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Osteo–Odonto–Kerato prosthesis: A tooth in an eye treatment for corneal blindness: A review

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Abstract

Osteo–Odonto–Kerato prosthesis is the kerato prosthesis of choice for end stage corneal blindness not amenable to penetrating keratoplasty. It is a complex two stage multidisciplinary team approach by a prosthodontist or a maxillofacial surgeon and ophthalmologist, which aims to restore vision in most severe cases of corneal & ocular surface disease. Originally described by Benedetto Strompelli nearly 50 years ago, later modified and refined by Prof. Giancarlo Falcinelli in a step wise manner using the patient's own tooth root & alveolar bone as a vital support to the optical cylinder, which is implanted in the eye to restore vision. The cornea is replaced by a Poly methyl methacrylate (PMMA) optical cylinder attached to a support (haptic) made by human tissue. The rigid optical cylinder will give an excellent image resolution & quality. Modified OOKP for corneal blindness may provide a long term, anatomically stable corneal prosthesis, hope for vision and rehabilitating recovery in corneal blind patients. This review article describes the desirable property of ideal kerato prosthesis, indication, contraindication, patient assessment (eye, tooth, buccal mucosa) & its surgical procedure with its advantages and limitation.

Keywords: Corneal blindness, Osteo-Odonto-Keratoprosthesis (OOKP), Keratoprosthesis (KPro), Osteo dental acrylic complex (ODA complex)

1. Introduction

Corneal blindness, the second most common human disability affecting a huge population [1]. Osteo odonto keratoprosthesis or 'tooth for an eye' [2-3] is a complex 2 stage procedure in which the canine tooth or any single root tooth is removed from the patients mouth; shaped and drilled to allow implantation of polymethyl metha acrylate (PMMA) or corneal device (optical cylinder). PMMA is fixed to a natural support (haptic) which is prepared by a human living tissue which is then implanted back into the eye after a few months [4-7]. Its goal is to restore sight in patients with damaged surface of the eye in whom all previous attempts of restoring vision has failed. OOKP is the ideal treatment for damaged cornea, extreme inflammatory corneal disease and dry eye in which cadaveric corneal graft is destined to fail [8].

2. An Ideal Keratoprosthesis

Ideally the keratoprosthesis must be better than the natural cornea. It should intensify the optical quality and have decreased aberrations with bio integration properties. It must defend against bacterial infection while lasting for a lifetime. Duplication of natural characteristics such as drug penetration and intra ocular pressure movement in the cornea is to be produced [9-10].

Distinctive keratoprosthesis are available varying in their design to support the optical cylinder. A non-biological skirt is commonly used in models, is permeable e.g. all PMMA, Dacron, expanded PTFE and Hydro gel. Keratoprosthesis with biological skirts were found to be more compatible, having a better Osseo integration property; e.g. the StremPELLI OOKP uses autogenous root of the tooth & alveolar bone to aid the PMMA optical cylinder cartilage (Casey) and tibial bone (Temprano)

A successful outcome in OOKP surgery mainly depends mostly upon its material composition of the Keratoprosthesis, not just the tooth but also its ligaments, surrounding bone & periosteum covered by oral mucosa [6].

3. Guidelines for osteo odontokeratoprosthesis surgery

3.1 Indications

OOKP is mainly indicated in patients with bilateral corneal blindness caused from end stage Steven Johnson syndrome [8], ocular cicatricial pemphigoid, chemical burns, ocular graft failure, corneal graft failure tracheoma and dry eyes

3.2 Contraindication

It is contraindicated in children under 17 years of age, advanced glaucoma and in patients with unrepairable retinal detachment. Smokers are contraindicated as may cause graft vascularization problems and Tobacco or betel nut chewing may compromise tissue quality [11].

3.3 Patient assessment

Clinical assessment

OOKP surgery is a multistage (usually two) surgery & differs in technique. The surgical procedure is multidisciplinary and carried out in the mouth & eye. Therefore, the ophthalmic, oral & psychological assessment of the patient is done prior to the surgery.

Ophthalmic assessment

In preoperative assessment, a detailed case history & determination of the chief diagnosis and any prior surgical intervention, specially concerning glaucoma, ocular perforation or a record of amblyopia. Prior to the surgery, the determination of an intact and functioning retina and optic nerve by relatively light projection in all quadrants and a normal B scan is examined. Examination of lids and fornices with the degree of dryness of the eyes are noted. Indication of stem cell failure is recorded. Evidence of previous corneal perforation, thinning of the cornea, adhesion of the iris and the degree of vascularization are also recorded. Intra ocular pressure is analyzed digitally to record if the eye is phobic, pseudo phakia or aphobic [11]. A&B scans are done for biometry to analyze the axial length, to confirm the status of the lens, rule out pre-phthisis, exclusion of retinal detachment, by detecting of gross glaucomatous copping.

