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Complications in Motility Peg Placement for Hydroxyapatite Orbital Implant in Anophthalmic Socket

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Purpose: In a retrospective study, we evaluated the complications in using the motility peg system (nonsleeved and sleeved) for hydroxyapatite orbital implants in an anophthalmic socket.

Methods: Drilling for motility peg placement was performed in 265 patients with hydroxyapatite implantation: nonsleeved peg system (n = 191), sleeved peg system (n = 74). A statistical analysis was performed using the chi-square test.

Results: Extrusion rates were significantly lower in the sleeved peg system (10.8%) compared to the nonsleeved peg system (27.2%) (P = .005). The other complications related to motility peg placement were granulation tissue overgrowth (4.2%), hydroxyapatite exposure around peg head (3.0%), and decentered peg (1.9%).

Conclusions: To minimize peg extrusion, the sleeved peg was better than the nonsleeved peg for use in primary motility peg placement. **Jpn J Ophthalmol 2002;46:103–107**

Key Words: Complications in motility peg placement, hydroxyapatite, nonsleeved peg, peg extrusion, sleeved peg.

Introduction

Porous allograft materials including hydroxyapatite and porous polyethylene have been commonly used in integrated orbital implants for the anophthalmic socket. The rates of postoperative complications have been reported to be lower with the hydroxyapatite orbital implant than with most conventional implant materials.[1] There are a few complications, such as conjunctival erosion and implant exposure, but serious complications, fortunately, are rare.[2–5] The risk factors and management of these complications have been widely discussed.[6–9]

The main advantage of the porous orbital implant is improved cosmetic results. The prosthesis is more natural in appearance because of increased motility. Prosthesis motility is achieved through a surgically placed motility peg that transfers the increased mobility of the implant to the prosthesis.

We report herein the complications occurring in 265 patients after drilling for motility peg placement in the hydroxyapatite implant.

Materials and Methods

The study group consisted of 265 patients who underwent enucleation (125 patients), evisceration (65 patients), or secondary procedure (75 patients) with hydroxyapatite implantation and subsequent placement of a motility peg, between May 1992 and December 1997 at Yonsei Medical Center. The mean

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age of patients at peg placement was 33.3 ± 10.7 years. There were 72 female and 193 male patients.

Surgical techniques of hydroxyapatite implantation after enucleation and evisceration were similar to previously published procedures.[4,7,10–12] On enucleation, hydroxyapatite was wrapped in 4 × 5 cm cadaveric dura mater using 5-0 polyglactin sutures. Four rectangular windows, about 3 × 4 mm, were made for insertion of the rectus muscles. These procedures were similar to those when using donor sclera.[7] Posterior Tenon's capsule as well as anterior Tenon's capsule were closed tightly with 6-0 polyglactin sutures. The conjunctiva was then closed separately with 6-0 black running sutures. Eviscerations were performed with (30 patients) or without (35 patients) keratectomy. During evisceration, scleral incisions along the equator were made to enlarge the scleral pouch to promote fibrovascularization into the implant through the scleral openings. After closure of the scleral incisions with 5-0 polyglactin sutures, Tenon's capsule and conjunctiva were closed in the same way as after enucleation.

Prior to drilling, we assessed the grade of vascularization in the hydroxyapatite implant through the use of a technetium-99m-MDP bone scan carried out at least 6 months after hydroxyapatite implantation. Vascularization as determined using the technetium-99m bone scan has been graded as follows: grade 4: greater (appears darker) implant uptake than the uptake of the mid-facial bone, grade 3: uptake equal to that of the mid-facial bone, grade 2: greater uptake than one half the distance between the uptake of the normal orbit and the mid-facial bone, grade 1: greater uptake than the normal orbit but less than grade 2.[13,14] When the bone scan showed an uptake of grade 2 or greater, we drilled a hole into the implant.

