

THE EFFECTS OF HEMIARTHROPLASTY UTILIZING A METAL FOSSA PROSTHESIS ON THE MANDIBULAR CONDYLE: A Retrospective Review

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ABSTRACT: The objective of this review was to determine the effect of hemiarthroplasty of the TMJ utilizing a partial joint implant (the Christensen TMJ Fossa-Eminence Prosthesis) on the natural condyle, as evidenced by the clinical outcomes and radiographic changes of patients implanted with the cobalt/chrome fossa eminence prosthesis.

Because past history indicates that certain alloplasts when used as a TMJ implant have fragmented creating significant pathological degenerative condylar changes and adverse clinical changes, a number of patients who had undergone hemiarthroplasty utilizing a Christensen Fossa-Eminence Prosthesis as a "permanent" implant were evaluated. Internal derangements of the TMJ develop from alterations in the structural integrity of the disc-condyle complex and often produce pain and/or functional disturbances in the masticatory system.¹ A definitive treatment that may be considered for such derangements that have been recalcitrant to non-surgical treatment, arthrocentesis or arthroscopy is open arthroplasty.² Some surgeons believe that the likelihood of developing severe bony deterioration, ankylosis, and fibrous adhesions can be reduced following discectomy by placing an interpositional material between the head of the natural condyle and the glenoid fossa.³ Severe complications including destructive lesions of the mandibular condyle following the use of some alloplastic implant materials have led to a bias against using any alloplastic material as an interpositional implant within the TMJ.⁴ Dolwick⁵, Ryan⁶ and a host of others have documented foreign body, radiographic and clinical failures that have soured surgeons to the prospect of "permanent" replacement of the disc following arthroplasty with discectomy. Christensen reported on the use of a cobalt-chromium alloy fossa -eminence prosthesis inserted between the head of the mandibular condyle and glenoid fossa in 1963.⁷ Eleven years later, Christensen reported good long-term results by the use of a metal glenoid fossa-eminence prosthesis with apparently no reported problems involving destruction of the natural mandibular condyle or foreign body reaction.⁸ The Christensen TMJ Fossa-Eminence Prosthesis is designed to provide a smooth surface for articulation with the

natural condyle in a partial joint replacement or hemiarthroplasty application. (Figure 1) Partial surface replacement represents a significant development in the evolution of TMJ arthroplasty with a material that is tissue friendly and does not fragment. Co-Cr alloy has had a long history of use in orthopedic applications.⁹ The American Society for Testing and Materials (ASTM) states that this material "has been shown to produce a well characterized level of local biological response following long term clinical use."¹⁰ The target population for a hemiarthroplasty utilizing a fossa-eminence prosthesis as a partial TMJ replacement system includes patients exhibiting diseased temporomandibular joints that have proven non-responsive to other treatment options including various non-surgical modalities or invasive procedures and where the natural condyle is healthy or salvageable.

Patients and Methods: Patients were selected based on implant type (fossa-eminence implant only) and duration (minimum three-year to thirty-five year follow-up radiograph available). (Table 1) Eighteen patients were identified in which the records contained radiographs at least three years following placement of a Christensen ArthroChromeTM (cobalt-chromium) Fossa-Eminence Prosthesis in a hemiarthroplasty application. Information on patient demographics, date of implant placement, and the original indication for the surgery and pre-operative and post-operative measurement of incisal opening were conducted.

Table 1: Data on 18 Patients Treated with Hemiarthroplasty

ID	DOS	DOB	AGE	GENDER	INDICATION	LAST PO XRAY	DURATION (yrs)
1	12/23/1988	11/28/1970	18	F	ID	02/19/1994	5.2
2	12/28/1988	05/22/1975	14	F	ID	01/10/1995	6.0
3	02/02/1989	06/12/1954	35	F	ID	09/01/1992	3.6
4	02/09/1989	05/27/1960	29	F	ID	03/26/1999	10.1
5	09/08/1989	03/22/1951	38	F	ID/DJD/perf	06/26/1997	7.8
6	09/15/1989	03/04/1949	41	M	ID/perf	02/19/1994	4.4
7	10/12/1989	02/03/1941	49	F	ID	02/21/1994	4.4
8	03/10/1990	12/31/1957	32	M	ID	02/22/1994	4.0
9	03/09/1990	12/20/1960	29	F	ID/perf	02/22/1993	3.0
10	09/05/1990	04/26/1956	34	M	ID/trauma	10/21/1996	6.1
11	12/17/1990	10/04/1967	23	F	ID/osteoarth.	03/03/1997	6.2
12	12/18/1990	08/09/1944	46	F	ID/DJD	03/26/1999	8.3
13	12/28/1990	11/20/1956	34	F	ID/perf	01/08/1996	5.0
14	05/08/1991	05/25/1937	54	F	ID	07/16/1996	5.2
15	09/23/1991	12/26/1938	53	F	ID/perf	04/06/1999	7.5
16	04/15/1992	12/20/1962	29	F	ID	06/15/1998	6.2
17	07/09/1992	11/22/1961	31	F	ID/perf	09/04/1996	4.2
18	01/01/1965	01/01/1917	48	F	ID	10/01/2000	35.8

