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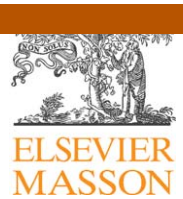

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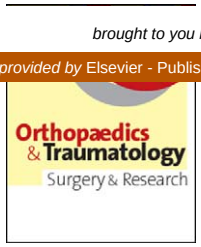

ORIGINAL ARTICLE

Discoid medial meniscus: Report of four cases and literature review

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KEYWORDS
Discoid medial meniscus;
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Summary
Introduction: Discoid medial meniscus is a rare abnormality, with incidence estimated at 0.12%. The present study describes this congenital abnormality anatomically and reports clinical results in four symptomatic cases managed by surgery.
Materials and method: A retrospective study included three patients (2 female, 1 male), one of whom had bilateral pathology. Mean age at consultation was 18.5 years (range, 13 to 28 yrs). Presenting symptoms were knee pain, associated with acute locking (1 case) or recurrent effusion (1 case). Plain X-rays were normal. MRI found discoid medial meniscus in all four cases, with intrameniscal hypersignal on T2-weighted sequences.
Results: Arthroscopy confirmed the discoid abnormality of the medial menisci. Meniscal tear was systematically associated: horizontal in two cases and vertical in the other two. Three cases showed insertion defect of the anterior horn of the discoid medial meniscus. All two cases were managed by meniscoplasty, removing the central part of the meniscus and sparing its peripheral part. Meniscal repair was associated in one case. Subjective results were assessed by KOOS score. At a mean 23 months' follow-up (range, 7 to 54 months), mean KOOS score was 82.7 (range, 77.6 to 86.4): 88 ± 5 for pain, 89 ± 8 for other symptoms, 98 ± 1 for function, 69 ± 17 for sports activity, and 69 ± 16 for quality of life.
Conclusion: Symptomatic discoid medial meniscus is frequently associated with bone insertion abnormality of the anterior horn. Meniscal tear is consistently present and revelatory, indicating meniscal tissue fragility, as in the lateral meniscus. Meniscoplasty, possibly with associated meniscal repair if the remaining meniscal wall is unstable, provides satisfactory but imperfect results while avoiding total meniscectomy, which would be disabling in this age group.
Level of evidence: Level IV Type of study: retrospective.

Introduction

Discoid meniscus is a rare anatomic variant, more often found in the lateral meniscus [1]. Young [2] reported the first case of discoid lateral meniscus in 1889. Cave and Staples

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[3], in 1941, reported the first two cases of partially discoid medial meniscus, a rare congenital anomaly with less than 70 cases in the literature [4—27]. A retrospective study including 14,731 menisci assessed incidence of discoid medial meniscus at 0.12%, compared to 1.5% for discoid lateral meniscus [14]; bilateral cases were even more rare (0.012%).

The present study reports our experience in a series of four cases of symptomatic discoid medial meniscus, one of which was bilateral, and seeks to describe this congenital abnormality anatomically and to report clinical results on the Knee Injury and Osteoarthritis Outcome Score (KOOS) [28,29] at a mean follow-up of 23 months (range, 7 to 54 months).

Materials and method

We report four cases of symptomatic discoid medial meniscus, one of which was bilateral, in three patients with a mean age of 18.5 years (range, 13 to 28 yrs). Table 1 presents patient data.

Pain was the main presenting symptom, located in the medial femorotibial compartment, associated with acute locking (1 case) or recurrent hydrarthrosis (1 case). Physical examination found normal joint motion, except in case 2 where there was acute locking and extension limited to 10°. All knees were stable, with normal axis. Meniscal maneuver induced medial femorotibial joint-line pain. In the bilateral case, the initial complaint was pain in the right knee (case 3), with the left knee asymptomatic until 3 years later (case 4).

Plain weight-bearing X-rays were normal; there was no medial femorotibial compartment asymmetry on PA Schuss view. MRI found complete discoid medial meniscus in all four cases, with high signal intensity on a T2 weighted image suggestive of meniscal tear (Table 1, Fig. 1A—D). The medial meniscus was systematically thicker than the lateral.

Arthroscopy was performed for diagnostic and therapeutic assessment.

Subjective results at end of follow-up were assessed on the KOOS scale [28,29]. Mean follow-up was 23 months (range, 7 to 54 months).

