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Loose bodies in the temporomandibular joint

The advantages of arthroscopy

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SUMMARY. **Loose bodies are a rare cause of temporomandibular joint symptoms. Their main source is synovial chondromatosis. We report on clinical findings, diagnostic methods, treatment choices and outcome following the removal of loose bodies in 10 patients. Seven patients were evaluated and treated by means of arthroscopy, while in three patients open arthrotomy was performed. In five patients, no diagnostic imaging technique had demonstrated the presence of loose bodies prior to arthroscopy.**

In six patients, histology revealed synovial chondromatosis. In four patients, osteochondral fragments alone were found.

Until now, the recommended treatment of choice for the removal of all loose bodies and of affected synovial tissue required open arthrotomy. We conclude that the advantages of arthroscopy consist in locating loose bodies that are not detectable radiologically and in reducing operative trauma.

INTRODUCTION

Orthopaedic surgeons quite often encounter loose bodies in the joints of patients with various clinical symptoms (*Clanton* and *DeLee*, 1982), such as mechanical blocking of normal joint motion or pain. At other times the loose bodies may even be asymptomatic.

Ambroise Paré was credited with removing loose bodies as early as 1585 (*Clanton* and *DeLee*, 1982). Loose bodies in the temporomandibular joint (TMJ) were first mentioned in the literature by *Baron Albrecht von Haller* (1708–1777) (*Norman* et al., 1988).

Detailed description of loose bodies was given 100 years ago by *Barth* (1898) and later by *Axhausen* (1914), who also gave a comprehensive report on synovial chondromatosis of the TMJ, a condition which can lead to the development of loose bodies (*Axhausen*, 1933).

A classification of the origins of loose bodies was given by *Milgram* (1977). They inevitably originate from some portion of the tissues that line the joint cavity. In the TMJ, these tissues are the synovial membrane, the articular disc and the articular surfaces of the bones that comprise the joint. A fragment of the joint surface may break off in degenerative arthritis or may be dislodged traumatically. A third cause for the development of loose bodies is the proliferation of cartilaginous nodules in chondromatosis and subsequent dislodgement of these nodules into the joint cavity by frictional forces.

Loose bodies are said to be a rare cause for TMJ symptoms generally. A solitary loose body in the TMJ is rarely palpable, contrary to experience with larger joints (*Norman* et al., 1988). Signs and symptoms vary and are non specific: pain is often, but not always present, mouth opening may be normal, persistently limited as in disc dislocation with closed lock, or intermittently limited as in disc dislocation with reduction. Crepitus in the affected joint may be present and there is often no associated muscle atrophy.

According to the literature, loose bodies arise in the TMJ primarily from synovial chondromatosis. Synovial chondromatosis as such may present with preauricular swelling, mimicking a parotid tumour (*Thompson* et al., 1986) or a tumour of the articulation or a metastasis (*Eideken* et al., 1994). Other clinical signs and symptoms of synovial chondromatosis of the TMJ may consist of pain, crepitus and limitation of mandibular movement (*Holmlund* et al., 1992; *Norman* et al., 1988). In addition there are reports on extracapsular extension of synovial chondromatosis of the TMJ (*Sun* et al., 1990).

Following *Axhausen's* description in 1933, 39 cases of loose bodies in the TMJ had been published up to 1988, according to a thorough review by Norman and his co-workers (*Norman* et al., 1988). They presented three additional patients with this condition and several case reports have been published since then (*Engleder* et al., 1993; *Holmlund* et al., 1992; *McCain* and *de la Rua*, 1989; *Musgrove* and *Moody*, 1991).

Radiographic evidence of loose bodies may or may not be present (*Norman* et al., 1988; *Von Arx* et al., 1988). Recent reports indicate that computed tomography (CT) and magnetic resonance imaging (MRI) might be helpful in diagnosing synovial chondromatosis (*de Bont* et al., 1993; *Dolan* et al., 1989; *Herzog* and *Mafee*, 1990; *Van Ingen* et al., 1990).

As far as can be ascertained, only two reports on the arthroscopic disclosure and treatment of synovial chondromatosis of the TMJ exist to date (*McCain* and *de la Rua*, 1989; *Thomas* and *Buchbinder* 1991). Removal of the affected synovial tissue and of loose particles was accomplished arthroscopically, which is a relatively non-invasive alternative to open arthrotomy.

