

Arthroscopic Microfracture of the Knee

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ABSTRACT

The purpose of this study was to assess the functional improvement of all patients that had undergone arthroscopic microfracture for osteoarthritis of the knee joint.

Between May 1997 and May 2000, 34 patients had this procedure performed. Only patients above 40 years of age with documented OA knees from history, physical examination and radiographic evidence who have failed medical treatment with minor mal-alignment were recruited for this study. Only Grade IV lesions (OA) were subjected to the microfracture technique. Steadman arthroscopic awls were used to make multiple "perforations" in the subchondral plate. Post-operatively patients were started on continuous passive motion for 8 hours a day for 48 hours before progressing to full weight bearing ambulation on the 2nd POD.

Significant improvement was noted for parameters of activities of daily living and pain ($P < 0.05$) using the modified WOMAC score. There were no complications as a result from surgery. In conclusion, arthroscopic microfracture can provide good functional results in the treatment of full thickness chondral defects of osteoarthritic knee.

Keywords: Arthroscopy, Microfracture, Knee

INTRODUCTION

Any damage or insult to the integrity of the articular cartilage seems to be the precipitating event that accelerates the onset of osteoarthritis. The inability of the articular cartilage to repair traumatic defects to its origin has long been appreciated by physicians.

In the twentieth century, surgeons began to experiment with various methods and techniques to stimulate damage joint surface to initiate a repair mechanism. The introduction of arthroscopy has allowed for less invasive techniques. The knee joint being a dynamic joint under constant strain has poor ability for chondral defects regeneration. Thus research has been focused on developing a more durable repair tissue that closely approximates the hyaline cartilage tissue.

Since the early work of Pirdie and Insall, who started open joint debridement with subchondral bone stimulation to treat OA of the knee^{1,2}, arthroscopic techniques have reduced the morbidity of open joint procedures in the repair and early assessment of chondral defects of the knee.

The most basic of all arthroscopic procedures where debridement / "washing out" the joint provides temporary relief of symptoms by removing loose cartilage fragments, catabolic enzymes, loose bodies and flaps of damaged cartilage. Jackson³ found that 88% of 137 patients were asymptomatic initially but only 68% after 3 years.

Baumgartner⁴ in his series 52% of 44 patients with OA had initial improvement with only 40% with relief after 33 months post arthroscopic debridement. Hubbard⁵ using the Lysholm scores convincingly found that 5-years after performing these procedures had improved outcome. Messner and Maletius⁶ also using Lysholm scores found from his 14-year follow-up, 21 of the 28 patients demonstrated continued functional improvement. Only 16 patients demonstrated progressive signs of early arthritis.

Thus sparked the race to devise techniques to improve on the long-term results led to marrow stimulation. It aims to provide blood elements that form a fibrin clot in the defect; this clot leads to differentiation into a fibrocartilage repair. Methods used to accomplish this type of stimulation to provide blood elements include arthroscopic abrasion, drilling and microfracture⁷⁻¹¹. Each of these procedures is preceded with debridement of the chondral surface. Abrasion arthroplasty is performed by abrading the surface of the exposed subchondral bone with an arthroscopic burr to create a bleeding bony surface whereas drilling relies on multiple drill holes through the exposed subchondral bone to provide access to the marrow elements. The drawback of these techniques is that the thermal injury to the chondral bone is not addressed.

The microfracture technique (MCFR) was first tried on articular cartilage of horses by CW McIlwraith et al. He concluded that the new MCFR tissue contained significantly increased amounts of type II collagen and less amount of type I collagen at 6 and 8 weeks compared to the control tissue. These early results imply that "microfracture" offers advantages over conventional debridement in providing critical components for long term articular cartilage healing. Bae from University, Seoul, Korea also applied the same technique to 46 patients between Oct 1997 and Dec 1998. There was significant improvement noted for the parameters of activities of daily living and pain ($P < 0.05$). There were no complications directly related to the technique.

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METHODS

Thirty-four patients from Singapore General Hospital between the years of 1997 to 2000 were recruited for this study. Only patients with osteoarthritis of the knee are subjected to the microfracture technique. The diagnosis is made based on history, physical examination and radiographic evidence of OA. Patients with rheumatoid arthritis or gout were excluded.

Our selection criteria:

- 1) Patients who failed conservative treatment i.e. pain killers and physiotherapy
- 2) More than 40 years old
- 3) Normal to mild mal-alignment; less than 15 degrees of varus or valgus alignment
- 4) Range of motion more than 90°
- 5) Arthroscopic diagnosed chondral lesion less than 2 cm²
- 6) No meniscus or ligamentous injury

Questionnaire evaluation was made through phone, clinic or inpatient interviews using the "modified" WOMAC score. This is the translated version of the original WOMAC scoring system.

Operative Technique

Patients were admitted on the day of surgery. The procedure is performed under general anaesthesia and tourniquet. Anterior, medial and lateral arthroscopic portals are used. Grade IV lesions based on Outerbridge's classification were subjected to the microfracture technique. Where indicated (i.e. there is mal-tracking of the patella), a concomitant lateral release of the patella retinacula was performed. A redivac drain was left in situ after arthroscopic lateral release was performed. 20 mls of intra-articular marcaine was injected post-procedure (Figure 1).

