

## Unusual Yellow Staining of the Knee Articular Bones

Antonios T\* and Willis-Owen CA

Queen Elizabeth Hospital, London, UK

### Abstract

We report on the unusual finding of yellow-stained bone during an elective knee arthroscopy for a 52 year old female complaining of worsening pain on mobility. The magnetic resonance scan (MRI) confirmed medial and lateral meniscal tears. During the procedure, marked dark yellow stains were seen in the tibia, femur and the patella bones. Partial meniscectomies were performed in the usual fashion. Retrospective history from the patient confirmed that she was subjected to Tetracycline antibiotics use for a considerable time during her childhood. We believe this striking finding is directly related to childhood use of tetracycline and that her skeleton is permanently yellow-stained.

**Keywords:** Knee arthroscopy; Tibia; Femur; Patella

### Introduction

Tetracycline-related discolouration of teeth is well reported in the literature with an incidence rate of up to 6% [1,2]. However, fewer papers have reported upon discolouration affecting bony skeleton and soft tissues [3,4]. Tetracycline was introduced in the late 1940s as an antibiotic and anti-inflammatory for treating common infections [2,5]. Due to its effectiveness, it was widely prescribed to children suffering from common infections. During the 1950s and 1960s, few reports started to appear in the literature linking tetracycline and its derivatives to discolouration of teeth [6,7].

The mechanism is not fully understood, but it appears that tetracycline incorporates into calcifying tissues such as teeth and bones by chelating calcium ions [8-12]. The discolouration can vary from yellow to grey or dark brown [2,3,10]. The incidence of tetracycline-related discolouration in bone and cartilage is not well quantified, as the majority of literature-reported findings were from incidental findings in surgical operations [4]. Bone staining in cranium, shoulder, hand, pelvic girdle, hip and femur has been reported in the literature [13-15]. Nevertheless, to the authors' knowledge there are no reported cases of tetracycline-related bone staining in the knee identified during arthroscopy procedures.

### Case Presentation

A 52 year-old female presented to the outpatient orthopaedic clinic with worsening left knee pain, and swelling on minimal activities. She used to do considerable amount of running and cycling in the past. Twenty four years prior to this, she underwent a left knee patella tendon anterior cruciate ligament (ACL) reconstruction for an injury seven years prior. She fully recovered and went back to running and cycling. After recently moving to the UK, she developed left knee pain and swelling. Her exercise tolerance had considerably reduced with her response to conservative measures (pain relief and activity modification) was inadequate.

On clinical examination of the left knee there was a large effusion and a mid line scar from her patellar tendon ACL reconstruction. Her range of motion was from 0° to 140° limited by the effusion and with some patellofemoral crepitus. She was diffusely tender around the medial and lateral joint lines, but not around the patella. There were no signs of knee instability and the ACL graft appeared to be functioning well. The MRI of the knee showed frayed torn medial and lateral menisci,

with frank arthritis within the knee in the patellofemoral compartment and in small patches in the medial and lateral compartments.

The patient underwent knee arthroscopy. She had moderate patellofemoral and medial compartment arthritis with degenerate medial and lateral meniscal tears which were debrided. Her cruciate ligament graft was intact. She had "neon yellow" staining of the exposed bone in all of the arthritic areas (Figures 1 and 2). Other soft tissue structures were not affected. Care was taken to ensure and check colour calibration and white balancing of the arthroscopic equipment to ensure that the colour change was genuine.

Postoperatively, she was reviewed in the orthopaedic clinic at 6 weeks. Her pain subsided and she later returned to light exercise. She confirmed that she was subjected to long-term tetracycline antibiotic

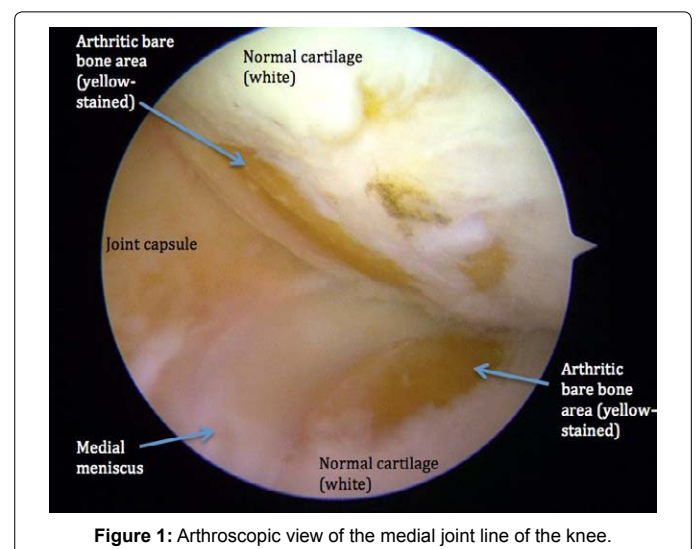


Figure 1: Arthroscopic view of the medial joint line of the knee.