Results

Arthroscopic findings

Surgery was performed under arthroscopy. Medial femorotibial compartment exploration confirmed the diagnosis of discoid medial meniscus and was able to exclude any associated cartilage lesion (Fig. 2). The other compartments were normal. All four cases showed medial meniscus **tear** (Table 1). In three cases, there was also an anomalous insertion of the anterior horn of the discoid medial meniscus (Table 1, Fig. 3A—C). In one case (case 2), anterior meniscal insertion on the tibia was lacking (no anterior horn); the anterior segment showed continuity with the anterior intermeniscal ligament, which bridged over the ACL (Figs. 3B and 4). In two cases (cases 3 and 4), the anterior segment of the discoid medial meniscus showed absolute continuity with the anterior cruciate ligament (ACL) (Fig. 3C). No peripheral capsule fixation abnormality was **observed**.

Arthroscopic treatment

Surgery consisted in meniscoplasty, removing the central but conserving the peripheral part of the meniscus, so as to restore a semilunar shape (Fig. 5). Any unstable meniscal fragments were dissected. In one case (case 2), the posterior meniscal segment remained unstable, mainly in its superior layer, following partial meniscectomy. All-inside meniscal suture was performed using non-resorbable FasT-Fix™ implants (Smith & Nephew, Andover, MA).

Table 1 Present series.

	Case 1 ♀	Case 2 ♂	Case 3* ♂	Case 4* ♂
Side	Left	Left	Right	Left
Age at diagnosis	28 years	13 years	15 years	18 years
Presenting symptoms	Pain	Pain + acute locking	Pain	Pain + iterative effusion
Aspect of medial meniscus	Horizontal tear of mid-segment	Horizontal tear of mid-segment	Tear of anterior and mid segments	Vertical tear of posterior segment
Aspect of medial meniscus anterior horn	Normal	Continuity with anterior intermeniscal ligament	Continuity with ACL	Continuity with ACL
Treatment	Central meniscoplasty	Central meniscoplasty + meniscal suture	Central meniscoplasty	Central meniscoplasty

ACL: anterior cruciate ligament.
* Bilateral case.

