

REVIEW ARTICLE

Odonto-Keratoplasty: A Review

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ABSTRACT

Eye forms the window of the soul and its cornea forms the window of the eye. In Odonto-keratoplasty procedure, a multidisciplinary approach from both oral and maxillofacial surgeon and ophthalmologist contributes to restore vision in the most severe cases of corneal blindness. This involves removing a tooth from the patient, shaping and drilling to allow implantation of an artificial plastic corneal device and finally implanting back into the eye few months later. Hence; in the present review, we aim to highlight some of the important aspects of Odonto-keratoplasty.

Key words: Dental, Odonto-keratoplasty, Tooth.

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INTRODUCTION

Blindness has been the most devastating condition for any individual. A combined oral and ocular procedure Odonto-keratoplasty (OKP) surgery has evolved itself as a new vision through dentistry. OKP is a complex surgical procedure in which a dental root lamina and buccal mucosal graft are used to secure a clear acrylic optical cylinder in anterior segment of the eye. Keratoprosthesis can be divided into two broad categories; those designed for eyes with a good ocular surface, intact tear film and lids, for example, Boston KPro type 1 or those designed to treat severe dry eyes and damaged ocular surfaces, for example, osteo-odonto keratoprosthesis (OOKP), Boston KPro type 2.¹⁻³

Historical aspect

OOKP was pioneered 50 years ago by Strampelli in 1963 and modified by Falcinelli et al which has led to improved visual results and retention of device. The first surgical case in a human was performed in 1855 with a quartz crystal implant developed by Nussbam as mentioned in literature by Liu et al. Numerous synthetic keratoprosthesis devices have been developed as total replacements of the cornea for the treatment of corneal

blindness. The ideal device of keratoprosthesis (kpro) should be able to surpass the natural cornea by having an improved optical quality, with decreased aberrations and a specifiable power. It should have an excellent biointegration, provide resistance against infection and last the lifetime of the patient. It should also replicate some of the qualities of the cornea such as drug penetration and allowing intraocular pressure measurement. Various materials have been used to support an optical cylinder in kpro surgery, e.g. PMMA (Cardona keratoprosthesis), dacron (Pintucci keratoprosthesis), aluminium oxide ceramic (Polack keratoprosthesis), polytetra fluoroethylene (Legeais keratoprosthesis). These have been associated with problems including rates of extrusion far greater than that of OOKP, ranging from 21% (Cardona) to 10% (Pintucci). More recently, an implantable hydrogel keratoprosthesis (Alphacor) has been used where the retention of the device was 62% at 2 years. So it would seem probable that if a plastic acrylic implant could be held in a piece of the patient's tooth and bone, and the whole placed in a corneal envelope, the tooth and bone would form an autograft picture-frame for the acrylic, and

so prevent its extrusion. This was modified over years and presently referred to as Rome-Veinna protocol.⁴⁻⁸

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. 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.^{9, 10}

REFERRAL GUIDELINES FOR OKP SURGERY

Indications

Patients with bilateral corneal blindness resulting from severe end-stage Stevens-Johnson syndrome, ocular cicatricial pemphigoid, chemical burns, trachoma, dry eyes or multiple corneal graft failure may be considered for OKP surgery. The better, or only, eye should have poor vision, such as PL, HM or at best CF. One eye only will be rehabilitated. In suitable cases, there would be no need to go through unsuccessful penetrating keratoplasty with or without limbal stem cells transplantation and amniotic membrane grafting beforehand.¹¹

Contraindications

Patients who are happy and managing with their level of vision, children under the age of 17, eyes that have no perception of light, evidence of phthisis, advanced glaucoma or irreparable retinal detachment should be excluded. Suitable candidates have to understand that the surgery can be prolonged—they may require multiple procedures—and that there is a significant risk of serious complications including loss of the eye. The patient must be able to commit to life-long follow-up, and not have unreasonable expectations of outcome and cosmesis.¹²

Fine Details of Harvesting Tooth, Root and Surrounding Jaw Bone

The harvest of the alveolar/dental complex involves the sectioning of bone on either sides and apical to the chosen tooth and removing the tooth and its surrounding alveolar bone, together with the associated mucoperiosteum. An incision is made to the bone and mucoperiosteum elevated from adjacent teeth. The bone cuts are made between the teeth and below the chosen tooth with a fine saw, under

constant irrigation to minimize any thermal injury to the lamina. The complex is then removed from the mouth in readiness to prepare the lamina. The resulting alveolar defect is covered as best as possible with adjacent mucosa but the exposed bone epithelializes very rapidly.¹³

ORAL COMPLICATIONS

Buccal Mucosa Harvest Site

The graft harvest bed is left to granulate. This usually takes place rapidly and is complete at two to four weeks. Occasionally there is an excess of scarring, resulting in limitation of mouth opening requiring mouth opening exercises and massage of the scar, otherwise this can easily be dealt with by incision of the scar bands.¹⁴

Alveolar Graft Harvest Site

The complications are due to poor healing at the site resulting in exposure of roots of adjacent teeth, and damage to adjacent anatomy. The areas most at risk are the roots of adjacent teeth and maxillary sinus. The dental damage can be avoided by using very fine blades and careful technique. The damage to the maxillary sinus can be avoided by not making the apical cut too high but if the root of the donor tooth is very close to the maxillary sinus this complication is unavoidable.¹²

CONCLUSION

Under the light of above mentioned literature, the authors conclude that the OKP surgical technique is extremely demanding but at the same time is also time-consuming. The patients will have limited peripheral vision; however, they will be able to navigate, read at least large print, feed, and dress themselves without any assistance. However; further studies are directed for better exploration of results and future aspects.

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