Oral mucosa

Oral assessment has to be done on the buccal graft site and a suitable tooth is to be selected for the dentine/bone lamina

Buccal mucosa

OOKP will result in having a damaged mucosa in patients. Smokers and betel nut chewers interfere in the chance of graft re-vascularization, compromising the tissue quality. Thus the buccal mucosa has to be assessed clinically

Dental Assessment

Harvesting of a single root tooth along with its alveolar bone is done to fabricate a 'lamina' to prevent complications the surrounding structures have to be carefully examined. The neighboring tooth must not be damaged while harvesting the tooth and therefore adequate space is required. Periodontal and overall oral hygiene assessment can be done clinically, however radiographs are essential. A canine tooth is ideally preferred for harvesting however, in the absence of the canine tooth, single root teeth can be used. The option of maxillary or mandibular canine depend upon its vicinity to maxillary sinus and the mental foramen in the mandible. Harvesting mandibular canine is straight forward but sometimes due to the thin buccal plate preservation of the lingual muco-periosteum is a task. The maxillary canine comprises of

denser palatal bone, risking violation of maxillary antrum, but makes harvesting much easier. At this stage, the patient must be given full information give consent [11].

3.4 Surgical procedure:

OOKP is carried out in two stages 2-4 months apart under general anesthesia. It requires a multidisciplinary approach after case selection.

Stage 1

A single root tooth is preferred especially the canine from either the upper or lower arch with its attached periosteum undergoes osteotomy. It is prepared by separating it into two halves in the sagittal plane of the tooth root, under copious saline irrigation. A round hole is prepared centrally through the tooth root after removal of the exposed pulp tissue. A PMMA optical cylinder is cemented in the tooth root with cement; the pulp chamber is obliterated with PMMA cement as well. The complete keratoprosthesis comprises of one sagittal half of the canine tooth root with bone with the dimension 12 mm x 6mm x 3mm, consisting of optical cylinder having a border of dentine 1mm [12]. Prior to cementation of the tooth to the optical cylinder, its crown is removed. The optical cylinder is available in two varying diameter sizes (3.5 and 4.0 mm) and a standard size 8.75mm. The greater the width, the better and wide osteo odonto lamina. Preferably, lamina should be of the dimension 12 mm x 6 mm x 3 mm [13]. If the lamina surface is found to be small, two lamina can be prepared from two teeth which can be glued together for a larger surface [14]. A 3.70mm (3.3-4.0) diameter hole is drilled leave a border of 1 to 1.5 mm dentine [14].

The properties of the PMMA optical cylinder are, mean intraocular diameter, 4.1 mm (range, 3.6-4.6 mm); mean extraocular diameter, 3.65 mm (range, 3.3-4.0 mm); mean length, 7.75 mm (range, 7.25-8.25 mm); mean radius of the convex extraocular surface, 16 mm; mean radius of the convex intraocular surface, 6.5 mm; refractive index, 1.49; and equivalent power, 50.8 diopters [15].

The kerato prosthesis is then placed below orbicularis oculi muscle of cheek beneath contra lateral eye to receive a soft tissue covering. Buccal mucous graft will be placed to ensure the osteo - odontal tissue recovery forming a fibro vascular covering over the lamina providing vascular supply to the osseous portion of the Osteo - Odonto lamina.

Stage 2

After Two to Four months stage 1 surgery is carried out in which the keratoprosthesis is retrieved. After inspection of the fibro vascular capsule is carried out, the reflection of the buccal mucosal graft is done while excess tissue is removed from the bone surface. Corneal trephination is carried out (5mm diameter) to form a central opening in the eye, removing the iris lens and the anterior vitreous. Incision is made to relieve and there is a complete removal of the iris. Posterior of the lamina is placed through the central hole. The lamina is sutured onto the cornea and sclera. Air is injected in to reform a globe, centering the keratoprosthesis implant is checked [12]. Intra venous manitol is administered to reduce the intra ocular pressure. After marking the center of the cornea, 3mm trephination will be carried out over the center of the graft to clear the visual axis and to allow the transmission of light for clear vision. Replacement of the mucosal flap is done after preparing a hole in the anterior part of the cylinder. Patient is kept in a supine position for 5 to 6 days till the invitreal air is completely resorbed. Cosmetic

prosthesis is later placed over the external ocular surface following a month after the surgery^[11, 14].

Post-operative period immediately following the surgery requires pain relief prednisolone 20mg and lansoprazole 30mg for 5 days and oral antibiotics for a week. Chlorhexidine and nystatin mouth washes are given to the patient. After stage 2 surgery, diamox, steroids and antibiotics are continued. The optic is kept clean and the buccal mucosa is monitored. Skin sutures are removed after a 5 days^[11].

Lifelong follow up and at weekly intervals for a month followed by monthly for three months, and then by every two months for six months & later every four months.