Procedures of the drilling were as follows. Before drilling, the peg location was marked with the patient sitting erect and the patient's eyelid held apart to about the same eyelid opening as the natural eye. We made a mark in the center of the socket or at the optimal location of motion in all directions. Drilling and peg placement were performed under local anesthesia with 2% xylocaine subconjunctival infiltration around the marking site. A 3–4-mm horizontal conjunctival incision was made at the marked site. The underlying Tenon's capsule was grasped with tooth forceps to avoid entanglement with the drill bit and to allow the drill bit to be in direct contact with the surface of the implant at the onset of drilling. A 3-mm-wide drill bit for a nonsleeved peg or a 3.8-mm-wide drill bit for a sleeved peg fitted into a hand drill (Integrated Orbital Implants, San Diego, CA, USA) was used to drill perpendicular to the anterior plane of the implant. The depth and direction of the hole were measured by inserting the wooden end of a cotton-tipped applicator. After completion of drilling, the hole was rinsed out with normal saline and filled with antibiotic ointment. A flat-headed temporary peg for a nonsleeved peg system or a sleeve with temporary flat peg for a sleeved peg system were placed into the drilled vestibule. The threaded sleeve was screwed into the hole by using a sleeved peg wrench. The flat temporary peg was replaced with a round-headed motility peg 4 weeks later. The posterior surface of the prosthesis was fitted with a round-headed motility peg.

Primary placement of nonsleeved or sleeved pegs was performed in 191 patients and 74 patients, respectively. The mean follow-up periods for nonsleeved and sleeved pegs were 29.9 ± 12.7 months and 17.9 ± 10.0 months, respectively.

The incidence of peg extrusion was analyzed for the statistical significance of each of the related factors: nonsleeved and sleeved peg, age, types of surgery (enucleation, evisceration, and secondary) and grade of bone scan. All statistical analyses were performed using a chi-square test.

Results

The complications in primary placement of the nonsleeved peg were as follows: extrusion (52 cases, 27.2%), granulation tissue overgrowth (9 cases, 4.7%) (Figure 1), hydroxyapatite exposure around the round peg head (8 cases, 4.2%) (Figure 2), and decentered peg (4 cases, 2.1%) (Table 1). The main

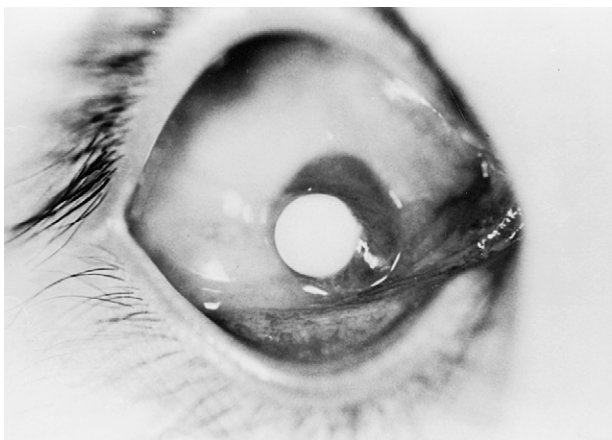

Figure 1. Granulation tissue overgrowth around motility peg head.

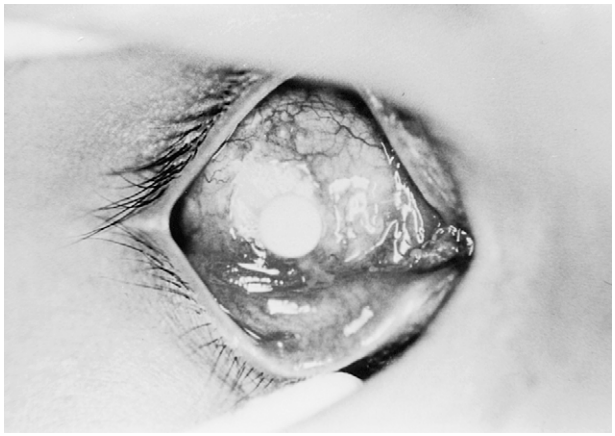

Figure 2. Hydroxyapatite exposure around motility peg head.

complication in using the nonsleeved peg system was extrusion. The median time interval from primary placement of the nonsleeved peg to the extrusion of the peg was 5.2 months (range, 3 weeks–2 years) (Table 2). Extruded pegs were managed by re-drilling and replacement with nonsleeved (36 cases) or sleeved pegs (14 cases). Extrusion rates of secondary placement of the nonsleeved and sleeved pegs were 44.4% (16 of 36) and 28.5% (4 of 14), respectively.

