Clinical outcomes after microfracture treatment of full-thickness articular cartilage lesions of the knee

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Purpose: The purpose of the study is to evaluate the clinical results after microfracture treatment of the full-thickness articular lesions of the knee.

Methods: This study presented clinical outcomes of 51 patients with focal full thickness articular cartilage lesion who were treated with microfracture technique and evaluated according Lysholm-Tegner, Oxford, Womac and KSS scores. According the age we examined of patients younger than 35 years and second group between 36-60 years old. Results: On the basis of follow-up at minimum 18 months, mean improvements in Lysholm-Tegner scores in younger group (from 38.4-94.1) in older group (from 37.1-87.3), Oxford scores in younger (from 29.5-45.2) and older group (from 25.5-50.5), and Womac score in younger group (from 51.1-94.8) in older (from 50.8-87.8). There was a strong and significant correlation between functional results and age of the patients with full-thickness cartilage lesion less than 2 cm in diameter. Conclusions: According to our short term results, microfracture technique is effective treatment for the full-thickness cartilage lesions with regard to the improvements of daily activities with a favorable impact on pain relief and better functional results. There was a strong correlation between functional results and age, size of defect location of defect as prognostic parameters.

Key words: cartilage lesion, Lysholm-Tegner, Oxford, Womac

INTRODUCTION

Within the past decades, much attention has been paid for cartilage lesions. Full-thickness articular cartilage lesions are among the most important and challenging problems for which there is no definite consensus regarding the preferred surgical management.

Different types of treatment can be used for cartilage injuries from conservative methods to prosthetic replacement. The goal of the treatment is to fill the cartilage defect with new hyaline-like cartilage tissue for good range of motion and satisfactory joint function. Untreated cartilage lesion associated with pain and edema end as osteoarthritis.

Surgical treatment include: reparative (marrow stimulation techniques) and restorative techniques using autografts or allografts for the treatment of the articular cartilage lesions.

Microfracture is simple, cheap and classic marrow stimulation technique who is very rare associ

Mid- and longterm results of the microfracture at cartilage lesions treatment in all knee compartments according to cartilage defects less than 4 cm, is accepted as a first line of the treatment in young active patients with isolated cartilage lesions.

METHODS

In this retrospective study we analyzed 51 patients in a 3 years period on the basis of follow up at a mean of 18 months. Patients included in the study were with complete isolated cartilage lesions Gr. III et IV according ICRS classification system. All of the lesions involved medial or lateral femoral condyle.

Patients were treated with arthroscopic microfracture procedure using microfracture awls. After preparation the defect, creation of the holes was started from periphery to the center of the lesion 3-4 mm in depth at 3-4 mm intervals.

According the age, patients were divided into two subgroups (age 15-35; and 36-60). Clinical outcomes and functional results were evaluated according Tegner-Lysholm, KSS, Oxford and Womac scores preoperative, postoperative at 3, 12 and 18 months.
RESULTS

In the study we present comparative clinical results regarding analyzed Lisholm-Tegner, Oxford, Womac and KSS score at two age groups (younger than 35 years and older than 35 years).

Average score of Tegner-Lisholm scale are presented in table 1 during 18 months follow up. Preoperative results between two age groups are quite different (p=0,32), postoperative results are significantly different at 3 months (p=0,046) at 12 and 18 months difference between two age groups is highly significant (p=0,00024 et p=0,00029).

These results shows that functional outcomes after arthroscopic microfracture procedure are significantly better in age group between 15-35 years.

Average preoperative results at Oxford scale in younger group were 29.5, in older group were 25.6. At the end of follow-up mean average in the first group were 45.3, in older group 40.2. (table 2.)

Statistical analyzes confirmed the significant difference in the values at Oxford scale between two age groups in all time points.

Average scores according womac score system are presented in Table 3 at the patients in two age groups.

Preoperative relative homogenous group with average 51.5 Womac score turn into two different age groups with highly significant difference in improvements at younger population at 3 months follow-up (p=0,0003), at 12 months (p=0,00005) and 18 months (p=00004).

Preoperative values of KSS scale, in age group between 15-35 years, were average 47,2, in the older group preoperative results were 44.9. At the end of follow up period -18 months average postoperative KSS scores in younger group were 94.3, in older group average score was 85.8.

Statistical analyzes confirmed significant difference among two population in all time zones, regarding better postoperative results in young patients.

DISCUSSION

This study demonstrated that arthroscopic microfracture procedure resulted in increased functional scores in patients treated for symptomatic cartilage lesions at a minimum follow-up of 18 months.

