Results of Arthroscopic Partial Meniscectomy in Patients with Generalized Joint Laxity

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Results of Arthroscopic Partial Meniscectomy in Patients with Generalized Joint Laxity

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Abstract

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Purpose **:** The purpose of this study was to the functional and radiographic outcomes of isolated arthroscopic partial meniscectomy between patients with generalized joint laxity and patients with normal joint laxity at 5-year minimum follow-up evaluation and to determine the influence of preexisting generalized joint laxity on the results of arthroscopic partial meniscectomy. I used 2 homogenous groups, defined with strict criteria.

Materials and Methods **:** The Beighton and Horan criteria were used to determine generalized joint laxity. 21 patients with excessive joint laxity who met the criteria (Group L) were carefully matched to 21 patients with normal joint laxity who met the established criteria (Group N) for sex, age and medial/lateral meniscus injury. The patients were evaluated clinically using the International Knee Documentation Committee (IKDC) grade and the Lysholm

score. Radiologic arthritic changes at final follow-up were evaluated by use of the classification of Tapper and Hoover.

Results **:** Preoperative and postoperative Lysholm score and IKDC grades were similarly excellent in both groups. Osteoarthritic changes were shown in 38% of the patients in group L and in 29% of the patients in group N lateral arthroscopic partial meniscectomy. There were more osteoarthritic changes in respect of frequency and severity in patients with generalized joint laxity than in patients with normal joint laxity, but this finding was not statistically significant.

Conclusion **:** Clinical and functional results are similar in both groups. Although no statistically significant difference was found between the groups, a trend toward higher progress of radiologic sign of osteoarthritis in patients with generalized joint laxity was observed. Studies with a longer follow-up are needed to conclude whether the preexisting generalized joint laxity eventually will influence the clinical and radiographic outcomes of arthroscopic partial meniscectomy.

Key words : Arthroscopy, Generalized joint laxity, Partial meniscectomy

Results of Arthroscopic Partial Meniscectomy in Patients with Generalized Joint Laxity

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I. Introduction

Arthroscopic partial meniscectomy is one of the most commonly performed orthopedic procedures. Although repair of the meniscus has become more popular in recent years, there are still many cases where repair is not thought to be possible and the surgeon performs a partial meniscectomy. Study of the determinants of poor surgical results would aid in identifying subsets of patients who might be approached differently or receive more accurate information about the expected outcomes of surgery. There are numerous reports on the outcomes after arthroscopic partial meniscectomy. These studies have identified a number of factors associated with worse outcomes after arthroscopic partial meniscectomy including the extent of cartilage damage

noted on preoperative radiographs or observed intraoperatively, size of meniscal resection, degenerative (vs traumatic) type, varus knee alignment, older age, female gender, higher body mass index (BMI), preoperative SF-36 functional status score, and ligamentous laxity[1-2]. However, in spite of the studies suggesting the association of meniscal damage or knee injury with generalized joint laxity[3-6], a paucity of information exists in the literature concerning the influence of generalized joint laxity on clinical and radiographic outcomes after arthroscopic partial meniscectomy. The purpose of this study was to compare the functional and radiographic outcomes of arthroscopic partial meniscectomy between patients with generalized joint laxity and patients with normal joint laxity at 5-year minimum follow-up evaluation and to determine the influence of preexisting generalized joint laxity on the results of arthroscopic partial meniscectomy. I used 2 homogenous groups, defined with strict criteria.

II. Materials and Methods

I retrospectively reviewed the records of 171 patients who underwent isolated primary arthroscopic partial meniscectomy between February 2001 and December 2004. All patients were given a preoperative diagnosis of torn medial meniscus or torn lateral meniscus based on history, physical examination, and confirmatory magnetic resonance imaging. Subjects were selected on the basis of the following criteria: (1) an age of more than 18 years; (2) no articular cartilage erosion greater than Grade I according to the Outerbridge classification[7] at the time of surgery; (3) intact cruciate ligaments and no major concomitant ligament injury; (4) no history of surgery involving the lower extremity ; (5) Follow-up greater than 5 years. On the basis of these criteria, 89 patients were excluded from the study. The remaining 93 patients were subdivided into subsets according to the joint laxity status. Beighton and Horan criteria[8] (**Table 1**) was applied for evaluation of generalized joint laxity before surgery.

