

The Microfracture Technique in the Treatment of Full-Thickness Chondral Lesions of the Knee in National Football League Players

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ABSTRACT: Between 1986 and 1997, 25 active National Football League (NFL) players underwent microfracture to treat full-thickness chondral lesions. Average follow-up was 4.5 years (range: 2-13 years). Preoperative and postoperative data were rated according to symptoms (4=severe, 1=none), function (5=unable to perform, 1=no limitations), and activity level (10=full activity, 1=unable to perform). Nineteen (76%) players returned to football the season following microfracture. Six players retired for various reasons. At follow-up, pain, swelling, running, cutting, and squatting improved. Activities of daily living, strenuous

work, and strenuous sport levels also improved. Those who returned to play averaged 4.6 seasons of participation (range: 1-13 seasons) and 56 games (range: 2-183 games) after microfracture. Nine (36%) players continue active participation in the NFL. Results of microfracture to resurface full-thickness chondral lesions in high-demand NFL players are encouraging. Microfracture is safe, effective, and appears to improve symptoms, function, and activity levels in NFL players.

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INTRODUCTION

Trauma to the articular cartilage of the knee is a common component of sports injuries. The challenge in the treatment of these lesions is the poor inherent capacity of articular cartilage to heal itself.⁴ Microfracture has been demonstrated to be an effective treatment for full-thickness chondral lesions of the knee.^{3,5-7} This technique is technically simple and safe, with an extremely low rate of associated patient morbidity.³

Microfracture relies on a "marrow-stimulation" strategy for the repair of full-thickness chondral lesions. In this procedure, the creation of controlled "microfrac-

tures" through the subchondral bone allows the egress of marrow-based mesenchymal stem cells and various cytokines into the fibrin clot that forms at the base of a prepared chondral lesion.² These cells proliferate and differentiate into cells with morphological features of chondrocytes, and they produce a cartilaginous repair tissue that fills the chondral defect.^{2,5}

Studies of microfracture have revealed significant improvement in symptoms and knee function in the general population as well as in competitive athletes.⁷ This study reviewed the results of microfracture in the treatment of full-thickness chondral injuries in National Football League (NFL) players.

MATERIALS AND METHODS

The medical records of 25 active NFL players who underwent microfracture to treat full-thickness chondral lesions of the knee at our clinic between 1986 and 1997 were reviewed. Three players underwent bilateral surgery.

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TABLE
DATA FOR PLAYERS WHO DID NOT RETURN TO PLAY

Player No.	Age (y)	Defect Location	Defect Size (mm ²)	Other Pathologies	No. Years in NFL	Lysholm Score	
						Preop	Postop
1	33	Trochlear groove	375		10	37	80
2	28	Trochlear groove	150		4	73	83
3	34	Trochlear groove	600		12	54	95
4	31	Medial femoral condyle	300	Meniscus	6	57	94
5	36	Trochlear groove	300	Meniscus	14	63	83
6	32	Lateral femoral condyle, lateral tibial plateau	350	Meniscus	5	61	84

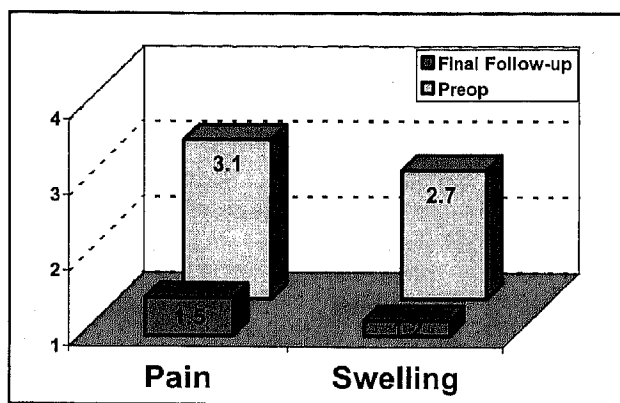


Figure 1. Preoperative and follow-up pain and swelling levels (1=none and 4=severe).

Of the 25 players, 14 were linemen, 7 were defensive backs and linebackers, 2 were receivers, and 2 were running backs. Average age at surgery was 29 years (range: 22-36 years). Indications for surgery were increased pain and swelling, increased difficulty with activities, or diagnosis of a chondral defect on magnetic resonance imaging (MRI). For each patient, age at surgery, football position, location of chondral injury, any associated knee pathology, and the number of games and seasons played after surgery were recorded. Average follow-up was 4.5 years (range: 2-14 years).

All patients completed an analog questionnaire pre- and postoperatively. Pain and swelling were individually graded on a scale of 1 (none) to 4 (severe). Function, including running, cutting, and squatting, was graded on a scale of 1 (no limitation) to 5 (unable to perform). Activities of daily living, strenuous work, and strenuous sports levels were graded on a scale of 1 (unable to perform) to 10 (full activity). The Lysholm score also was calculated preoperatively and at follow-up.

Preoperatively, 82% of patients reported moderate to severe pain, 82% reported limitations in running and cutting exercises, and 93% reported limitations in squatting exercises.

RESULTS

Surgical Findings

Thirty-five full-thickness chondral lesions were treated with microfracture. The average size of the lesion was 380 mm² (range: 150-1000 mm²). Anatomic location of the chondral lesions, in descending order, were: trochlear groove (n=12), medial femoral condyle (n=9), lateral femoral condyle (n=6), lateral tibial plateau (4), medial tibial plateau (2), and patella (2). Additional pathology was noted in 10 (36%) patients. These findings, in descending order, included: meniscus pathology alone (n=5), anterior cruciate ligament (ACL) insufficiency alone (n=2), combined ACL insufficiency and meniscus pathology (n=2), and posterior cruciate ligament insufficiency (n=1).

