidence based practice.

Competing Interests: I am the author of this article

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