The complications of the sleeved peg system (n = 88) were as follows: exposure of the sleeve head (7 cases, 7.0%) (Figure 3), granulation tissue overgrowth (4 cases, 4.6%), and extrusion of the sleeve (12 cases, 13.6%) (Table 1). The overall extrusion rate of the nonsleeved pegs was 30.0% (68 of 227), whereas that of sleeved pegs was 13.6% (12 of 88) ($P = .003$).

Extrusion rates in primary nonsleeved peg placements according to the grade of bone scan were 18.8% (6 of 32) in grade 2, 19.2% (15 of 78) in grade 3, and 38.3% (31 of 81) in grade 4 ($P = .013$). The extrusion rates showed no significant differences according to the type of surgery or age (Table 3).

Exposure of hydroxyapatite implants around the peg head was noted in 8 (3.0%) of 265 patients. All exposed cases developed in patients who underwent evisceration without keratectomy (22.8%, 8 of 35), whereas none of the 30 patients who underwent evisceration with keratectomy developed implant exposure ($P = .005$). Exposed implants were managed by observation in 4 cases and dermis graft in 4 cases.

Granulation tissue overgrowths around the permanent peg head could be managed easily by simple removal with forceps, but in a recurrent case, excision with intralesional steroid injection was performed with success.

Discussion

The most apparent benefit of porous orbital implants, including hydroxyapatite and porous polyethylene, in the anophthalmic socket is improved socket and prosthesis motility. A small degree of prosthesis motility can be present regardless of motility peg placement after hydroxyapatite implantation. In a previous report, only 12% of patients with hydroxyapatite implants underwent drilling for placement of a motility peg to improve the motility of their prosthesis.[7] However, to maximize prosthesis motility, placing the motility peg and coupling it to the prosthesis is necessary.

Several types of motility pegs have been designed over the years. At present, there are three kinds of available peg systems supplied with the hydroxyapatite package, sleeved, nonsleeved, and titanium pegs. The first report about the complications of motility peg placement in hydroxyapatite orbital implants was published in 1997.[15] In this report, the main complication of peg placement was peg extrusion. Formation of granulation tissue in the base of the drilled vestibule led to peg extrusion. The extrusion of nonsleeved pegs was noted in 26% of the patients (12/47), whereas none of the 9 sleeved pegs was extruded. The authors mentioned that there was a decreased risk of extrusion with sleeved pegs. How-

Table 1. Complications in Placement of Nonsleeved Pegs and Sleeved Pegs

	Nonsleeved Peg (n = 227)		Sleeved Peg (n = 88)	
Complications	Primary (n = 191)	Secondary (n = 36)	Primary (n = 74)	Secondary (n = 14)
Extrusion	52 (27.2%)	16 (44.4%)	8 (10.8%)	4 (28.5%)
Granulation tissue overgrowth	9 (4.7%)	1 (2.8%)	2 (2.7%)	2 (14.3%)
Hydroxyapatite exposure around peg head	8 (4.2%)	0	0	0
Decentered peg	4 (2.1%)	0	1 (1.4%)	0
Exposure of sleeve head	NA	NA	4 (5.4%)	3 (21.4%)

NA: not applicable.

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Table 2. Interval from Primary Placement of Nonsleeved Pegs to Extrusion

Periods (months)	Cases (n = 52)
<1	3 (5.8%)
1–3	22 (42.3%)
3–6	14 (26.9%)
6–12	8 (15.4%)
12–24	5 (9.6%)

ever, this did not prove to be statistically significant ($P = .10$) because of the small sample size.