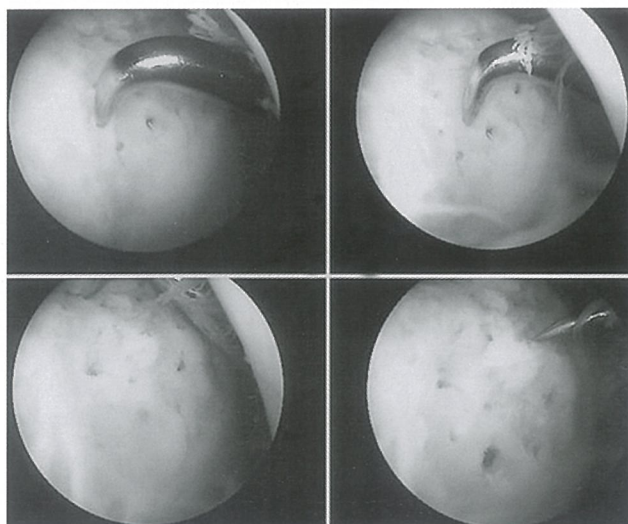


Figure 1. Arthroscopic microfracture of the knee. The arthroscopic technique includes arthroscopic debridement of the knee joint. Steadman awls are used to create "holes" in the chondral defect at 3-4 mm² apart.

Post-Operative Physiotherapy Regime

Immediately after the surgery, patients were started on continuous passive motion (CPM) at 0-90 degrees. On the 1st POD patients progressed to 0-120 degrees on the CPM and were started on isometric exercises. CPM was commenced immediately post-op for 8 hours a day for 48 hours. The drain was removed if there is minimal drainage. On the 2nd POD, patients were begun on full weight bearing ambulatory physiotherapy. They were discharged on the 3rd POD onwards. Patients were reviewed in the clinic a month later.

Patient's Profile

From a cohort of 34 patients, there were 11 males and 23 females with a mean age of 55 years (range 43-71 years). There were Chinese (N=19), Malay (N=7), Indian (N=6) and Others (N=2).

Both knees were performed with comparable frequency (18 left:16 right). Lateral release was deemed necessary when there was evidence of patella tilt on x-ray or presence of patella mal-tracking.

RESULTS

Our mean follow-up period was 11.9 months; (12-70 months). The mean operative time was 28 mins and patient's average duration of hospitalization was 3.97 days. Patients were assessed using the modified WOMAC questionnaire. This is an analog scale where patients are assessed on 3 main categories, which are: pain, stiffness and functional assessment.

Patients scored significantly better for all 3 categories for pain, stiffness and functional outcome after the procedure. Twenty-three were employed and all resumed their normal duties. Statistical analysis was performed using the paired t-test. For the main categories of pain, stiffness and function there were statistically significant results.

Each of the functional task also showed statistical significance at confidence interval of $P < 0.05$.

In each category of pain, stiffness and function, patients also showed statistical improvement after the procedure.

Only two patients gave consent for rescopes for arthroscopic evaluation and biopsy. The cartilage defect has been filled with "cartilage" tissue. The histology results showed that these were fibro-cartilage tissue. Short term functional relief is comparable to hyaline cartilage (Figure 2).

CONCLUSION

Full-thickness chondral defects do not spontaneously heal with similar quality hyaline tissue. Therefore many of these patients progress to osteoarthritis of the joint. The traditional treatment of degenerative joint disease has come a long way since the birth of arthroscopy. We now have a repertoire of treatment modalities, which are still at a developmental stage. We believe that our goal of achieving hyaline-like repair tissue will provide positive biomechanical and durability results. At the moment we can continue to offer a cheap, safe, quick and satisfactory therapeutic option to our patients. Steadman¹² has reported

good functional improvement in his patient cohort. This relief is clinically apparent even in NFL players¹³. The renewed interest by the medical will undoubtedly lead to further refinements and developments- ultimately providing even better results for this common clinical problem.

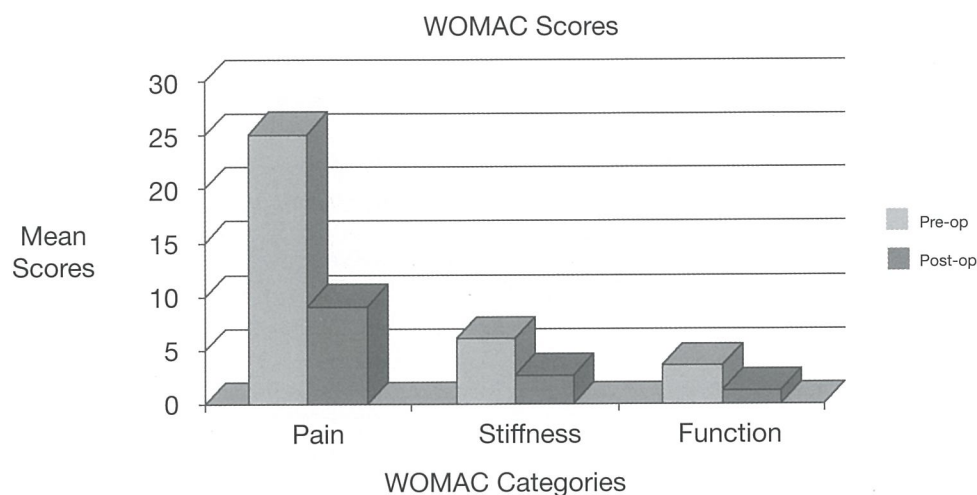


Figure 2. Comparison of pre-operative and post-operative scores (WOMAC).

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