Table 1. Beighton and Horan Criteria for Generalized Ligamentous Laxity

1. Passive dorsiflexion of the little fingers beyond 90°
2. Passive apposition of the thumbs to the flexor aspects of the forearms
3. Hyperextension of the elbows beyond 10°
4. Hyperextension of the knees beyond 10°
5. Forward flexion of the trunks, with the knees straight, so that the palms of the hands rest easily on the floor

A patient receives 1 point for the ability to perform each of the listed actions

The patients who were considered to have generalized joint laxity had four or five positive findings of these criteria, including hyperextension of the contralateral knee. According to the Beighton and Horan criteria[8], the patients were classified as falling into gray zone when they had one or less positive finding, and as having normal joint laxity when they had one or no positive findings. Of the 93 patients, 47 patients had normal joint laxity, and 21 patients had excessive joint laxity. All 21 patients with excessive joint laxity who met the criteria (Group L) were carefully matched to 21 patients with normal joint laxity who met the established criteria (Group N) for sex, age (within 3 years) and medial/lateral meniscus injury. In order to enhance dichotomous characteristic of Beighton and Horan criteria, 25 patients who fell into Gray zone were also excluded form the current investigation. The demographic data, postoperative follow-up period, and duration of symptoms before surgery did not differ significantly between Group L and group N (**Table 2**).

Table 2. Patient demographics

	Group L	Group N	*P* Value
Number of patients	21	21	
Age (years) *	28.7 (19-43)	28.9 (19-42)	0.913
Male/female (n)	12/9	12/9	
BMI* (kg/cm^2) *	22.2 (16.9-5.51)	21.8 (18.4-25.9)	0.506
Medial/lateral (n)	15/6	15/6	
Duration (months) *	20.2 (0.5-80)	21.7 (1-120)	0.851
Follow-up (months) *	72.3 (60-89)	73.9 (60-95)	0.534

* Values expressed as means with ranges in parentheses; Group L = patients with generalized joint laxity; Group N = patients with normal joint laxity.

Clinical outcomes were obtained from data taken before surgery and at the latest follow-up. The clinical findings were assessed using the Lysholm scrore[9] and the rating system using the International Knee Documentation Committee (IKDC) form[10]. The Lysholm score was originally developed for evaluation of ligamentous reconstruction of the knee, but it has also been shown to provide an excellent objective measure of results after meniscal surgery[11]. The IKDC form was originally created to evaluate results of treatment of knee ligament injury[10]. For that reason, in order to apply the IKDC form to the patients who underwent isolated arthroscopic meniscectomy, the first four categories in the eight categories of the form were used[12]: the patient's subjective assessment, the symptoms, the range of motion and the stability of the ligament. Each category is assessed by four grades:, normal (A), nearly normal (B), abnormal (C), severely abnormal (D). The lowest grade within a category determines the grade of a category and the lowest grade of a category determines the final overall grade.

Radiographs of the meniscectomized knee were obtained at follow-up study in all patients. All radiographs were reviewed independently and anonymously from clinical examination by two orthopedic surgeons. The radiographs were evaluated for signs of degenerative changes. Radiographic changes were graded according to the classification of Tapper and Hoover[6], based on the criteria reported by Fairbank[13]: Grade 0, normal; Grade I, squaring of the tibial margin; Grade II, flattening of the femoral condyle and squaring

and sclerosis of the tibial plateau; Grade III, narrowing of the joint space or hypertrophic change or both; Grade IV, all of these to a more severe degree.

Statistical analysis was performed with aid of the statistical package for social sciences, version 13.0 (SPSS Inc., Chicago, Illinois). The clinical and radiological grade data were analyzed using Fisher's exact test. The Mann-Whitney test was used for analysis of differences in Lysholm scores between the groups. A *P* value less than 0.05 was considered statistically significant.

III. Results

Preoperatively, average Lysholm scores of Group L (62.6 ± 6.6) were similar (p = 0.512) to those of Group N (64.1 ± 4.9). At final follow-up, the average Lysholm scores were 88.4 ± 5.8 and 89.4 ± 5.4 in Groups L and N, respectively (**Table 3**). According to the rating system using the IKDC form, the two groups had similar strenuous activities preoperatively. At the postoperative evaluation, in Group L, 9.5% (two of 21) were graded as A (normal), 47.6% (10 of 21) were graded as B (nearly normal), and 42.9% (9 of 21) were graded as C (abnormal). In Group N, 19% (four of 21) were graded as A, 52.4% (11 of 21) were graded as B, and 28.6% (six of 21) were graded as C (**Table 4**). There was no difference (p = 0.214) in the IKDC grade between groups.

Table 3. Lysholm functional knee score

Status	Group L	Group N	P value
Preoperative	62.6 ± 6.6	64.1 ± 4.9	0.512
Postoperative	88.4 ± 5.8	89.4 ± 5.4	0.614

* Mean ± standard deviation; Group L = patients with generalized joint laxity; Group N = patients with normal joint laxity.