Return to Play

Nineteen (76%) players returned to football the season following microfracture, at an average of 10 months after microfracture (range: 4-13 months). Six players retired for various reasons and did not return to play (Table). Those players that returned to competition played in an average of 57 games (range: 2-180 games) and completed an average of 4.6 seasons (range: 1-13 seasons). Nine (36%) players continued active participation in the NFL, as of the 2001-2002 NFL season.

Functional Outcome

Average symptomatic levels of pain and swelling improved postoperatively (Figure 1). Preoperative functional scores also improved postoperatively (Figure 2). Activities of daily living, strenuous work, and strenuous sports levels also improved postoperatively (Figure 3). Lysholm score improved from 52 preoperatively to 90 postoperatively.

DISCUSSION

Blevins et al¹ reported the results of microfracture in

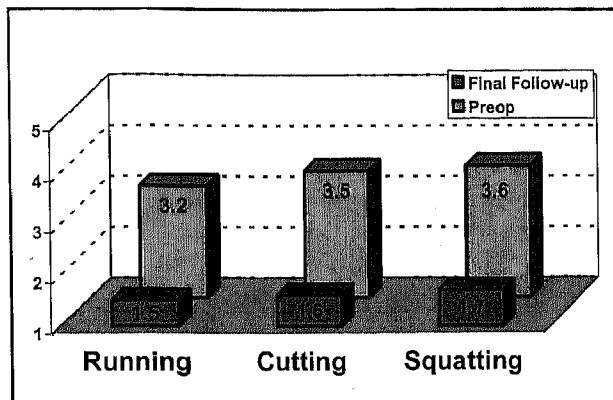


Figure 2. Preoperative and follow-up function level (1=no limitations and 5=unable to perform).

the treatment of chondral injuries of the knee in 48 professional and high-level athletes. All parameters measured revealed significant improvement from microfracture to final follow-up. In addition, no difference in outcome parameters was noted when the subgroup of athletes who had concomitant ACL reconstruction was compared to a subgroup without reconstruction.

Results of the present study are in agreement with the findings of Blevins et al.¹ All players showed marked improvement in all symptomatic and functional parameters measured. In addition, concomitant knee pathology did not seem to alter this pattern of improvement. Six players, however, did not return to play in the NFL. Many factors are associated with an athlete's decision to retire from his or her professional sport. The number of games played and the average age of the patients showed that many of the players might have been near the end of their careers. It was undetermined whether the results of their surgery were the primary reason for retirement. Most players indicated that this was a decision based on many factors (ie, age, familial factors, etc).

In a previous publication on the results of microfracture in competitive athletes,¹ continued improvement was noted in pain scores and functional capacity after the first postoperative year. In many patients, optimal results do not occur until after the second postoperative year.^{8,9} Thus, in a sport such as professional football where immediate return to play is often the goal, some players may retire prior to achieving maximum improvement from microfracture.

A concern regarding "marrow-stimulation" techniques in the treatment of chondral lesions has been the durability of the repair tissue. The cartilaginous tissue that appears after such procedures "does not duplicate the composition, structure, or mechanical properties of normal articular cartilage."² However, this tissue has been demonstrated to improve symptoms and joint function at long-term follow-

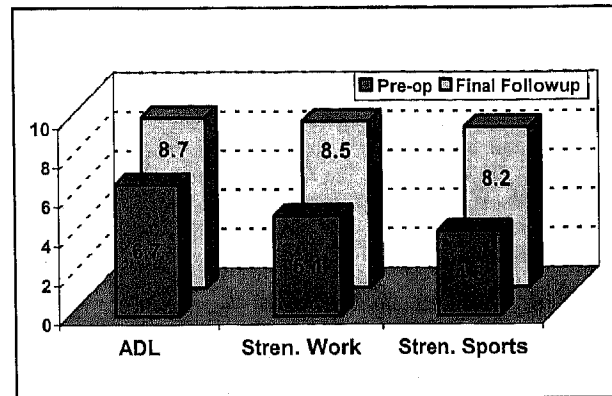


Figure 3. Preoperative and follow-up activity levels (10=full activity level and 0=unable to perform). Abbreviations: ADL=activities of daily living and Stren=strenuous.

up. This point is best illustrated by one of the patients in this series, a linebacker who has completed 13 seasons of play after isolated microfracture of a medial femoral condyle lesion.

Three limitations are noted in this study. First, a control group undergoing no treatment or alternative resurfacing techniques was not included. However, all players had significant limitation preoperatively, hence each player effectively served as his own control. This was a functional outcome case series of NFL football players with chondral lesions of the knee who underwent microfracture, therefore it was not designed with a separate control cohort.

The second limitation is that the study group was restricted to a specific cross-section of elite athletes. How this might impact the results is unclear. For example, the athletes in question received extensive daily physical therapy by professional trainers. Although the rigorous therapy regimen may have helped improve outcomes, the desire to return to the sport and the extreme demands of professional football may have negatively impacted their ability to continue to perform their sport.

The presence of repair tissue in the treated chondral defects was not defined in all of the patients, which is a third limitation. This study is a functional outcome case series. Objective measures of chondral resurfacing, such as follow-up MRIs, are an area of future research to provide additional data on this patient population.

Results of microfracture to resurface full-thickness chondral lesions in high-demand NFL players are encouraging. Microfracture is safe, effective, and appears to markedly improve symptoms, function, and activity levels in NFL players. This technique may increase career longevity and help players return to play following chondral injuries to the knee.

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