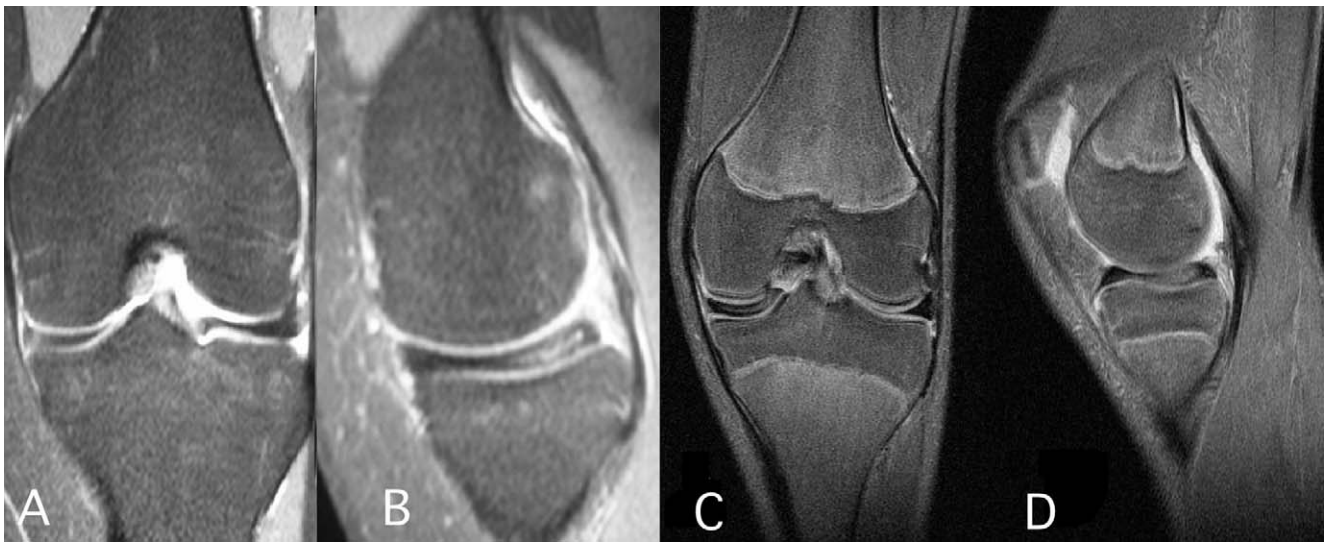

Figure 1 MRI of the left knee in case 1, showing a discoid medial meniscus with grade-2 signal. A. Coronal image showing the medial and lateral menisci extending to the intercondylar notch. B. Sagittal image of the same knee. MRI of the left knee in case 2 showing a discoid medial meniscus with grade-2 signal. C. Coronal image of the left knee in case 2 showing the medial and lateral menisci extending to the intercondylar notch. D. Sagittal image of the same knee. Both cases show discoid medial meniscus with grade-2 hypersignal, suggestive of horizontal meniscal tear.

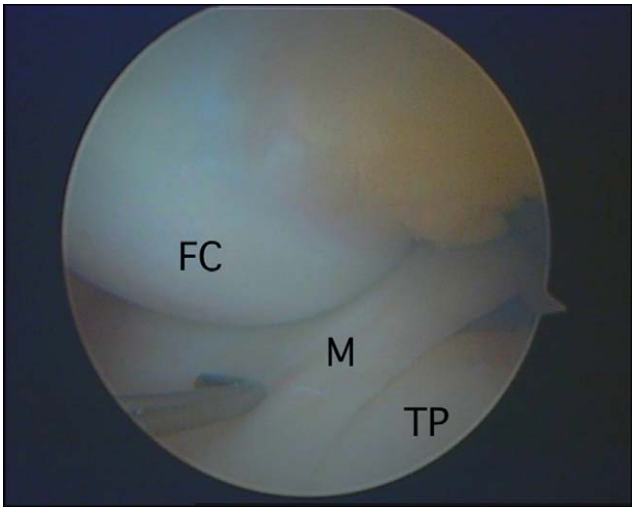

Figure 2 Arthroscopic view of the posterior segment of the discoid medial meniscus of the left knee (M), impinged between the bearing surface of the femoral condyle (FC) and the medial tibial plateau (TP) (case 2).

Complete weight-bearing was allowed, except in the case where meniscal suture was performed (case 2). A self-rehabilitation program was initiated as soon as pain-relief was achieved.

Functional results

There were no postoperative complications. Table 2 shows KOOS scale results: mean score on the four knees was 82.7 (range, 77.6 to 86.4). Joint motion was normal, with no cases of knee locking. One patient (case 3) complained of knee snapping, which he could induce on request by mobilizing his knee. In one patient (case 4), MRI at 1 year after central meniscoplasty revealed resection of the central part of the discoid medial meniscus associated with lateral subluxation of the remaining meniscus (Fig. 6).

All three patients were able to resume everyday activities and sports, such as cycling or running, but pivoting activities remained impossible for two patients (cases 1 and 4), triggering severe pain. All patients reported some disabling medial femorotibial compartment pain.

Discussion

Discoid medial meniscus is a rare abnormality, with incidence estimated at 0.12% [14]; bilateral cases are even more rare [5,7—11,13,14,16—19,23]. Table 3 presents the most recent publications; the largest series comprised only eight cases, without iconography [14].

The origin of discoid meniscus is disputed. Smillie [22] implicated defective disappearance of the meniscal center during fetal development, with persistence of a fetal stage into adulthood. Several later studies demonstrated that the embryonic meniscus never takes on a discoid shape [30—33]. According to Kaplan [30], discoid lateral meniscus is a pathologic entity developing under certain conditions and influenced by mechanical factors such as posterior segment hypermobility; however, he had no explanation for discoid medial meniscus. Anatomically, the latter may be associated with abnormal anterior horn insertion on the ACL [7—9,14,25,27,34,35], with ipsilateral discoid lateral meniscus [4,5,27] or meniscal cyst [6,26]. In 1979, Watanabe et al. [36] classified discoid lateral meniscus according to degree of tibial plateau cover and presence/absence of posterior attachment; this 3-type classification (complete, incomplete and Wrisberg variant) was designed for discoid lateral meniscus, and remains debatable since degree of tibial