In our data, the extrusion rates of primary nonsleeved peg placement was 27.2%, but increased to 44.4% in secondary placement. In the sleeved peg system, the extrusion rate was 13.6%. Statistical analysis of extrusion rates between the sleeved and nonsleeved pegs showed highly significant differences ($P = .003$). It is unclear what factors may influence the decreased extrusion of the sleeved pegs. Tissues getting in between the thread of a sleeve may inhibit the proliferation of granulation tissue in the base of the vestibule. However, a slight protrusion and exposure of the anterior surface of the sleeve were noted in 7 cases (8.0%) of sleeved peg placement. None of these cases progressed to a serious condition but we recommend that the sleeve should be positioned 1–2 mm deeper than the anterior surface of the hydroxyapatite implant during drilling.

In order for a lining of conjunctival epithelium to form around a motility peg, it is necessary to have a good blood supply within the implant. A bone scan or magnetic resonance imaging can provide useful information about the amount of blood vessel in-

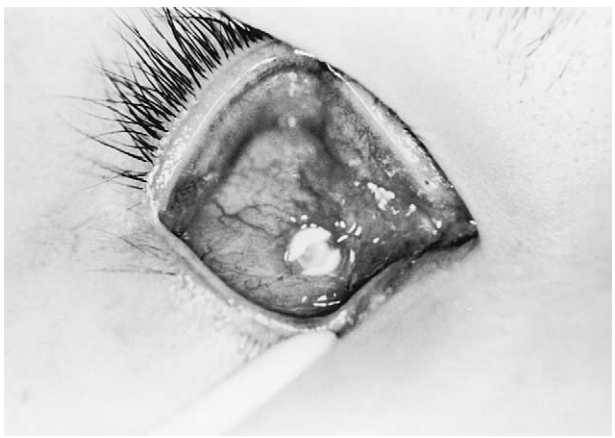

Figure 3. Exposure of sleeve head.

Table 3. Factors Influencing Extrusion of Primary Nonsleeved Pegs (n = 191)

Factors	Extruded	Unextruded	% of Extrusion	*P* Value
Age (y)				.236
<45	44	126	34.9	
≥45	8	13	38.1	
Type of surgery				.395
Enucleation	30	72	29.4	
Evisceration	7	31	18.4	
Secondary	15	36	29.4	
Bone scan				.013
Grade 2	6	26	18.8	
Grade 3	15	63	19.2	
Grade 4	31	50	38.3	

growth into the hydroxyapatite implant. If the bone scan shows a grade 2 uptake or greater, it is expected that a hole drilled into the implant will become lined with fibrovascular tissue and epithelium.[13,14] In our data, the rates of peg extrusion were significantly higher in a grade 4 bone scan. It seems that rich fibrovascularization into the implant may promote the proliferation of granulation tissue in the drilled vestibule. An analysis of other clinical variables such as age and type of surgery found them to be statistically insignificant to the incidence of peg extrusion.

The other troublesome complication was exposure of the hydroxyapatite implant around the peg head. All exposed cases were noted in patients following evisceration without keratectomy. No patients developed implant exposure following evisceration with keratectomy. The reasons why implant exposure is more common in evisceration without keratectomy are also unclear. One possible factor is the easy resorption or necrosis of avascularized cornea tissue due to the interruption of the nutrition supply via the extension incision to the sclera. Another factor is the relative lack of Tenon's capsule coverage over the hydroxyapatite implant. Difficulties in pulling the posterior and anterior Tenon's capsule over the cornea induce thinning of the anterior layer. Drilling of the thinned anterior layer and peg irritation by motility may accelerate the exposure of the hydroxyapatite implant around the peg head. Therefore, removal of the cornea during evisceration would minimize the hydroxyapatite exposure.

In summary, we report our experience with motility peg placement into the hydroxyapatite implant and its complications. The major problem of peg placement was peg extrusion. The incidence of this complication was significantly lower with the sleeved

peg system than with the nonsleeved peg system. Unfortunately, the titanium peg was not available during the study, so it was not included in this study. The sleeved peg system was better than the nonsleeved peg as a primary procedure for motility peg placement despite more manipulation of the socket. Hydroxyapatite exposure around the peg head developed in patients following evisceration without keratectomy. Therefore, the cornea should be removed during evisceration to minimize hydroxyapatite exposure.

The authors have no proprietary interest in any of the materials used in this study.

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