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## Correlation between type of discoid lateral menisci and tear pattern

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**Abstract** This study analyzed the relationship between type of discoid lateral menisci and tear pattern. There were 108 consecutive cases (103 patients) with discoid lateral meniscus tear treated by arthroscopy. Regarding type of discoid meniscus (Watanabe's classification), 38 cases were "complete" and 70 cases "incomplete." There was no Wrisberg type. Tear patterns were classified into simple horizontal, complicated horizontal, longitudinal, radial, degenerative, and complex tear. The relationship between tear pattern and type of discoid menisci was statistically highly significant. Simple horizontal tear was found only in the complete type of case, and radial, degenerative, and complex tears were found only in the incomplete type of case. In the longitudinal tear, however, we found no correlation be-

tween tear pattern and type of discoid meniscus. In addition, the extent of meniscal resection was dependent on the tear pattern. Subtotal or total meniscectomy was performed significantly more frequently in longitudinal and complex tears. In radial and degenerative tears only partial meniscectomy was carried out. Complicated horizontal tears showed no difference in extent of resection. Among the 13 cases of simple horizontal tears partial meniscectomy was performed in 12 cases. These findings about relationship between the type of discoid menisci and tear pattern could be useful in planning operation and deciding extent of resection.

**Keywords** Discoid lateral meniscus · Type · Tear pattern

### Introduction

Studies on the discoid meniscus have been carried out in many fields since the first report by Young in 1889 [18]. However, most of these [1, 2, 4, 6, 16] have treated only a limited age group (mostly children), which is not the actual situation in which we meet patients of diverse age groups. Discoid lateral meniscus is known to be relatively rare in Western countries, with a reported incidence of 0.7–5.2% [3, 16, 10, 11]. On the other hand, a relatively high incidence has been reported in Koreans and Japanese. Seong and Park [12] reported that 15.3% of patients who underwent arthroscopy during a given period had discoid lateral meniscus, and Ikeuchi [7] discovered dis-

cid lateral meniscus in 16.6% of arthroscopic procedures.

Watanabe [17] has classified the discoid lateral meniscus into complete, incomplete, and Wrisberg types based on the degree of coverage of the lateral tibial plateau and the presence or absence of the normal posterior meniscotibial attachment. Although this famous classification has been widely used, its significance for treatment is somewhat questionable. Classifications of the tear patterns such as that described by O'Connor [13] are thought to be more relevant in planning the degree of meniscal resection in symptomatic discoid lateral meniscal tears. O'Connor classified meniscal tears, either medial or lateral, into longitudinal, horizontal, oblique, radial, flap, complex, degenerative, and interstitial types.

In operating on discoid lateral meniscal tears we follow a number of principles [9] which are respected by most arthroscopic surgeons. First, if at all possible, the capsular rim of the meniscus should be preserved to maintain joint stability and congruence. Second, only the portion of the meniscus catching or impinging during weight bearing and causing symptom should be removed. Third, a careful trimming and contouring of the remaining rim should be carried out to prevent further tearing. Finally, the natural adjacent articular cartilage is protected during the meniscal resection. During surgery we decide the amount of resection on the basis of these principles, and we have found that the decision is closely related to the tear pattern, not to the type of discoid lateral menisci. Furthermore we have found a striking correlation between the type of discoid lateral menisci and the tear pattern. We report here the relationship based on our own clinical experiences, hoping that this will be helpful in preoperative planning and deciding the extent to which one should resect during surgery. To our knowledge, this is the first