Many studies in recent years attempted to determine the best treatment option for knee cartilage defects, investigating a large variety of surgical techniques and available products.1,2

The overall clinical results with microfracture in our study are comparable with those in previous reports, which have shown improved knee function in 70% to 95% of patients.3,4,5

Steadman et al. reported that their patients had substantial increases in the ability to perform the activities of daily living, strenuous work, and sports after microfracture. This finding is consistent with the significant increase in the activities of daily living scores observed in our study. Besides the changes in the activities of daily living score, we also observed significant increases in the Lys-
Since the decrease in knee function after twenty-four months was primarily observed in patients with a poor fill grade after cartilage repair, our study provides the first clinical evidence that repair cartilage volume plays a critical role in the durability of functional improvement in the knee after microfracture repair. Similar to the 17% rate of poor fill (four of twenty-four patients) in our study, Blevins et al. described the persistence of subchondral bone exposure in 8% to 35% of the lesions treated with microfracture at the time of second-look arthroscopy. Poor filling may explain the decrease in function observed in some of the athletes in that study. While deterioration was seen in all patients with poor fill in our study, our data indicated that deterioration of knee function is not limited to patients with a poor fill grade and that other factors must be considered. The study present the results from arthroscopic procedure in two different age groups with focal cartilage lesions. Effectiveness of the treatment is seen in significant improvements in functional outcomes and clinical results according Lysholm-tegner, Oxford, Womac and KSS scores from preoperative to all time zones during follow up. Bone marrow stimulation techniques produced similar results in comparison with autologous chondrocyte implantation.

A current systematic analysis of the existing clinical literature of the microfracture in the knee revealed that this technique electively improved knee function in all studies during the first two years. Several factors were identified that affected clinical outcome. Disadvantages of the technique include limited hyaline repair tissue, variable repair cartilage volume and functional deterioration. Like described in the literature, we show a correlation between clinical results and patient age.

In general, for measuring and evaluating the clinical outcome of a given treatment strategy, patient satisfaction and improvement are most important and are the best assessed by well established clinical outcome scores. The purpose of this study was to evaluate the efficacy of MF technique for the treatment of full thickness chondral lesions. In particular, Blevins et al makes the case that the progressive nature of untreated full thickness chondral injuries results in localized pain, particularly synovitis, which may result in inflammation, effusion and further cartilage injury. This detail would make it irresponsible to attempt to have a blinded controlled study. All of the studies evaluated in - this paper, with the exception of Gudas et al, focus specifically on MF as the single treatment modality for full thickness chondral injuries.

Reliable and satisfying clinical results have been reported for treating lesions on femoral condyles contraindication for microfracture repair in the knee. Previous studies have shown that articular cartilage repair after microfracture in patients who are less than thirty years old had better clinical outcomes.

A trend toward better functional scores in patients who were younger than thirty years was also observed in our patients and may be attributed to an age-dependent quali-

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### TABLE 1

<table>
<thead>
<tr>
<th>Lysholm-Tegner score</th>
<th>Group</th>
<th>stats (mean±SD)</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>age 15-35</td>
<td>age 36-60</td>
<td></td>
</tr>
<tr>
<td>preoperative</td>
<td>38.42±10.87</td>
<td>37.11±145.2</td>
<td>Z=1.0 p=0.32</td>
</tr>
<tr>
<td>3 months</td>
<td>93.29±3.2</td>
<td>90.33±5.46</td>
<td>Z=1.99 p=0.046*</td>
</tr>
<tr>
<td>12 months</td>
<td>94.08±3.6</td>
<td>88.44±5.8</td>
<td>Z=3.67 p=0.00024**</td>
</tr>
<tr>
<td>18 months</td>
<td>93.5±4.3</td>
<td>87.33±6.28</td>
<td>Z=3.63 p=0.000029*</td>
</tr>
</tbody>
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*p<0.05, **p<0.01

### TABLE 2

<table>
<thead>
<tr>
<th>Oxford score</th>
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<th>stats (mean±SD)</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>age 15-35</td>
<td>age 36-60</td>
<td></td>
</tr>
<tr>
<td>preoperative</td>
<td>29.46±4.9</td>
<td>25.26±5.03</td>
<td>Z=2.59 p=0.009**</td>
</tr>
<tr>
<td>3 months</td>
<td>44.87±2.15</td>
<td>42.26±3.2</td>
<td>Z=3.16 p=0.016**</td>
</tr>
<tr>
<td>12 months</td>
<td>45.58±2.76</td>
<td>41.07±3.44</td>
<td>Z=4.24 p=0.00002**</td>
</tr>
<tr>
<td>18 months</td>
<td>45.29±2.9</td>
<td>40.18±3.69</td>
<td>Z=4.36 p=0.00001**</td>
</tr>
</tbody>
</table>

Similar to our findings, the most substantial improvement after microfracture has been shown to occur within the first two postoperative years in several other studies.

In contrast to some other studies, our findings indicated a deterioration of knee function after two years.

The limitation of follow-up to two years or less may have prevented this observation by some authors. As we found in our patients, other investigators have observed that pain scores decreased in recreational athletes three years after microfracture and Tegner scores declined in 80% of the patients two years after microfracture. The reason for this decline in functional score has not yet been identified. While some patients may simply change their interest in a given sport, Steadman et al. observed that deterioration of knee function occurred in some patients who did not demonstrate repair cartilage fill at second-look arthroscopy.