This study reports on the clinical findings and diagnostic accuracy of different imaging methods in patients with loose bodies in the TMJ. Furthermore, the results of loose body extraction by arthroscopic surgery as opposed to arthrotomy are compared.

MATERIALS AND METHODS

From 1987 until 1993, 1785 patients were seen in the outpatient clinic of the Department of Maxillofacial Surgery because of signs and symptoms from the TMJ. Most of them were referred by their dentists and had undergone different kinds of noninvasive treatment for at least 6 months.

After a carefully taken history, clinical and radiographic examination, the indication for arthroscopic evaluation was given in 295 patients. Sixty-one patients were male, 234 female, the male/female ratio being approximately 1:4. The mean age was 38.5 years (range 17–78 years), the right/left joint ratio was 1:2. In 54 patients arthroscopy was carried out in both right and left TMJs and 7 patients underwent an arthroscopic re-evaluation after four to six years. Altogether, 356 arthroscopic examinations of the TMJ were performed.

Indications for arthroscopy were disc displacement, perforation of the retrodiscal tissue, degenerative joint disease (osteoarthritis), rheumatic arthritis, acute trauma with internal derangement, unexplained pain in the TMJ and prior to open surgery.

Diagnostic imaging techniques carried out before arthroscopy are listed in Table 1. All patients had linear, reproducible tomograms of both joints, in accordance with a recent description (*Engelke* and *Colla*, 1991). Dynamic arthrographic studies with double contrast (*Westesson*, 1983) were undertaken in 174 patients and subsequently 618 double contrast arthrotomographies in these patients were performed. In addition, 72 MRIs and 61 CTS were undertaken.

Except in patients with acute trauma and internal derangement, all patients were treated nonsurgically for at least 6 months before arthroscopy, by splints, occlusal adjustments, physiotherapy and/or medication.

Table 1 – Imaging techniques performed prior to 356 arthroscopies

Arthrotomography	662
Arthrography with dynamic studies	174
Double contrast arthrotomography	618
Magnetic resonance imaging	72
Computertomography	61

Arthroscopy was then performed under general anaesthesia according to a standardized protocol described elsewhere (*Carls* et al., 1994). A 30° 2.4 mm rod-lens arthroscope (Hopkins-Optik, Karl Storz GmbH & Co, Tuttlingen, Germany) was used. All findings were recorded on videotape (Medical TV-Kamera OTV-S, Olympus Optical Co, Ltd, Japan and U-matic-Recorder VO-5630, Sony Co, Ltd, Japan) and photographs of findings of special interest were taken.

Immediately prior to surgery and for 24 h afterwards, the patients had antibiotic treatment perorally. They were also given local icebag applications for 12 to 24 h and were put on soft diet for 2 to 4 weeks. Postoperatively, they were able to leave the clinic either the same day or the following morning. In addition, relief was provided by an occlusal splint for 4 to 8 weeks and physiotherapy if applicable.

In the same period from 1987 to 1993, three arthrotomies without prior arthroscopy were performed. This was because noninvasive diagnostic investigations showed loose bodies in the TMJ too large and too solid for removal via the arthroscope, or because of possible involvement of periarticular structures in the disease process.

One patient (male, 35-years-old) had previously sustained trauma to the joint. One other (female, 45-years-old) was diagnosed prior to surgery as possibly having otitis maligna externa or a similar inflammation (CT scan showed contrast medium enhancement of joint capsule), and the third patient (male, 45-years-old) was suspected of having a metastastatic lesion.

Surgery was performed through a tragal incision according to routine methods of arthrotomy. Peri- and postoperatively these three patients had antibiotic treatment for 5 days, remained hospitalized for 3 to 5 days postoperatively and otherwise followed the same protocol for postoperative treatment.

Treatment results in both groups were separated clinically into three categories:

Category 1: no pain and normal opening of the mouth

Category 2: no pain but limited opening of the mouth, or pain but normal opening of the mouth

Category 3: persistent pain and limited opening of the mouth

RESULTS

Radiographic imaging techniques depicted loose bodies before arthroscopy and surgery in 4 out of 10 patients, twice in linear arthrotomograms (Fig. 1A, B) and twice in CT scans (Fig. 2). In two other patients, CT was suspicious but not conclusive for loose bodies. Both these patients refused the proposed MRI because of claustrophobia. Four patients were diagnosed preoperatively by clinical and radiographic examination as having degenerative joint disease of different degrees. Two of these patients had widening