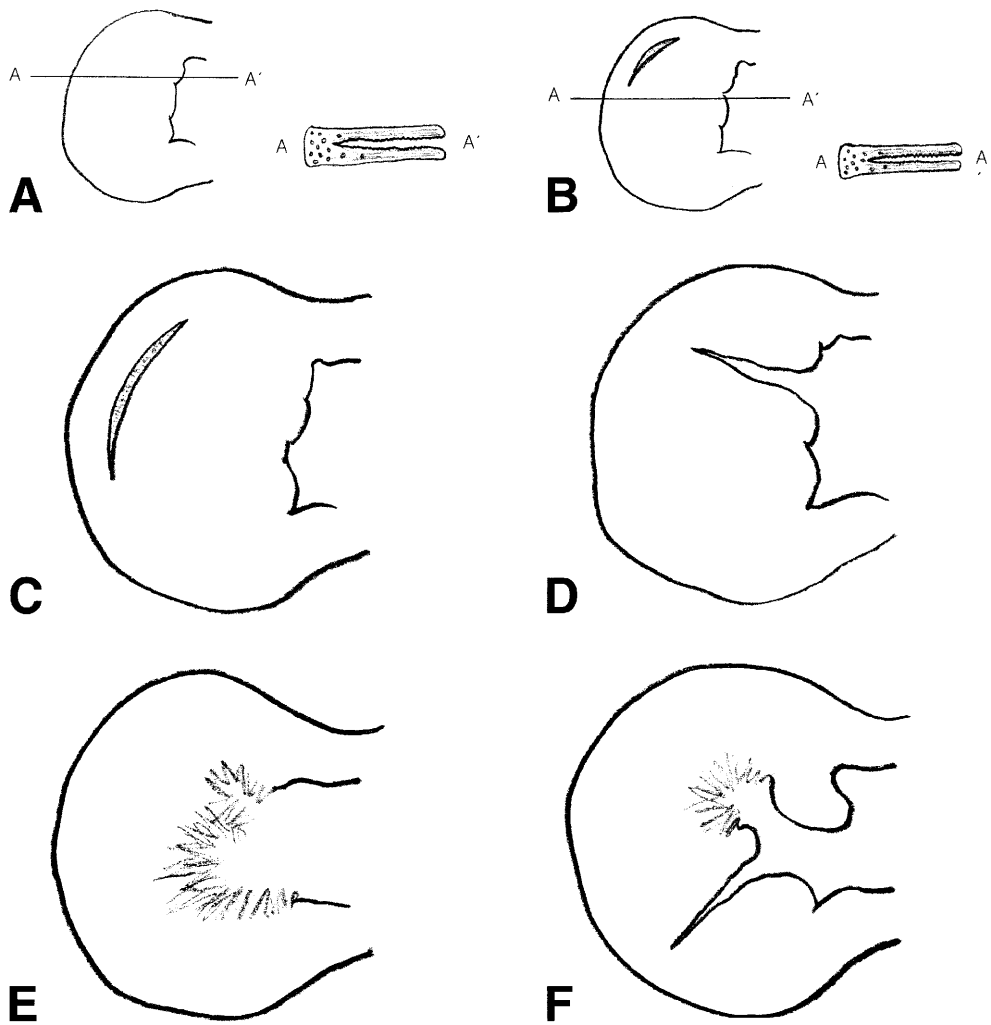
study of a correlation between the type and the tear pattern of discoid lateral menisci.

**Materials and methods**

We reviewed 108 consecutive cases (103 patients) of arthroscopic meniscectomies performed by the senior author (B.S.I.) for symptomatic discoid lateral meniscal tears between September 1996 and August 1999. There were 50 males and 58 females, and their age at surgery ranged from 6 to 71, with a mean age of 33.6. During the same period 987 arthroscopic operations were performed because of symptoms attributable to the meniscus or other structures of the knee. Among them, 150 knees (15.2%) had discoid meniscus whether torn or intact and 837 (84.8%) had nondiscoid meniscus. Torn discoid lateral meniscus was found in 108 knees (10.9%) and intact discoid lateral meniscus in 42 knees (4.3%). Nondiscoid lateral meniscal tear was found in 212 knees (21.5%), and the lateral meniscus was normal in the other 625 cases (63.3%).