\*Corresponding author: Antonios T, Queen Elizabeth Hospital, London, UK, Tel: +4407940402202; E-mail: [tonyantionios@nhs.net](mailto:tonyantionios@nhs.net)

Received June 02, 2015; Accepted June 26, 2015; Published July 02, 2015

Citation: Antonios T, Willis-Owen CA (2015) Unusual Yellow Staining of the Knee Articular Bones J Trauma Treat 4: 259. doi:10.4172/2167-1222.1000259

Copyright: © 2015 Antonios T, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

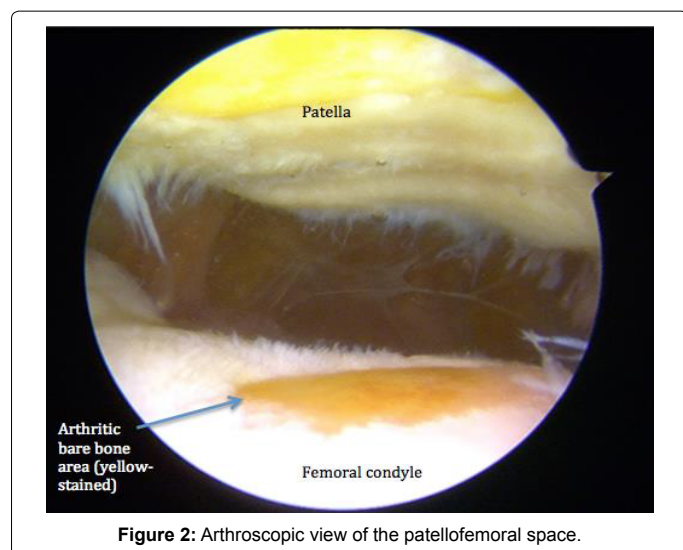


Figure 2: Arthroscopic view of the patellofemoral space.

use during her childhood. She provided consent for using data from her case for publication.

## Discussion

Several studies have discussed the mechanism of bone discoloration secondary to tetracycline use [2-4]. Tetracycline incorporates into calcifying tissues through chelating calcium ions in osteogenic parts of the bone. It irreversibly binds to hydroxyapatite forming a tetracycline-calcium phosphate complex and deposited during osteoid mineralization [8-12]. Higher rates of mineralization lead to more tetracycline deposition in tissues [8-12].

Shining ultraviolet light over a tetracycline stained bone produces yellow-fluorescence [16-19]. This made it possible to use it in research as marker of rate of bone mineralization [2,4]. Tetracycline components are given to subjects and bone biopsies at different intervals measure the difference in different linear fluorescent labels under microscopy [16-19].

Few incidental findings of tetracycline bone-related discoloration have been cited in the literature [3,4]. However, there were no reports of any structural difference or damages to bone quality post fracture fixation or joint arthroplasty [13-15]. One paper has reported an incidental finding of tetracycline-related discoloration during a routine cemented knee arthroplasty [14]. The authors reported no difference subsequent postoperative fixation after one year follow up.

## Conclusion

The vast majority of literature on tetracycline related discoloration is case reports. With the increasing number of orthopaedic procedures, more incidental findings of similar cases will occur. Detailed history taking and consideration of such a diagnosis during surgery would avoid unnecessary tests and bewilderment for the patient and surgeon respectively!

## References

- Berger RS, Mandel EB, Hayes TJ, Grimwood RR (1989) Minocycline staining of the oral cavity. *J Am Acad Dermatol* 21: 1300-1301.
- Sánchez AR, Rogers RS 3rd, Sheridan PJ (2004) Tetracycline and other tetracycline-derivative staining of the teeth and oral cavity. *Int J Dermatol* 43: 709-715.
- Pandit S, Hadden W (2004) Black pigmentation of bone due to long-term minocycline use. *Surgeon* 2: 236-237.
- Chan CM, Hicks DG, Giordano BD (2012) Minocycline-Induced Bone Discoloration – A Case Report. *JBJs Case Connect* 2: e47.
- Sande MA, Mandell GL (1990) Tetracyclines, chloramphenicol, erythromycin, and miscellaneous antibacterial agents. In: Goodman Gilman A, Rall TW, Nies AS, Taylor P (ed.) *The Pharmacological Basis of Therapeutics*, 8th edn. New York, NY: Pergamon Press 1117-1118.
- Schuster A, Shwachman H (1956) The tetracyclines; applied pharmacology. *Pediatr Clin North Am* .
- Davies PA, Little K, Aherne W (1962) Tetracyclines and yellow teeth. *Lancet* 1: 742-743.
- Dhem A, Piret N, Fortunati D (1976) Tetracyclines, doxycycline and calcified tissues. *Scand J Infect Dis Suppl* 42-46.
- Cale AE, Freedman PD, Lumerman H (1988) Pigmentation of the jawbones and teeth secondary to minocycline hydrochloride therapy. *J Periodontol* 59: 112-114.
- Hilton HB (1962) Skeletal pigmentation due to tetracycline. *J Clin Pathol* 15: 112-115.
- Rosen T, Hoffmann TJ (1989) Minocycline-induced discoloration of the permanent teeth. *J Am Acad Dermatol* 21: 569.
- Eisenberg E, Bernick SM (1975) Anomalies of the teeth with stains and discolorations. *J Prev Dent* 2: 7-20.
- Somayazula R, Rogers GF (2010) Metacarpal darkening associated with minocycline therapy. *J Hand Surg Eur Vol* 35: 760-761.
- McCleskey PE, Littleton KH (2004) Minocycline-induced blue-green discoloration of bone. A case report. *J Bone Joint Surg Am* 86-86A: 146-8.
- Wolfe ID, Reichmister J (1984) Minocycline hyperpigmentation: skin, tooth, nail, and bone involvement. *Cutis* 33: 457-458.
- Frost HM (1969) Tetracycline-based histological analysis of bone remodeling. *Calcif Tissue Res* 3: 211-237.
- Roberts WE, Turley PK, Breznjak N, Fielder PJ (1987) Implants: Bone physiology and metabolism. *CDA J* 15: 54-61.
- White C Jr, Hancock EB, Garetto LP, Kafrawy AA (1994) A histomorphometric study on the healing of class III furcations utilizing bone labelling in beagle dogs. *J Periodontol* 65: 84-92.
- Bullough PG, Bansal M, DiCarlo EF (1990) The tissue diagnosis of metabolic bone disease. Role of histomorphometry. *Orthop Clin North Am* 21: 65-79.