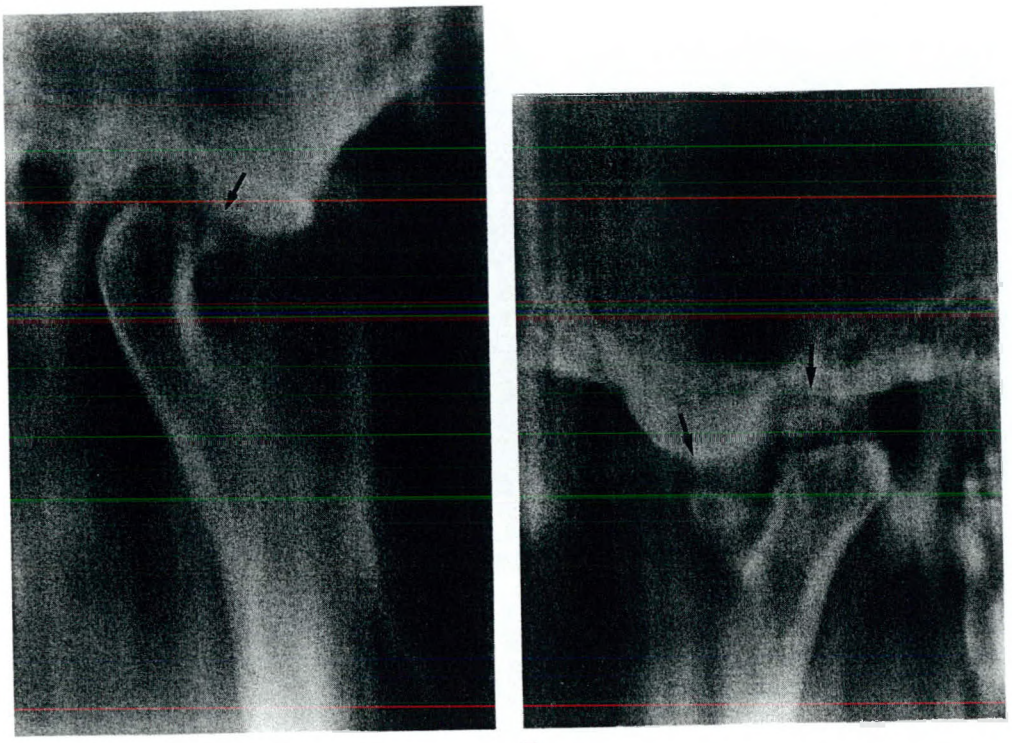


Fig. 1 – (A) Arthrotomogram showing a small radiopacity (arrow) anterior to the condyle after acute trauma (osteochondral fragment), removed via arthroscope. (B) Arthrotomogram showing two large osteochondral fragments (arrows) several years after trauma, removed by arthrotomy.

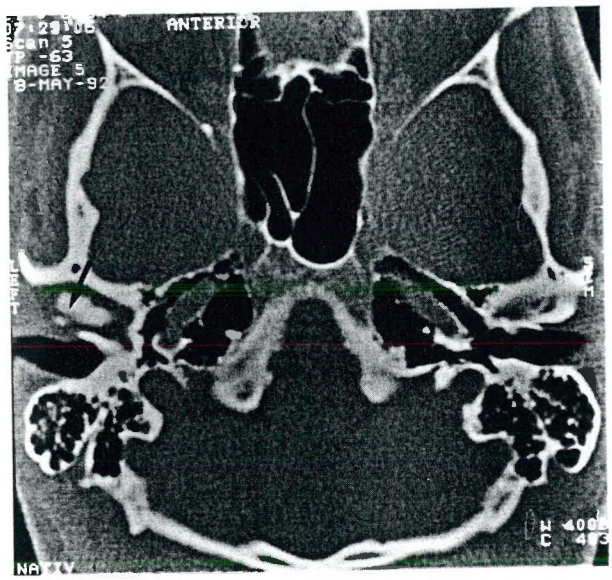


Fig. 2 Axial CT showing a small radiopacity posterior to the condyle (arrow) (osteochondral fragment), removed via arthroscope.

of the joint space and double-contrast arthrography revealed perforation of the disc.

Neither arthrography (5 patients) nor MRI (2 patients) depicted loose bodies before arthroscopy/surgery.