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Microfracture is a technically simple and an inexpensive classical marrow stimulation technique that causes hardly any patient morbidity. It results in good medium-to-long-term outcomes in all knee compartments for defects up to about 4 cm² and is an accepted first-line procedure in younger patients with small, isolated defects not only on the femoral condyles but also in the patellofemoral joint. More invasive and expensive cell transplantation techniques should yield clinical outcomes at least equivalent to microfracture. Possible shortcomings of microfracture include limited hyaline repair tissue and variable repaired cartilage volume, which may result in a possible functional deterioration over time. Reports regarding long-term durability are conflicting.

Previous studies have shown that articular cartilage repair after microfracture in patients who are less than thirty years old had better clinical outcomes. A trend toward better functional scores in patients who were younger than thirty years was also observed in our patients and may be attributed to an age-dependent qualitative and quantitative difference in metabolic activity in the repair cartilage. However, we were unable to detect a statistical correlation between age and repair tissue fill volume in the cartilage defect. This may be due to the fact that magnetic resonance imaging studies were available for only half of our patients.

The preoperative duration of symptoms was found to be an important factor for cartilage repair with microfracture in our study, as significantly fewer patients with preoperative intervals of more than twelve months showed improved activities of daily living scores. Similarly, prolonged preoperative intervals also have been associated with an inferior grade of repair cartilage at second-look arthroscopy after microfracture. A worse functional outcome has also been observed for both autologous chondrocyte transplantation and mosaicplasty after a prolonged preoperative duration of symptoms.

Cartilage defects left untreated for prolonged periods may lead to the development of early degenerative joint changes, particularly at the margin of the defects, perhaps with late repair in our study and other investigations. Our findings, therefore, further emphasize the importance of early surgical treatment of articular cartilage lesions.

**CONCLUSION**

Improvements in clinical results and functional outcomes according functional scores favorate arthroscopic microfracture procedure. In summary, microfracture provides subjective functional improvement and significantly increased activity levels in patients with isolated articular cartilage lesions of the femur. The best functional results are observed in younger patients with a good repair cartilage volume on magnetic resonance imaging, patients with a lower body-mass index, and those with a shorter preoperative duration of symptoms. Poor defect filling frequently results in limited functional improvement and durability of the repair.

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**TABLE 3**

<table>
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<tr>
<th>Group</th>
<th>stats (mean±SD)</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>age 15-35</td>
<td>51.18±4.9</td>
<td>Z=1.92 p=0.054</td>
</tr>
<tr>
<td>age 36-60</td>
<td>50.18±8.63</td>
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</table>

**TABLE 4**

<table>
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<tr>
<th>Group</th>
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</tr>
</thead>
<tbody>
<tr>
<td>age 15-35</td>
<td>47.21±6.29</td>
<td>Z=1.22 p=0.22</td>
</tr>
<tr>
<td>age 36-60</td>
<td>44.96±6.14</td>
<td></td>
</tr>
</tbody>
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SYMMARY

CLINICAL OUTCOMES AFTER MICROFRACTURE TREATMENT OF FULL-THICKNESS ARTICULAR CARTILAGE LESIONS OF THE KNEE

Cilj studije je evvaluacija kliničkih rezultata posle tretmana artroскопског mikroфrakturiranja kompletnih zglobnih oštećenja hrskavice kolena. Ova prospektivna studija prikazuje kliničke nalaze kod 51 pacijenta sa kompletnim zglobnim oštećenjem kolena koji su bili tretirani sa metodom artroскопског mikroфrakturiranja i bili su evaluirani po Lysholm-Tegner, Oxford, Womac i KSS funkcionalnim skorovima. Ishpitanci su podeljeni u dve grupe: mlade do 35 godina i starije od 36-60 godina. U toku praćenja od minimum 18 meseci, srednje poboljšanje funkcionalnih rezultata bilo je sledeće: u prvu grupu (od 38.4 na 94.1) kod starije (od 37.1 na 87.3), Oxford score, kod mladih (od 29.5 na 45.2) dok kod starije (od 25.5 na 50.5), i Womac rezultate kod mladih ispitanci (od 51.1 na 94.8) kod uzrasne grupe (od 50.8 na 87.8). Postoji jaka i značajna korelacija izmedju funkcionalnih rezultata i uzrasta pacijenta sa kompletnim malim zglobnim oštećenjima kolena. Zaključak: Ova studija potvrđuje da je tehnika artroскопског mikroфrakturiranja efikasan tretman zglobnih oštećenja hrskavice kolena i prikazuje poboljšanja u dnevnim aktivnostima ispitanika sa posebnim akcentom na prestanak bolova i boljih funkcionalnih rezultata. Postoji značajna korelacija izmedju funkcionalnih rezultata, uzrasta i veličine oštećenja zgloboine rskavice kolena kako prognostički parametar.


REFERENCES