Table 4. IKDC grade

Status		A	B	C	D	P value
Preoperative	Group L	0	0	12	0	0.215
	Group N	0	1	7	13	
Postoperative	Group L	2	10	9	0	0.490
	Group N	4	11	6	0	

IKDC = International Knee Documentation Committee; Group L = patients with generalized joint laxity; Group N = patients with normal joint laxity.

Preoperatively, none of the patients enrolled in the current investigation were classified as having radiographic evidence of arthritic change in the knee according to the Tapper and Hoover classification. Postoperatively, in Group L, thirteen patients (61.9%) showed no radiologic signs of osteoarthritic changes in the meniscectomized knee. Eight patients (38.1%) had arthritic changes, of which four were classified as Grade I, and three were classified as Grade II. Remaining 1 patient was classified as Grade 3. In group N, no radiologic evidence of osteoarthritis was shown in the meniscectomized knee in fifteen patients (71.4%). Six patients (28.6%) had arthritic changes, of which five were classified as Grade I, and one was classified as Grade II. There were more osteoarthritic changes in respect of frequency and severity in patients with generalized joint laxity than in patients with normal joint laxity, but this finding was not statistically significant (**Table 5**).

Table 5. Radiological results according to Tapper and Hoover classification

	0	I	II	III	IV	P value
Group L	13	4	3	1	0	0.707
Group N	15	5	1	0	0	

Group L = patients with generalized joint laxity; Group N = patients with normal joint laxity.

Only 1 secondary procedure was required after the index procedure. The patient was in Group L and underwent arthroscopic subtotal meniscectomy on the same meniscus (lateral meniscus) 56 months postoperatively. Because there was no definite additional traumatic insert and the surgery was performed on the same meniscus, I could not determine if it was a new meniscal tear or if the original injury was incompletely treated at the first time. The response of the knee was satisfactory.

IV. Discussion

The term generalized joint laxity indicates a condition in which most of an individual`s synovial joints move beyond the normal limit of range of motion. Range of motion that a joint is capable of is determined by the flexibility of the restraining ligaments. The laxity or tightness of a joint and its supporting capsular and ligamentous structures is largely determined by non-modifiable characteristics (those that are structural and physiologic and difficult to change with non-invasive methods). These joint characteristics are primarily influenced by the inherent connective tissue extensibility that is determined by the composition of connective tissue and the orientation of the various soft-tissue structures. Thus, the increased connective tissue flexibility in generalized joint laxity is considered to be of primarily genetic origin, given its common autosomal dominant presentation[14], and it was suggested that generalized joint laxity or tightness cannot be readily altered by stretching[15]. Although many of the genes responsible for the monogenetic disorders associated with generalized joint laxity have been identified[16], the cause of idiopathic generalized joint laxity requires further investigation. In general, laxity decreases with age, females are more lax than males (although this is less true in young children), and nonwhites are more lax than whites. To adjust these variables, a matched paired study in terms of age, gender and race (all Asian-Koreans) was performed in the present investigation.

The prevalence of generalized joint laxity in published reports varies from 5% to 43% in adults[17-18] and 2% to 55% in children[19]. Such a large variation may be explained by the use of different measuring instruments and different cutoff points in Beighton-Horan index. However, many studies have been performed based upon Beighton methods although there is no universal agreement for generalized joint laxity criteria among authors using cutoff level. One of the inherent limitations of the current study is that the clinical index for joint laxity is subject to observer bias. This may lead to misinterpretation of the severity of generalized joint laxity. Therefore, to enhance reliability of the test, evaluation skills should be tested for consistency between the examiners. I could not provide consistency owing to the retrospective nature of the investigation. However, several studies have shown superior reproducibility and concurrent validity of Beighton-Horan index than other various methods[20-23], and, in this study, data collections were performed by experienced clinical fellows so that observer bias could be minimized. Clinically, this method has many advantages, since it can be carried out very easily without any special measuring instruments and applies a dichotomous principle. In order to enhance this dichotomous feature and eliminate the negative effect of arbitrarily determined cutoff value, a gray zone was set and the patients who fell into this category were excluded from this investigation.

Generalized joint laxity may contribute to the genesis of osteoarthritis, and several investigations have indeed indicated that it can be a factor favoring

joint degeneration[24-25] One confirmative study showed that in a series of 16 cases, 11 displayed widespread osteoarthritis, as opposed to 2 cases in matched controls[26]. The etiology and pathogenesis of osteoarthritis is unknown but may be associated with abnormal joint connective tissue and abnormal joint biomechanics of stress[27]. Generalized joint laxity may be associated with abnormal 'loose' connective tissue and abnormal joint biomechanics[27-29]. Thus generalized joint laxity may be associated with two mechanisms which are suggested as playing a causative part in the pathogenesis of osteoarthritis.