Results: Fifteen (15) of the patients were female-83%, three of the patients were male-17%. The average age of these patients at the time of implant placement was (35.4years). (Table 1) Fourteen (14) patients received bilateral partial joint implants and four (4) patients received unilateral partial joint implants (two left and two right). The indication for hemiarthroplasty with placement of a fossa prosthesis was internal derangement for 16 of the 18 patients. Degenerative joint disease with meniscal perforation was listed as the indication for surgery for two patients. (Table 1) The charts indicate that five of the patients reported that their TMJ symptoms began following motor vehicle accidents.

Two surgically related events were noted in the files. One event, a dislocation of the condyle, occurred immediately following surgery that required repositioning under anesthesia with no recurrence of the problem. The second event occurred when the head of a screw, used to fix the fossa implant to the zygoma, was sheared off during tightening. No problems have been reported as a result of this event and the device continues to function.

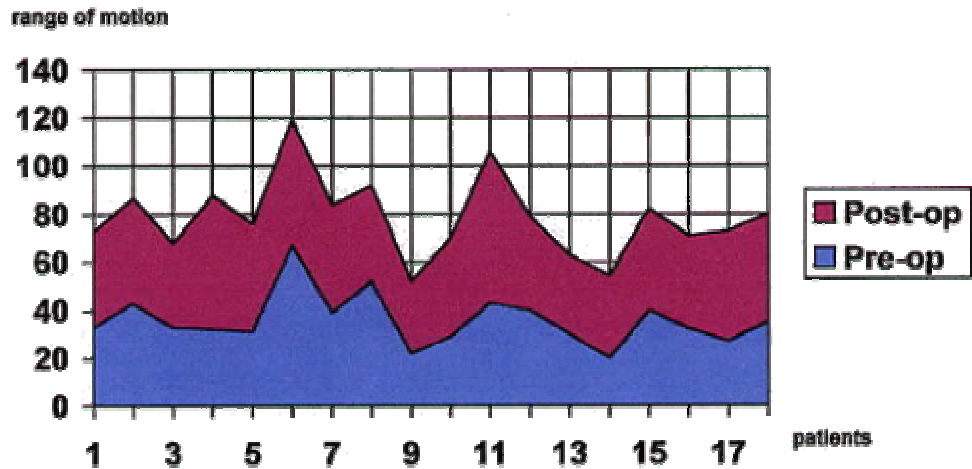
Additional surgery has been performed on four (4) of the 18 patients (22%). Three patients had the meniscus repositioned and retained at the time of implant placement and required an additional surgery to remove the damaged meniscus. One patient required a styloidectomy to relieve pain from an elongated styloid process. These additional procedures were not related to the use of the partial joint implant as the symptoms were relieved following meniscectomy with retention of the fossa prosthesis. None of the patients who required meniscectomy at the time of implant placement have required additional surgical intervention.

A review of the postoperative radiographs indicates that there were no significant deleterious changes in the natural condyles of these partial joint patients. Five patients were available for CT scans of their temporomandibular joints to provide a comparison of a panorex radiograph to a CT scan. (Figures 2-5) The files of three (3) patients indicated slight bony changes had occurred from the preoperative radiographic status. Patient 9 exhibited advanced degenerative condylar disease at the time of implant placement and has not required additional treatment since hemiarthroplasty with placement of a fossa liner. Patient 11 also exhibited degenerative condylar disease at the time of implant placement that required initial condylar arthroplasty with no requirement for additional surgery to date. (Figure 6) The records indicate that total joint replacement was contemplated at the time of the original surgery; however, the more conservative approach, that of hemiarthroplasty, was utilized in an effort to preserve the patient's condyle. This appears to have been a prudent choice. Patient 5 exhibited moderate "degenerative" change in the right condyle when evaluated radiographically postoperatively. Additional follow-up indicates this change represents adaptive remodeling rather than pathological degeneration.