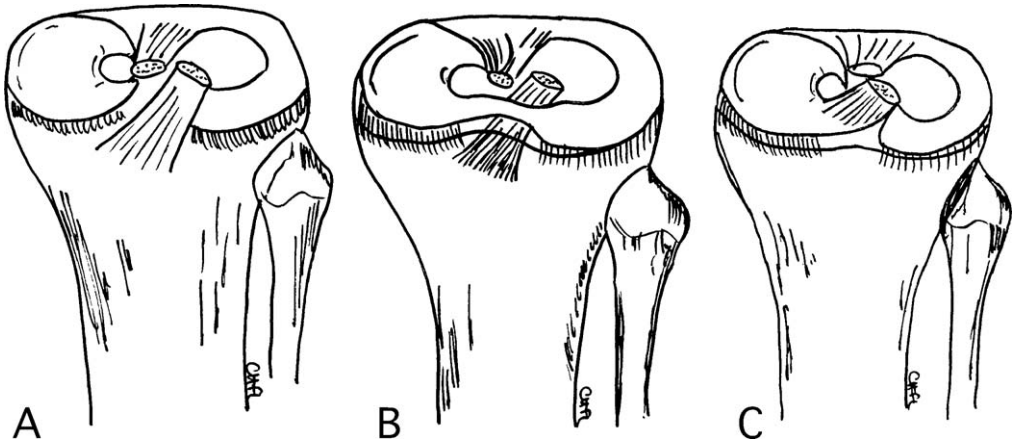

Figure 3 Abnormal attachment of the anterior horn may be associated with discoid medial meniscus, and was found in three cases out of four. A. Normal attachment of the anterior horn to the medial tibial plateau. B. The anterior horn is not attached to the medial tibial plateau. The anterior segment of the discoid medial meniscus is in continuity with the anterior intermeniscal ligament, which passes over the anterior cruciate ligament. C. The anterior segment of the discoid medial meniscus is in absolute continuity with the anterior cruciate ligament.

Table 2 KOOS score at end of FU.

Case	FU (months)	Pain	Symptoms	Function	Sport and leisure	Quality of life
1	24	86	79	99	80	88
2	7	83	96	99	60	50
3	54	94	93	99	85	75
4	7	89	89	97	50	63
Mean ± SD	23 ± 19	88 ± 5	89,3 ± 8	98,5 ± 1	68,8 ± 17	69 ± 16

FU: follow-up.

Table 3 Review of recent literature reporting discoid medial meniscus.

Author	Date	Number of cases	Age (years)	Meniscal tear	Treatment	FU	Results
Stern et Hallel [6]	1988	1	9	No	Total men.	3 yrs	Asymptomatic
Blacksin et al. [25]	1992	1	15	Yes	Partial men.	ND	ND
Schonholtz et al. [17]	1993	1 bilateral	37	Yes	Partial men.	3 months	Asymptomatic
Akgun et al. [16]	1998	1	37	Yes	Partial men.	ND	ND
Narvekar et al. [8]	1999	1 bilateral	11		Partial men. Abstention	8 months	Asymptomatic Asymptomatic
Pinar et al. [7]	2000	2	16	No	Partial men.	2 yrs	Crouching
			32	Yes	Subtotal men.	10 months	impossible
Choi et al. [15]	2001	2	18	No	Abstention	1 months	Pain on crouching
			31				
Yanez-Acevedo [27]	2001	1	11	No	Partial men.	3 yrs	Asymptomatic
Tachibana et al. [5]	2003	4	59	Yes	Partial men.	33 months	Asymptomatic
			33	Yes	Partial men.	6 yrs	Asymptomatic
			51	Yes	Partial men.	28 months	Asymptomatic
			39	Yes	Partial men.	15 yrs	Asymptomatic
Kim et al. [11]	2005	1 bilateral	22	Yes	Partial men.	ND	ND
Lee et al. [9]	2007	3 bilateral	21	Yes	Partial men.	ND	ND

Men.: meniscectomy; ND: no data.

