

Managing Delayed Union Of Sub-Trochanteric Fractures After Intra-Medullary Nailing By Non-Operative Means

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Citation

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Abstract

Objective: This represents a prospective clinical case series to assess the efficacy of low-level laser therapy (LLLT) in treating delayed union of hip sub-trochanteric fracture after intra-medullary nailing

Materials and Methods: the study period of the clinical case series lasted from 2014 to 2018. Serial unselected patients with delayed union of hip sub-trochanteric fractures who consented for a course of non invasive LLLT administered on alternate days for a period of 12 weeks with a view to improve bony healing entered the study. Radiographs were taken at intervals of 4 weeks to assess for evidence of radiological bone healing. Only non-pathological sub-trochanteric fractures were included as underlying malignancy contraindicates the use of laser.

Results: among the study population of 13 subjects, there was only one subject whose delayed union failed to respond positively to 12 weeks of LLLT treatment. All remaining 12 subjects went on to solid radiological union (p value less than 0.5)

Conclusion: Use of 12 weeks of non invasive LLLT treatment is clinically effective in managing delayed union of hip sub-trochanteric fractures without resort to revision surgery and/or bone grafting.

INTRODUCTION

Delayed union of sub-trochanteric fracture despite treatment with intra-medullary nailing is not uncommon especially since the sub-trochanteric region of the proximal femur is under high stress from previous biomechanical studies. Delayed bony healing is especially common at the lateral or tension side rather than the medial compression side since that lateral aspect of the sub-trochanteric region of the proximal femur is under high tension. Low level laser therapy (LLLT) has been shown by the author to enhance the healing of human long bones of the upper and lower extremity and has been reported in this journal [1]. The current study assesses whether LLLT can be used to enhance bony healing of more challenging scenarios such as patients demonstrating delayed bone healing despite operative fracture fixation. The sub-trochanteric region of the proximal femur is one such region where solid bone healing is not guaranteed despite meticulous fracture fixation being implemented. Enhancement of bone healing in such cases is important to prevent the failure of or breakage of implants. Furthermore, better and prompt bone healing can make early full weight bearing walking possible to prevent lower limb

muscle atrophy and weakness from too prolonged protected weight bearing

MATERIALS AND METHODS

The study period spans from 2014 to 2018, consisting of patients attending 3 clinics namely wellness pain centre, Asia medical pain centre, and digital pain centre. The male:female ratio was 3:10 and the mean age was 64 (range 58 to 69). All subjects upon referral had no or minimal bony healing after not less than 3 months of the index operation of intra-medullary nailing. Each subject had been worked up to exclude the possibility of underlying malignancy or metastases as the cause of the fracture. All subjects consented to a 3-month trial of LLLT treatment prior to consideration of revision surgery and/or bone grafting. LLLT was provided by a GaAlAs semiconductor device emitting 810 nm wavelength, 5.4 J per point, and power density of 20 mW/cm² was used and the duration of application of LLLT over the delayed union site was 480 seconds administered on alternate daily basis to the fracture site, without the use of other oral medications added from the various pain centres.

Serial radiographs were taken every 4 weeks to assess the degree of bone heal of bone healing if any. No other physiotherapy treatments were administered other than FDA approved LLLT devices. The use of control by sham light source was objected by the majority of subjects and thus sham light irradiation was not employed.

RESULTS

All subjects completed the LLLT treatment of 12 weeks without side effects. Treatment failure is defined by failure to obtain radiological bone healing that necessitated revision surgery upon study completion. In this study, there were no defaulters, and 12 out of 13 subjects demonstrated good bony responses to LLLT.

Fig 1 illustrates a typical patient with paucity of bony healing on the tension side despite properly performed intra-medullary nailing.

Figure 1



Fig 2 illustrates the typical response at 12 weeks of new bone response at the tension side of the sub-trochanteric fracture site.

Figure 2



DISCUSSION

Subtrochanteric fractures constitute 20 % of all fractures involving the proximal femur and even in this day and age still poses challenge even to experienced surgeons. This fracture type has significantly high rates of malunion and nonunion relative to other types of proximal femoral fractures [2,3]. This in fact stems from the not uncommon bone healing problems in that anatomical region. As many a patient suffering from sub-trochanteric fractures are in advanced age, subjecting them to revision surgery may be the last thing they desire and one need sometimes to resort to safer non-invasive means to tackle bone healing problems of this region.

The author had previously reported in this journal [1] as well as book publication [4] that LLLT can augment the healing of human upper and lower extremity fractures un-subjected to surgery. Sub-trochanteric fractures can seldom be treated conservatively as this will risk both shortening and mal-rotation of the affected lower limb. As said, bony healing in this region is not guaranteed despite operative fixation and delayed union should quickly be tackled to prevent implant failure and muscle weakness from prolonged protected weight bear walking exercise. The result of this study highlights the fact that LLLT can be used to enhance bony healing even in such challenging circumstances and serves as a blessing in particular to those subjects at high operative

risks for further surgery. To stress yet again, LLLT can enhance bony healing by various mechanisms including an increase in BMP2-induced phosphorylation of the Smad 1/5/8 pathway [5] as well as stimulate BMPs-induced expression of type 1 collagen, osteonectin, and osteocalcin mRNA [6] besides improving bone mineralization [7].

CONCLUSION

The administration of low-level laser therapy for 12 weeks was shown to be effective in enhancing bony healing of delayed union of sub-trochanteric fractures not due to underlying malignancy after operative fixation with intra-medullary nailing. Enhanced bony healing lessen the chance of implant failure and shortens the period of protected weight bearing.

References

1. Ip D (2017) Use of low-level laser therapy in conservative treatment of delayed union of human upper and lower limb fractures Internet J Ortho Surg Vol 25 No 1
2. Chapman MW et al (2001) Chapman's Orthopaedic Surgery 3rd Edition Lippincott Williams & Wilkins
3. Rockwood CA et al (2001) Rockwood, Green and Wilkins Handbook of Fractures 5th Edition Lippincott Williams & Wilkins
4. Ip D (2016) use of low-level laser therapy in Orthopedics Chapter 3 Use of LLLT in Fracture Management Lap Lambert Academic Publishing Germany
5. Hirata SC, et al (2010) Low-level laser irradiation enhances BMP-induced osteoblast differentiation by stimulating the BMP/Smad signaling pathway J Cell Biochem 111:1445-1452
6. Favaro-Pipi et al (2011) Low-level laser induces differential expression of osteogenic genes during bone repair in rats. Photomed Laser Surg 29:311-317
7. Ling LC et al (2010) Synergism between Wnt3a and heparin enhances osteogenesis via a phosphoinositide 3-kinase/Akt/RUNx2 pathway J Biol Chem 285:26223-26224

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