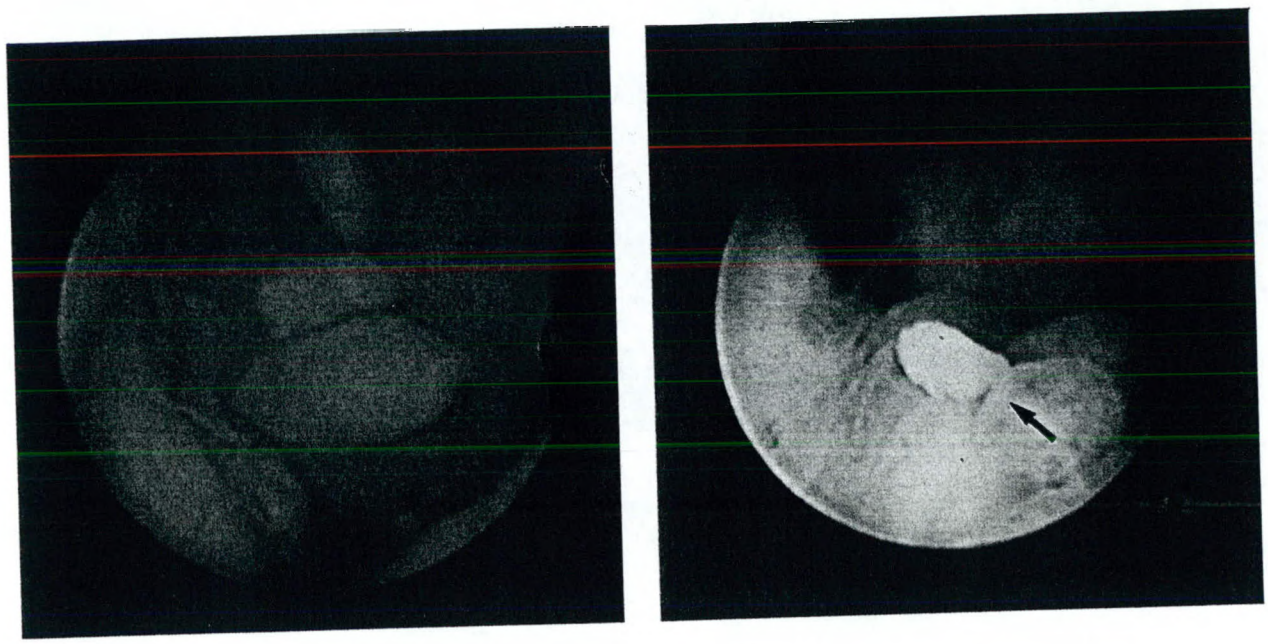
Table 2 – Findings during 356 arthroscopies

Normal	23
Minor surface alterations	67
Fibrillations	181
Fine adhesions	49
Severe adhesions	36
Folded distal ligament	98
Disc displacement	104
Disc perforation	71
Increased vascularity	105
Petechiae	46
Diffuse redness	64
Suffusion	17
Synovial hyperplasia	22
Loose bodies	7

Arthroscopic findings during 356 arthroscopies are listed in Table 2. In 7 arthroscopies (1.96%) loose bodies in the TMJ were encountered (Fig. 3A, B), (Table 3).

In 5 of these 7 patients, no other imaging technique prior to arthroscopy had demonstrated loose bodies. In two patients, a loose body had been suspected preoperatively on linear arthrotomograms and CT scans respectively, disclosing a radiopacity close to the condyle.

Between 1 and 64 loose bodies of 0.5 mm to 2.0 mm in diameter could be washed out of the joints through the arthroscope. About 5 loose bodies had to be fragmented by forceps, because their sizes exceeded 2 mm, the largest being about 5 mm. The loose bodies



A B

Fig. 3 – (A) Arthroscopy showing several loose bodies. (B) Arthroscopy showing single loose body (arrow).