Baker et al[3] suggested that meniscal injury is associated with joint laxity as assessed by Beighton and Horan score. The biological explanation for the association of meniscal damage with joint laxity is unknown. Possibilities include increased mechanical loading of the meniscus in a knee with a lax joint capsule or ligaments, as well as shared structural defects in the collagen that makes up part of the joint capsule, supporting ligaments, and meniscal fibrocartilage.

On the basis of these theoretical bases, I hypothesized patients who had generalized joint laxity, compared with those with normal joint laxity, would have worse outcomes regarding clinical outcomes and radiographic changes after isolated arthroscopic partial meniscectomy. In this study, I methodically compared these two groups at 5-year minimum follow-up evaluation. The clinical results are similarly excellent in both groups and not statistically different. These results compare favorably with reported results of

arthroscopic partial meniscectomy[30-32]. Osteoarthritic changes were shown in 38% of the patients in group L and in 24% of the patients in group N lateral arthroscopic partial meniscectomy. There were more osteoarthritic changes in respect of frequency and severity in patients with generalized joint laxity than in patients with normal joint laxity, but this finding was not statistically significant. This result may be attributed to the relatively small number of cases, and the relatively short follow-up period. I believe that a 5-year follow-up is a short period for evaluating the natural history of arthroscopic partial meniscectomy. Increased mechanical loading of the meniscus in knee with lax joint capsule or ligaments in patients with generalized joint laxity will likely have consequences on long-term radiographic changes and ultimately result in inferior functional outcome.

The present study had several additional weaknesses. First, the early dropout rate was relatively high. This may jeopardize the significance of the study. Second, some variables, including size of meniscal resection, type of meniscal tear, and receipt of Workers' Compensation, that can affect the outcome after arthroscopic partial meniscectomy were not taken into account because of relatively small number of samples. Thus, further studies must be conducted to include an assessment of the effects of these variables on the outcomes of arthroscopic partial meniscectomy in each group via gathering more samples.

V. Conclusion

In this study, I compared the clinical and radiographic outcomes of isolated arthroscopic partial meniscectomy between patients with generalized joint laxity and patients with normal joint laxity at 5-year minimum follow-up evaluation. Clinical and functional results are similar in both groups. Although no statistically significant difference was found between the groups, a trend toward higher progress of radiologic sign of osteoarthritis in patients with generalized joint laxity was observed. Studies with a longer follow-up are needed to conclude whether the preexisting generalized joint laxity eventually will influence the clinical and radiographic outcomes of arthroscopic partial meniscectomy.

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Abstract (In Korean)

전신적 인대 이완성을 동반한 환자에서 관절경적 반월상 연골 부분 절제술의 결과

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서 동 석

목적: 본 연구의 목적은 전신적 인대 이완성을 동반한 한자에서 관절경적 반월상 연골 부분 절제술 후 임상적, 방사선적 결과를 정상 인대 이완성을 가진 환자와 비교하여 분석하는 것이다.

재료 및 방법: 전신적 인대 이완성 동반 여부를 결정하기 위해 Beighton and Horan Criteria가 사용되었다. 5년 이상 추시가 가능전신적 인대 이완성을 동반한 21명의 환자(이완군)를 정상 인대 이완성을 가진 21명의 환자(정상군)와 비교하기 위해 성별, 연령, 손상 연골에 따라 1:1 대응하였다. 추시 기간은 최소 5년 이상으로 평균 6년이었다. 임상적 결과는 IKDC grade 및 Lysholm score로 평가하였고, 최종 추시 시의 방사선적 퇴행성 변화는 Tapper and

Hoover의 분류에 따라 판정하였다.

결과: 최종 추시 시의 Lysholm score 및 IKDC grade는 양 군에서 모두 유사한 정도로 양호하게 나타났다. 방사선적으로는 이완군의 환자 중 38%, 정상군의 환자 중 29%에서 관절의 퇴행성 변화를 보였으며 이완군에서 관절의 퇴행성 변화의 정도가 정상군보다 심한 경향을 보였으나. 통계적으로 유의한 차이는 없었다.

결론: 양군의 임상적 결과는 유사하였다. 통계적으로 유의하지는 않았으나 이완군에서 방사선적 퇴행성 변화가 정상군보다 보다 빠르게 진행되는 경향을 보였다. 전신적 관절 이완성이 결과적으로 관절경적 반월상 연골 부분 절제술의 임상적, 방사선적 결과에 영향을 미칠 것인지에 대한 결론을 내기 위해서는 보다 장기간의 추시가 필요할 것으로 사료된다.

핵심되는 말: 관절경, 전신적 인대 이완성, 반월상 연골 부분 절제술