3.5 Advantages

It is a positive heterotrophic auto graft made of living human tissue. The biological support or haptic is made of dentin, a hard tissue with decreased metabolic exchange, helps to provide stability through tight long lasting contact to the ODA lamina by acrylic resins with PMMA optical cylinder; thus protecting against cylinder extrusion and fistulization. It has the least risk of infection, making it more suitable for a lifelong support to the optical part of keratoprosthesis.

As the dentin is avascular tissue connecting the corneal surface and optical PMMA cylinder, formation of retro prosthetic membrane can be limited or prevented. An epithelial seal is generated to the anterior chamber, due to the tight contact between the mucous epithelium and components of osteo dental lamina, preventing infection, leakage of the aqueous humor and tissue neo vascular proliferation, which are responsible for formation of retro prosthetic membrane. The out dental lamina provides defense characteristics to the prosthesis, thus protecting against infection. Post-operative endophthalmitis caused with poor tooth condition can be avoided before surgery^[14].

3.6 Disadvantages

It requires lifelong follow up because it a two stage surgery while the esthetic coefficient is average^[14].

3.7 Complications during surgery

Possible complication may include ocular infection, ulceration of the implant buccal mucosa, extrusion, secondary glaucoma, retro prosthetic membrane formation and retinal detachment^[16].

4 Conclusion

OOKP today, is the only successful method of restoring long term vision in patients with corneal blindness. Following the innovative work of Strampelli, OOKP has proved to be most successful approach to KPRO implantation. This procedure however requires the extraction of patients one teeth, which is a disadvantage compared to other synthetic materials. However, studies have provided us with evidence of long term stability of visual rehabilitation that is not achievable in other methods.

5. References

1. World Health Organization, The World health report 1998: Life in 21st century. Geneva, Switzerland WHO. 1998, 47.
2. Langan EA, Liu C, Ogden S, Griffiths CE. A tooth for an eye: Cicatricial pemphigoid and the osteo-odonto-keratoprosthesis. *Arch Dermatol*. 2010; 146:1188-9.
3. Monteiro MJ, Herold J, Liu C, Francis I. Osteo-odontokeratoprosthesis (OOKP): A tooth for an eye

4. technique. *Br J Oral Maxillofac Surg*. 2009; 47:e19.
5. Strampelli B. Keratoprosthesis with osteodental tissue. *American J Ophthalmol*. 1963; 89:1029-39.
6. Falcinelli G, Missiroli A, Petitti V, Pinna C. Osteo-Odonto-Keratoprosthesis up to Date. *Acta XXV Concilium Ophthalmologicum* 1986. Rome. Kugler & Ghedini. 1987, 2772-6.
7. Falcinelli G, Barogi G, Taloni M. Osteo-odonto-Keratoprosthesis: present experience and future prospects. *Refractive Corneal Surg*. 1993; 9:193-4.
8. Falcinelli G, Barogi G, Caselli M, Colliardod P, Taloni M. personal changes and innovations in Strampelli's Osteo-Odonto-Keratoprosthesis. *An InstBarraquet (Barc)*. 1999; 29:47-8.
9. Liu C, Sciscio A, Smith G, Pagliarini S, Herold J. Indications and technique of modern Osteo-Odonto-Keratoprosthesis (OOKP) surgery. *Eye News*. 1998; 5:17-22.
10. Liu C, Tighe B. The properties of the ideal keratoprosthesis. *Anales Del Instituton Barraquer (Barc)*. 1999; 28(S):155-6.
11. Liu C, Tighe B. Striving for the perfect keratoprosthesis. *British Journal of Ophthalmology* 1998; 82:3-4.
12. Liu C, Paul B, Tandon R, Lee E, Fong K, Mavrikakis I *et al*. The Osteo-Odonto-Keratoprosthesis (OOKP). *Seminars in Ophthalmol*. 2005; 20:113-28.
13. Shetty L, Gupta A, Shah N, Shah U. A new vision through combined osteo odonto-keratoplasty: A review. *Med J D Y Patil Univ* 2014; 7:272-7.
14. Tay AB, Tan DT, Lye KW, Theng J, Parthasarathy A, Por YM. Osteo-odonto keratoprosthesis: a combined ocular-oral procedure for ocular blindness. *Int J Oral Maxillo Surg*. 2007; 36:807-13.
15. Falcinelli G, Falsini B, Taloni M, Colliardo P, Falcinelli G. Modified Osteo-Odonto-Keratoprosthesis for treatment of Corneal Blindness Long-term Anatomical and Functional Outcomes in 181 Cases. *Archives of Ophthalmol*. 2005; 123:1319-29.
16. Lupelli L, Fletcher RJ, Palumbo P, Menghi A, Taloni M. Improved optics for OOKP. *An Inst Barraquer* 1999; 28:159-60.
17. Hughes EH, Mokete B, Ainsworth G, Casswell AG, Eckstein MB, Zambarakji HJ *et al*. Vitreo retinal complications of Osteo-Odonto- Keratoprosthesis surgery. *Retina*. 2008; 28:1138-45.