
CHAPTER 5

Replacing Organs with Permanent Prostheses

5.1 Defining the Clinical Problem

5.2 Anatomical Considerations

5.3 Biomechanical Considerations

5.4 Functional Requirements

5.5 Goodness of Fit

5.6 Fixation

5.1 ABSORBABLE VERSUS PERMANENT DEVICES/IMPLANTS

	Absorbable	Permanent
Goal	Regeneration	Replacement of Function: Temporary or permanent ("prosthesis" - "artificial organ")
Function	Template for regeneration. Temporary replacement of key function(s) until regeneration occurs	Replicate/approximate key function(s) of the organ
Materials	"Absorbable, resorbable, biodegradable" polymers (synthetic or natural) and certain calcium compounds	Metals, nondegradable polymers, and ceramics
Incorporation of Cells	"Tissue engineering"	Hybrid artificial organs
Requirements for Use	Potential for tissue regeneration: 1) ability of cells to divide or regenerate organelles 2) Integration into the organ system	Benefit/risk ration

Limitations

Limitations in regeneration

- 1) size of defect,
- 2) number of tissues involved,
- 3) controlling mechanical and chemical environment during regeneration.

Imperfect adaptation to changing demands of human activity.

Implications in Falling Short of Goal

Incomplete regeneration of reparative tissue (accelerated degeneration)

Inability to adequately duplicate function (need for revision with additional loss of tissue)

Adverse Effects of the Body on the Implant (chemical and mechanical environment)

Premature degradation

Fracture, wear, and corrosion (polymer degradation)

Adverse Effects of the Implant on the Body ("Biocompatibility")

Local response:
degradation products cause cell toxicity or inflammation, or alteration in strain distribution
Systemic response:
1) migration of material to distant organs with effects,
2) immune response

Same

Complications

Bacterial infection (lower incidence than with permanent devices)

Infection:
bacteria colonize implant surface