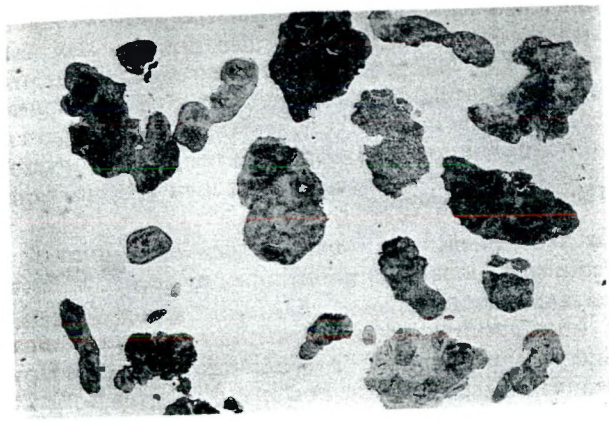
Table 3 – Patients with loose bodies in the TMJ

	Arthroscopy							Arthrotomy		
Patient	1	2	3	4	5	6	7	8	9	10
Sex	w	m	m	m	m	m	w	m	w	m
Age	31	36	61	72	35	51	45	35	40	37
Side	left	right	left	left	right	right	right	left	right	right
Length of history (yrs/mo)	1 yr	1 mo	4 yrs	6 mo	5 yrs	18 mo	1 yr	1 mo	1 yr	2 yrs
Pain	+	+	+	+	+	+	+	–	+	+
Swelling	–	–	(+)	–	+	+	–	–	(+)	–
Crepitus	–	+	+	+	+	–	+	+	–	+
Limited opening of mouth	+	–	+	+	–	+	–	+	–	–
Radiology */MRI	+	+	OA, space	–	OA, Disc perf.	OA space	OA Disc perf.	+	–	+
Number of loose bodies	1	1	52	4	64	14	12	1	1	2
Size (mm)	4	3	0.5–2.0	0.5–2.0	0.5–3.0	1.5–5.0	1.0–2.0	17	13	10–15
Other arthroscopic findings	Disc. perf.	Disc perf., OA	Disc perf., Cond. den.	Disc perf.	Disc perf., Syn. hyp.	Syn. chon. conglom-erate	Disc perf.	—	—	—
Histology	OCF	OCF	Syn. chon.	Syn. chon.	Syn. chon.	Syn. chon.	Syn. chon.	Syn. chon.	Granuloma	OCF
*Outcome	2	1	1	2	1	2	1	1	1	2
Follow-up time (years)	3	2	1	1.5	3	2	3.5	6	1	4

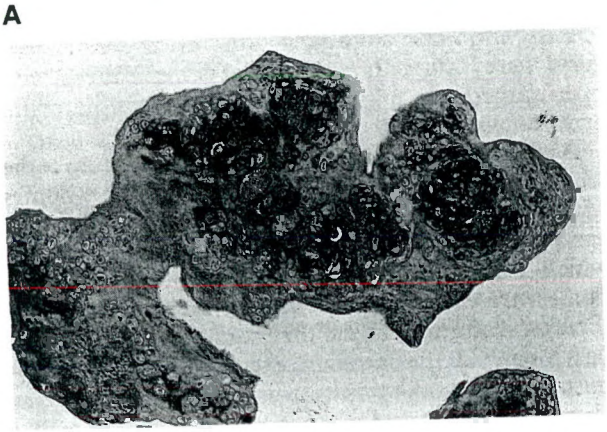
\+ = intraarticular radiolucency
OA = osteoarthritis
Disc perf. = disc perforation diagnosed by arthrography/arthroscopy
space = widening of the joint space
Cond. den. = condyle denuded
Syn. hyp. = synovial hyperplasia
Syn. chon. = synovial chondromatosis
OCF = osteochondral fragment
*Outcome: 1 = Patient at latest follow-up free of pain and improved/normal joint mobility
2 = No pain but limited opening of the mouth, or pain but normal opening of the mouth.
3 = Persistent pain, joint mobility not improved (not encountered in this series).

were mainly white in colour, firm to hard in consistency, and rice- or pearl-shaped, with a smooth or lobulated surface.

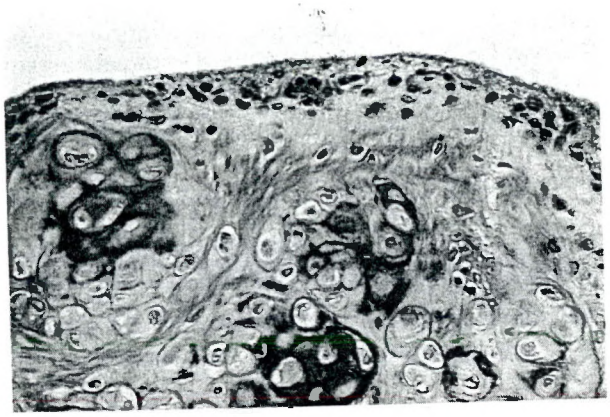
In one joint, a conglomerate mass adherent to the synovium was found in addition and was resected arthroscopically. Other arthroscopic findings included



