ABSTRACT:
Stem cell allograft requires long term immunosuppression with its attendant risks and variable outcomes. The implantation of a keratoprosthesis serves as a last resort to restore vision in these eyes. A vast number of designs and materials of keratoprostheses with different methods of insertion have been developed and implanted in patients over the past two centuries with quite variable long-term results. Most studies report either a short follow up or a comparatively short lived visual recovery in majority of the cases. The technique with by far the best results and proven long term follow up is the osteo-odonto-keratoprosthesis (OOKP) invented by Strampelli and modified over the years by Prof. G. Falcinelli. OOKP developed some 40 years ago by Strampelli uses a biological skirt in the form of the patient's own tooth root and alveolar bone to support a polymethylmethacrylate (PMMA) optical cylinder. Over the years, Prof. Falcinelli devised stepwise modifications to the original Strampelli technique, now termed as the modified osteo-odontokeratoprosthesis (MOOKP), which has led to improved visual results and retention of the device. 

Indications and Contraindications
All cases of bilateral blindness due to severe end stage ocular surface disease form the major indications of the procedure. 

Indications for OOKP
1. Stevens-Johnson syndrome (figure 1)
2. Ocular cicatricial pemphigoid
3. Epidermolysis bullosa
4. Chemical injury
5. Thermal injury
6. Trachoma
7. Multiple failed penetrating keratoplasties
8. Aniridia with severe corneal changes
9. Corneal failure after vitrectomy with silicone oil filled eyes

The only absolute contraindications to the procedure include absent light perception and an edentulous patient. Age below 17 years, retinal detachment or other posterior segment pathologies that severely interferes with potential visual acuity, mentally unstable patients, unavailability for long term follow up and unreasonable visual or cosmetic expectations are relative contraindications.

Preoperative Assessment
A detailed history to determine the primary diagnosis and previous surgical interventions is recorded. A brisk perception of light and normal B-scan are essential prerequisites. Intraocular pressure is usually assessed by digital tonometry. Oral and dental hygiene state and state of buccal mucosa. An orthopanto-mography(OPG), X-ray and spiral CT scan of canines is carried out for selection of a suitable tooth with the assistance of an maxillofacial surgeon.

Surgical Technique
The OOKP procedure involves 2 stages performed over a period of 6-9 months.

Stage 1 involves ocular surface reconstruction and fashioning of an osteo-odontoo lamina and its optical cylinder. A large circular piece of buccal mucosa is harvested from the cheek. The graft is trimmed of excess fat and soaked in cefuroxime solution. A lateral canthotomy is performed, followed by division of symblephara and superficial keratectomy. The buccal mucus membrane graft is sutured to the sclera bounded by the insertion of the rectus muscles to create a new ocular surface (figure 2). The crown of the harvested tooth is used as a handle; whilst the attached tooth root and surrounding bone is worked into a lamina with dentine on one side and bone on the other. Periosteum is conserved and where possible glued back with fibrinogen adhesive. A hole is drilled through the dentine to accommodate a PMMA optical cylinder, which is cemented in place (figure 5). The resultant osteo-odontoo lamina is placed into a sub-muscular pocket under orbicularis oculi, usually in the lower lid of the fellow eye, in order to acquire a soft tissue covering.

Stage 2 starts with retrieval of the osteo-odontoo lamina from its sub-muscular pocket and excess soft tissue is removed from the bone surface (figure 6). On the dentine surface, no soft tissue is allowed to remain. The lamina is reinserted into its pocket until the eye is ready to receive it. The buccal mucosal flap is reflected back to allow access to the cornea. A flininga ring is sutured in place. The centre of the cornea is marked and a small hole is trephined, the diameter of which corresponds to that of posterior part of the optical cylinder. Relieving incisions are made and total iridodialysis, lens extraction and anterior vitrectomy are performed. The posterior part of the lamina is inserted through the central corneal hole and the lamina is sutured onto the cornea and sclera (figure 7). The eye is re-inflated with filtered air. The mucosal flap is replaced after cutting a hole to allow the protrusion of the anterior part of the optical cylinder. The final picture one year post op is shown in figure 8.

Fine Details of Harvesting Tooth, Root and Surrounding Jaw Bone
The ideal tooth in size and shape with the best
surrounding bone is usually the canine tooth (figure 3). There is usually little to chose in these parameters between the upper or lower canine. Other single-rooted teeth can be used in the absence of a canine. The assessment of suitability of the tooth depends on clinical examination but mainly on radiological assessment. The mainstay views are orthopantomograms (OPT) and intra-oral periapical radiographs (IOPAs). These views are essential. They give enough information in the majority of cases. CT scans can be useful to get more detail and are advocated by some operators. All other things being equal, the choice of upper or lower canine depends on the proximity of the maxillary sinus in the upper and, although rarely a problem, the proximity of the mental foramen in the lower. The lower canine harvesting is straightforward but the buccal plate is occasionally a little thin and the lingual mucoperiosteum is more difficult to preserve. The upper canine occasionally gives too much bone palatally and there is the risk of violation of the antrum; however, technically, the harvesting is easier. 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 (figure 4). 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.

Complications
The procedure is associated with complications. Awareness regarding these complications is necessary for early recognition and appropriate management.

Ocular
1. Glaucoma
2. Retroprosthetic membrane
3. Vitritis
4. Expulsion of cylinder
5. Endophthalmitis
6. Retinal detachment

Mucous membrane/ODAL
1. MMG thinning
2. MMG necrosis
3. Extrusion of prosthesis

Oral
1. Oroantral fistula
2. Damage to parotid duct
3. Damage to adjacent teeth
4. Mandibular fracture

Conclusion
MOOKP provides a stable and superior long term visual rehabilitation in patients with end stage ocular surface disorders. Though an extremely demanding and time consuming surgical procedure, the rewards are extremely satisfying which makes the effort worthwhile.

Acknowledgement;