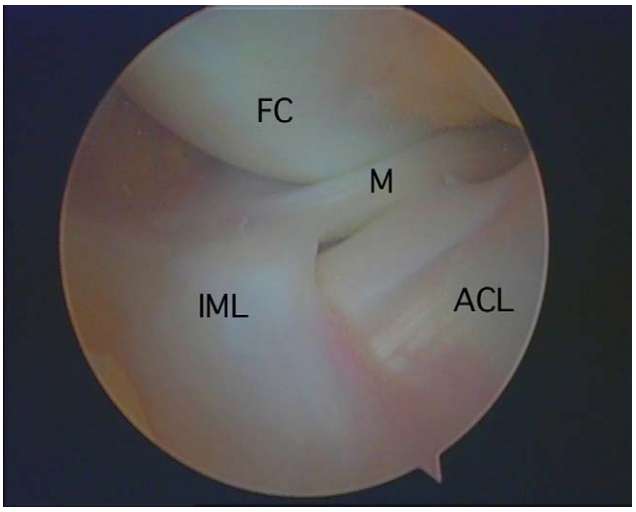

Figure 4 Arthroscopic view of the posterior segment of the discoid medial meniscus of the left knee (M), impinged between the femoral condyle (FC) and the tibial plateau. The anterior horn is in continuity with the anterior intermeniscal ligament (IML) which passes over the anterior cruciate ligament (ACL), which itself is normal.

plateau cover is not always easy to assess on arthroscopy [37]. There is no anatomic classification for discoid medial meniscus. In the present series, three forms were observed according to anterior horn insertion: normal insertion (case 1), defective anterior horn attachment to the tibia and continuity of the anterior horn with the anterior intermeniscal ligament bridging over the ACL (case 2) and anterior horn continuity with the ACL (cases 3 and 4) (Fig. 3A—C). There were no abnormalities of peripheral meniscal attachment to the capsule, as described in discoid lateral meniscus [38,39].

Clinically, the most frequent symptoms in discoid medial meniscus are medial knee pain, iterative effusion and locking in flexion [5—9,11,12,14—16,18,20,25,27,40], none of

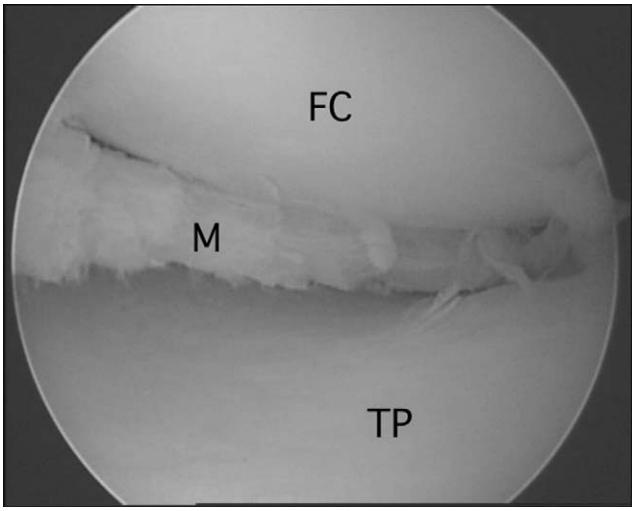

Figure 5 Arthroscopic view after central meniscoplasty of left medial discoid meniscus (case 3). Resting on the flat tibial plateau (TP), a C-shaped meniscus (M) forms a concave surface to receive the femoral condyle (FC).

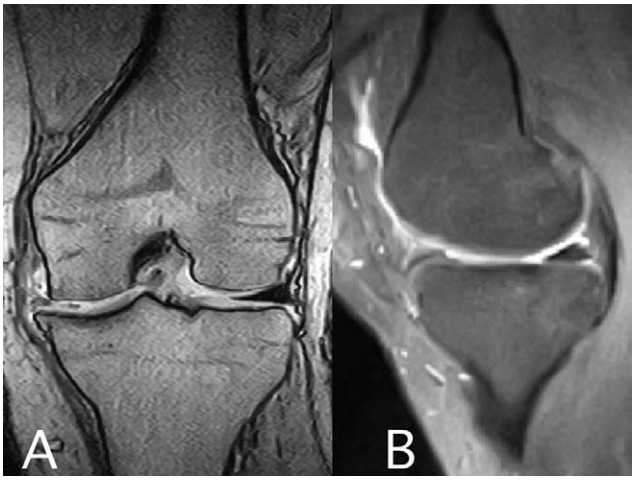

Figure 6 MRI of the left knee in case 4 one year after central meniscoplasty. A. Coronal image showing that the central part of de discoid medial meniscus has been resected. The remaining meniscus is subluxated laterally. B. Sagittal image of the same knee.