A



B



C

Fig. 4 – (A) Multiple loose cartilaginous loose bodies (16 × HE). (B) synovial membrane (joint capsule) with foci of cartilaginous differentiation and pericellular mineralization (63 × HE). (C) Detail of cartilaginous nodule showing large single chondrocytes and spotty calcification of the matrix (250 × HE).

perforation of disc or of retrodiscal tissues as well as other features of degenerative joint disease, such as fibrosis, adhesions and loss of articular cartilage.

Before surgery, all 10 patients but one suffered pain during chewing, 5 had limited opening of the mouth, 7 crepitus of the joint and 4 patients showed a slight swelling of the joint area, of which 2 were tender to palpation (Table 3).

Following arthroscopic removal of the loose bodies, of irregularly thickened synovial tissue (in three patients) and irrigation of the joint cavity, all patients with limited opening of the mouth had improved joint mobility and suffered less or no pain. No recurrence occurred on a follow-up of between 1 and 3.5 years.

Similar results were achieved in the 3 patients who had open surgery for removal of loose bodies. Two patients are free of pain and both had improved opening of the mouth. The third patient has some alleviation of his pain and the same normal opening of the mouth as preoperatively. Follow-up in this group is between 1 and 6 years.

All loose bodies and the resected synovial tissue were sent for histological examination. Histology of the specimen of the arthroscopy-group depicted in five cases cartilaginous bodies with irregularly grouped chondrocytes and spotty calcification, typical of synovial chondromatosis (Fig. 4A–C).

In two cases fragments of non vital bone with fibrocartilage were encountered, consistent with osteochondrosis dissicans (*Milgram*, 1990).

Histology of the specimens of the arthrotomy-group twice revealed fragments of bone with fibrous cartilage, one without other pathological changes, one with degenerative changes.

In one patient, the loose body consisted essentially of granulomas of indeterminate nature. The patient had no history of gout and serum levels of uric acid were within normal limits (228 mol/100 ml).

DISCUSSION

Clinical signs and symptoms

Signs and symptoms vary and are nonspecific. Pain is often, but not always present. Opening of the mouth may be normal, persistently limited or intermittently limited. Crepitus may be present or absent and palpation will most often not reveal a solitary loose body (*Norman* et al., 1988), but might be positive in synovial chondromatosis (*Holmlund* et al., 1992).

Hence a thorough history is important. In two patients with strong evidence of intraarticular bodies, we proceeded with arthrotomy instead of arthroscopy, because history and preoperative investigations could not exclude a tumour, metastasis or a localized infective lesion.

In the patients of the present study, pain during chewing, crepitus and limited joint motion were the most prominent features. Five patients showed limited opening of the mouth, 3 of whom had intermittent closed locking. Deviation to either side on opening was present in most patients.

Swelling could be found in less than half of the patients. This can be attributed to the fact that the loose bodies were too small in size and number to exhibit swelling.

Also, only one case was encountered of synovial chondromatosis with a conglomerate mass lesion in the joint, obviously not large enough to give rise to periarticular swelling. Swelling therefore might be a manifestation in advanced cases. Only 2 patients presented with a history longer than 2 years, which

differs somewhat from most reports (*Norman* et al., 1988).

Imaging and diagnosis

Radiographic evidence of loose bodies may or may not be present (*Norman* et al., 1988; *Von Arx* et al., 1988). Conventional radiography has not yielded consistent findings in synovial chondromatosis. The most common findings have been calcified loose bodies, widening of the joint space and signs of degenerative joint disease (*Herzog* and *Mafee*, 1990). We found mainly osteoarthritic changes, twice with widening of the joint space. In two other cases, double-contrast arthrography depicted perforations of the disc preoperatively, confirmed by arthroscopy, but the loose bodies were not visible in the contrast medium.

CT has great potential for imaging intra- and extracapsular hard tissue abnormality of the TMJ and is especially useful in bony lesions (*de Bont*, 1993). Osteochondral fragments were therefore successfully depicted in the present study, whereas calcification of loose bodies in the patients with synovial chondromatosis seem not to have been sufficient for delineation in the investigations performed.

