The potential role of bioengineering and three-dimensional printing in curing global corneal blindness

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An insufficiency of accessible allograft tissue for corneal transplantation leaves many impaired by untreated corneal disease. There is promise in the field of regenerative medicine for the development of autologous corneal tissue grafts or collagen-based scaffolds. Another approach is to create a suitable corneal implant that meets the refractive needs of the cornea and is integrated into the surrounding tissue but does not attempt to perfectly mimic the native cornea on a cellular level. Materials that have been investigated for use in the latter concept include natural polymers such as gelatin, semisynthetic polymers like gelatin methacrylate, and synthetic polymers. There are advantages and disadvantages inherent in natural and synthetic polymers: natural polymers are generally more biodegradable and biocompatible, while synthetic polymers typically provide greater control over the characteristics or property adjustment of the materials. Additive manufacturing could aid in the precision production of keratoprostheses and the personalization of implants.

additive manufacturing

Cornea

hydrogel

keratoprosthesis

polymer

collagen type 1

cytokeratin 3

gelatin

macrogol

methacrylic acid

n,n dimethylacrylamide

politef

poly(methyl methacrylate)

polyglactin

polymacon

polyvinyl alcohol

biocompatibility

biodegradability

bioengineering

biosynthesis

blindness

cell adhesion

cell structure

cell viability

cornea disease

cross linking

flow kinetics

Fourier transform infrared spectroscopy

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