A review of the pre-operative and post-operative interincisal opening measurements was conducted. (Table 2) Three patients experienced a decrease in opening over time. Two of these patients had large incisal openings prior to surgery (67 mm and 52 mm). The interincisal measurement at last follow-up for each of these patients was 52 mm and 40

mm respectively. The third patient experienced a very slight decrease from 40 mm to 39 mm.

Table 2: Comparative data on 18 Patients Pre-op Opening and Post-op Opening



PT ID	IMPLANT DATE	PRE-OP OPENING	POST-OP OPENING	DATE MEASURED
1	12/23/1988	33	40	03/02/1998
2	12/28/1988	43	44	01/23/1997
3	02/02/1989	33	35	03/01/1996
4	02/09/1989	32	56	02/29/1996
5	09/08/1989	31	45	08/19/1997
6	09/15/1989	67	52	09/08/1996
7	10/12/1989	39	45	09/01/1996
8	03/10/1990	52	40	06/08/1990
9	03/09/1990	22	30	03/26/1991
10	09/05/1990	29	41	04/22/1999
11	12/17/1990	43	63	10/07/1996
12	12/18/1990	40	39	03/26/1999
13	12/28/1990	30	33	03/04/1996
14	05/08/1991	20	34	07/16/1996
15	09/23/1991	40	42	04/06/1999
16	04/15/1992	32	39	08/28/1997
17	07/09/1992	27	46	09/04/1996
18	01/01/1965	35	45	10/01/00

None of the 18 patients reported in this review have required removal of the device nor have any required conversion to a total joint in order to address their symptoms.

Discussion: Boering has addressed clinical and radiographic progression of temporomandibular joint disease.¹¹ Progression appears to take on at least two forms, clinical and radiographic. The radiographic changes indicating progression were flattening, sclerosis, cyst and osteophyte formation. Boering also noted a difference in length between the ascending ramus of the affected side when compared with the unaffected side.¹² Progression of TMJ disease then can be severe to the point of being considered pathological and destructive in nature or mild to the point of being considered physiologic and remodeling in nature. Pathologic condylar degeneration is often manifested by 1) clinically worsening symptoms, 2) development of a malocclusion with open bite, and 3) radiographic evidence of condylar deterioration.¹³ This retrospective review has addressed these issues in an effort to determine whether the presence of a metal fossa liner can be expected to cause significant deleterious changes to the natural mandibular condyle. We believe many patients can benefit from hemiarthroplasty rather than total joint replacement if early intervention utilizing this technique is employed. Hemiarthroplasty has been utilized in orthopedic applications and is considered a well-accepted surgical procedure.¹⁴ In an effort to preserve bone stock, orthopedic surgeons have at their disposal a technique that provides the benefits of hemiarthroplasty when the conditions are appropriate. Oral and Maxillofacial Surgeons have desired to preserve the bone and soft tissues of the TMJ when appropriate. Various techniques have been proposed over the last 20 years in order to "preserve" TMJ structures. These include disc repositioning by plication and arthroscopic techniques. A number of reports have been generated in peer-reviewed literature indicating the futility of such efforts over time.^{15,16} When partial TMJ reconstruction is contemplated, the memory of the disaster brought on by use of materials that showed a tendency to fragment over time causing serious destruction of bone and soft tissue elements of the jaw joint makes one very cautious. In this paper, evidence has been presented that the bone of the mandibular condyle generally does not show signs of pathological degeneration after years of articulating against a cobalt/chrome liner. The clinical outcomes also indicate that no unacceptable degenerative conditions occur because of hemiarthroplasty with placement of a "permanent" implant. If the natural mandibular condyle is in reality adversely affected following placement of a Christensen Fossa-Eminence prosthesis, pathological bony changes manifested by condylar deterioration and malocclusion should be evident in many of the cases that have been treated with this technique. It appears from previous reports¹⁷ and from the clinical and radiographic review of these 18 patients that pathological bony changes are not usually encountered following placement of a metal fossa liner. We believe that destructive pathological changes in the natural mandibular condyle occur because of progressive disease rather than as a process caused merely by articulation against a metal liner. Additional reports are encouraged to further evaluate the safety and efficacy of placing a metal fossa liner in a hemiarthroplasty application in the temporomandibular joint.

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