Recent reports indicate that MRI might be helpful in diagnosing synovial chondromatosis, particularly when thickening and distension of the capsule is present (*Dolan* et al., 1989; *Van Ingen* et al., 1990; *Holmlund* et al., 1992; *Engleder* et al., 1993). In the 10 patients presented MRI was performed twice without depicting loose bodies and 2 other patients refused this investigation because of claustrophobia.

The diagnosis and removal of loose bodies from the knee and other larger joints under arthroscopic control is a well established method. A very important advantage of arthroscopy in diagnosing loose bodies of the knee is the ability to find loose bodies which are not detectable radiologically (*Dandy* and *O'Carroll*, 1982). Although the removal of loose bodies via the arthroscope requires considerable arthroscopic expertise and can be technically more exacting than other arthroscopic procedures (*Dandy* and *O'Carroll* 1982) the operative trauma is smaller, to such an extent that in the knee, arthroscopic removal is the method of choice.

We are aware of only two reports on arthroscopic observation and removal of loose bodies in the TMJ (*McCain* and *de la Rua* 1989; *Thomas* and *Buchbinder*, 1991) Norman (*Norman* et al., 1988) did use the arthroscope in his cases for accurate inspection of all regions difficult to reach in the TMJ after open joint surgery.

In our series of 7 patients with arthroscopically encountered loose bodies, this feature was an absolute surprise in 5 patients, because other imaging techniques did not reveal intraarticular bodies. Only in this group of patients were we suspicious of loose bodies after arthrotomograms and CT showed opacities, and we had gained some clinical experience with this condition. Because arthroscopy provides direct visual inspection of the internal joint, we agree with the statement that it is also possibly the best method for diagnosing synovial chondromatosis (*Holmlund* et al., 1992).

Therapy and histology

In comparison with open surgery of a joint for removal of loose bodies, arthroscopy seems to have certain advantages.

Most striking is the reduction in operative trauma and the time required for rehabilitation. Arthroscopy required hospitalization postoperatively for 8 to 24 hours, whereas hospitalization for open surgery of the TMJ lasted 4 to 5 days postoperatively.

Less antibiotic is needed after arthroscopic surgery, there is no scar, and surgical complications with open surgery can in general be more severe than with endoscopic surgery.

A disadvantage of the arthroscopic procedure is the technical difficulty in cases where larger loose bodies are present which have to be fragmented before they can pass the cannula system (in our series 4 patients) which demands arthroscopic expertise. The loose bodies are extremely mobile and one needs biopsy forceps, disc graspers, etc for fragmentation. *McCain* has long had the required expertise, so he accomplished the first identification and removal of synovial chondromatosis of the TMJ (*McCain* and *de la Rua*, 1989).

The development and the classification of loose bodies in human joints has been treated thoroughly by *Milgram* (1977). They are dislodged traumatically or by frictional forces in degenerative, osteoarthritic joints or in chondromatosis.

Ultrastructural studies on synovial chondromatosis are well documented in the literature (*McCarthy* and *Dorfman*, 1982; *Milgram* 1977). Its pathogenesis is an active metaplastic, not a neoplastic process. According to *Milgram* (1977) three phases may be distinguished: (1) active synovial disease without loose bodies, (2) synovial nodules with loose bodies and (3) multiple loose bodies with inactive synovial disease.

Many reports on this disease affecting the TMJ have been presented (*Ballard* and *Weiland* 1972 *Norman* et al., 1988; *Holmlund* et al. 1992), including reports of synovial chondromatosis in combination with unilateral condylar hyperplasia (*de Bont* et al. 1985) or intracranial extension (*Sun* et al., 1990).

Total resection of the synovial membrane has been advocated because the remaining synovium may be source of recurrence (*Ballard* and *Weiland* 1972 However, the recurrence rate is low and even spontaneous regression has been reported (*Swan* and *Owens* 1972). Thus removal of the mass together with all loose bodies and the affected synovium seems to be sufficient. In our patients, no recurrence had occurred at follow-up between 1 and 6 years (mean follow-up years), in keeping with the experience of other authors (*Holmlund* et al., 1992; *McCain* and *de la Rua*, 1989). Histology revealed no signs of malignant transformation.

CONCLUSION

We conclude that arthroscopy is indicated as a diagnostic as well as a therapeutic tool under the circumstances described, as it is superior to other diagnostic imaging techniques and is often superior to open surgery with its drawbacks.

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