This was a retrospective study. Operative findings, however, were recorded and collected in a standard, predetermined format by a single surgeon (B.S.I.). Based on detailed arthroscopic photographs and operation records we classified types of the discoid

**Fig. 1A-F** Schematic drawings of modified classification for discoid lateral meniscus tear. Simple horizontal (A), complicated horizontal (B), longitudinal (C), radial (D), degenerative (E), and complex tear (F)





**Fig. 2** Simple horizontal tear which was originally concealed is visible after a few bites



**Fig. 4** Longitudinal (peripheral) tear is seen on traction with probe



**Fig. 3A,B** Complicated horizontal tear. Obvious horizontal tear (A). In the same patient, peripheral tear is visible on probing (B)



**Fig. 5** Radial tear is visible on probing

lateral menisci as complete, incomplete, and Wrisberg according to Watanabe's [17] classification. We modified the well-known O'Connor [13] general classification of meniscal tears to classify variable tear patterns into more effective and simple category

(Fig. 1): simple horizontal tear (Fig. 2); complicated horizontal tear (Fig. 3) in which the main component of tear is horizontal, while another component is combined; longitudinal tear including peripheral and bucket-handle tear (Fig. 4); radial tear including oblique tear (Fig. 5); degenerative tear; and complex tear which is a combination of two major tear components except horizontal tear or a combination of three or more major tear components including horizontal tear. We regarded a degenerative tear as a tear which had shaggy and irregular edge as a result of repeated maceration. In a degenerative tear the original tear was usually not identifiable.

Treatments of the symptomatic meniscus consist of partial meniscectomy, subtotal meniscectomy, total meniscectomy, and partial meniscectomy followed by repair. Operative indications were enough pain in daily living which persisted more than 3 months, locking, and limitation of motion.

Two statistical variables (type of discoid lateral menisci and tear pattern) were summarized and analyzed by Fisher's exact test of statistical significance. In addition, relationship between the tear pattern and the extent of resection was analyzed by the same method. The distribution of each tear pattern according to the type of discoid meniscus and the relationship between extent of meniscal resection and tear pattern were analyzed by logit analysis and logistic regression.

## Results

By Watanabe's classification, 38 cases were complete, and 70 cases were incomplete. There was no case of a Wrisberg type. Tear patterns were as follows: 12 simple horizontal, 27 complicated horizontal, 34 longitudinal, 21 radial, 6 degenerative, and 8 complex. Tear patterns according to the type of discoid menisci were: in complete type, 12 simple horizontal, 15 complicated horizontal, and 11 longitudinal, but no case of radial, degenerative, or complex tears. On the other hand, in incomplete type, 12 complicated horizontal, 23 longitudinal, 21 radial, 6 degenerative, and 8 complex, but no case of simple horizontal tear were found (Table 1). On analysis, the distribution of the tear pattern according to the type of discoid menisci showed significant difference ( $P < 0.0001$ ). All simple horizontal tears were observed in complete type and complicated horizontal tear was found significantly more in complete type. On the other hand, all radial, degenerative and complex tears were observed in incomplete type. Longitudinal tear, however, showed no significant differences in distribution between complete and incomplete type.

For the treatment, types of surgery performed were 68 partial meniscectomies, 8 partial meniscectomies followed by meniscal repair, 24 subtotal meniscectomies,

and 8 total meniscectomies. The extent of resection according to the tear pattern showed a significant difference ( $P < 0.0001$ ). Subtotal or total meniscectomy was performed more often in longitudinal and complex tears. In radial and degenerative tears only partial meniscectomy was carried out. As to 13 cases of simple horizontal tears partial meniscectomy was performed in 12 cases. However, in cases of complicated horizontal tears the extent of resection was dependent on the tear pattern other than horizontal (Table 2).

On clinical follow-up, with a duration of 12–36 months, symptoms such as pain, locking and limitation of motion were improved in all cases. No patient has returned to clinic for reoperation of retear.

## Discussion

Discoid lateral meniscus is not a rare disease entity in Far Eastern countries such as Korea and Japan. In our clinic 15.2% of knees which need arthroscopic operation have discoid lateral meniscus. Since Watanabe [17] proposed a classification of the discoid lateral meniscus according to morphological basis, many authors have used the classification in their reports. He classified discoid menisci into three types: complete, incomplete, and the Wrisberg type. In the Wrisberg type the posterior meniscotibial attachment is absent, resulting in a hypermobile meniscus. Some authors [1, 3] recommend total meniscectomy with this type of discoid meniscus. In other series [6, 7, 15] no case of the Wrisberg type discoid meniscus was found. In 108 consecutive cases of our study there was no Wrisberg type discoid meniscus, and we think the Wrisberg type discoid meniscus is very rare, if any does exist.