which are specific. Knee snapping is rarer than in discoid lateral meniscus. Pain and effusion are more probably due to the meniscal tear than to the discoid shape of the meniscus [41]. Locking may be due to the discoid shape as such, with the thick central region passing forward of the medial condyle. It may also be due to a vertical tear, inducing instability. Plain X-ray may show an enlarged medial femorotibial joint line [3,7,11,25,42], but is more often, as in the present cases, normal. MRI is the best means of confirming diagnosis and exploring for associated meniscal lesions [5,15,25,40]. Diagnosis requires continuity between the anterior and posterior horns on three consecutive 5 mm sagittal slices [5], and is confirmed by coronal slices showing an abnormally thick meniscus, sometimes extending as far as the intercondylar groove [5,25,40]. Tachibana and Lee both recommend systematic MRI of the asymptomatic contralateral knee [5,9]; they consider the incidence of bilateral cases to be underestimated: as the abnormality is congenital, they believe it to be usually bilateral. We, on the other hand, like Pinar and Andrisani, investigate and treat only symptomatic cases [5,7,41]. The present bilateral case was discovered at a new consultation following onset of symptoms in the contralateral knee.

All four knees showed medial meniscal tear, which is almost systematic in the literature (Table 3). Medial discoid meniscus is often diagnosed on meniscal tear in older patients than in the lateral meniscus. Discoid lateral meniscus tends to manifest as hypermobility (snapping knee) as of childhood, without tear, whereas discoid medial meniscus is asymptomatic in childhood until revealed by tear. The ultrastructure of discoid menisci differs from that of normal menisci [43]; this difference in collagen fiber organization and the stress redistribution induced by increased meniscal thickness are factors of vulnerability [37].

Surgical indications are the same in discoid lateral and medial meniscus. Only symptomatic lesions should be operated on [41,42,44,45]; in peroperative discovery of asymptomatic discoid meniscus, abstention is the rule [5,7,8,41]. Several modes of treatment have been described

for symptomatic lesions. Total meniscectomy [7,18,46—48] was the reference treatment until partial meniscectomy and meniscoplasty, which are now the most frequent techniques, were developed [5,11,12,17,25] (Table 3). Short-term results have not shown one technique to be preferable to the other, although meniscectomy restores a semilunar meniscus with more harmonious distribution of femorotibial stress [41]. The objective is to retard evolution toward medial femorotibial osteoarthritis. Patients report symptom relief following meniscectomy extending to the unstable meniscal flaps. Meniscectomy, however, does not restore a normal meniscus: it remains thick and liable to induce snapping [41], as in case 3, or residual pain (cases 1 and 4). Discoid medial meniscus is generally diagnosed in young subjects (Table 3), with considerable functional and athletic demand. KOOS score analysis of the present four cases showed that meniscectomy provided satisfactory medium-term pain control, which was the prime reason for consultation. Everyday function was well restored. The main impact, however, was on sports and leisure activities and on quality of life (respectively, 69 ± 17 and 69 ± 16): these scores, although good, may be judged as failure by a young athletic patient. Patients should be warned ahead of surgery that menisectomy will not restore a normal meniscus and that activities will have to be adjusted.

Conclusion

Given the rarity of this pathology, the present series is significant: the largest series comprised only eight cases, without iconography [14]. Moreover, it includes one bilateral case, which is even rarer. Symptomatic discoid medial meniscus may be associated with abnormal anterior horn insertion. Meniscal tear is systematic and represent a means of revelation; it is due to the fact that the discoid meniscus is thicker and more fragile and alters the biomechanics of the joint. Meniscoplasty, possibly associated to meniscal repair if the remaining wall is unstable, provides a satisfactory but imperfect result, avoiding total menisectomy, which would be detrimental for patients in this age group. Residual pain and knee snapping may persist after treatment.

Disclosure of interest

C.H. Flouzat-Lachaniette, N. Pujol, P. Boisrenoult declare that they have no conflicts of interest concerning this article.

P. Beaufils acts as a consultant for Smith and Nephew.

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