Watanabe's classification is simple, easy method to use. The classification also encompasses two other theories [8, 14] as to the cause of the discoid menisci. However, we think that the classification in itself is less helpful in deciding the extent of resection in symptomatic discoid lateral menisci. On the other hand, O'Connor's classification, if modified, seems useful in planning surgery of torn discoid lateral menisci as in nondiscoid meniscal tears. O'Connor classified the patterns of meniscal tears into: longitudinal, horizontal, oblique, radial, flap, complex, degenerative and interstitial. Our classification is simpler than that of original O'Connor's. Longitudinal tears include peripheral and bucket-handle tears. Radial tears include radial and oblique tears. In our experience 36% (39 of 108 cases) had horizontal tear component. When horizontal tear was accompanied by another tear component, extent of meniscal resection depended mainly upon the latter; hence we subdivided horizontal tears into simple and complicated horizontal tear groups.

The distribution of the tear pattern has been reported in a number of studies. Smillie [14] stated that horizontal cleavage is the most frequent type of tear of a discoid

**Table 1** Tear patterns according to types of discoid lateral meniscus

Tear pattern	Type of discoid meniscus		
	Complete	Incomplete	Total
Simple horizontal	12	0	12
Complicated horizontal	15	12	27
Longitudinal <sup>a</sup>	11	23	34
Radial	0	21	21
Degenerative	0	6	6
Complex	0	8	8
Total	38	70	108

<sup>a</sup>Including peripheral and bucket-handle

**Table 2** Extent of meniscal resection according to tear patterns

Tear pattern	Extent of meniscal resection		
	Partial	Subtotal or total	Total
Simple horizontal	11	1	12
Complicated horizontal	20	7	27
Longitudinal	15	19	34
Radial	21	0	21
Degenerative	6	0	6
Complex	3	5	8
Total	76	32	108

meniscus. Ikeuchi [7] reported the incidence of each tear according to the type of discoid menisci. However, the classification of the tear pattern was neither comprehensive nor organized, and his main interest was about the operative technique and its long-term results. Hayashi et al. [6] reported detailed arthroscopic findings about the tear patterns according to the type of discoid menisci which differed substantially from our observation. They stated that longitudinal tear was the most frequent tear pattern found. In their series the age of the patients ranged from 4 to 15 years (mean 11.1), and we believe that the age of patients made a difference in tear pattern between their findings and ours. Although some authors have reported the distribution of the tear patterns, no study has focused on the relationship between the tear pattern and the type of the discoid menisci.

Dickhaut and DeLee [3] proposed that the treatment of different lesions found in discoid menisci should be individualized, and that factors such as the location of the tear, clinical presentation, extent of tear, and associated intra-articular findings should affect the choice of treatment. We agree with this and do not believe that the type of discoid menisci alone can be a decisive factor of the

treatment. Nevertheless, this study on the correlation between the type of discoid lateral menisci and the tear pattern can give a useful predictive idea about what kind of tears may be present, and it can be helpful to surgeons who must struggle to obtain a clear inspection of tears in very narrow space between lateral femoral condyle and thick and large discoid lateral meniscus.

It is striking that all simple horizontal tears were observed in the complete type, and all radial, degenerative, and complex tears in the incomplete type of discoid menisci. What makes remarkable differences in tear patterns according to the types of discoid menisci is a question that must yet be answered.

In summary, tear pattern showed a clear relationship to the type of discoid menisci. In addition, our newly proposed classification of tear patterns for discoid lateral menisci is a simple and useful method for use in planning treatment. This is the first study investigating the correlation between the type of the discoid lateral menisci and tear pattern. After long-term follow-up we hope to clarify the results of each treatment performed and relationship of the type of discoid lateral menisci, tear pattern, and proper treatment.

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