transplanting it into the defective site (Stevens 2008). The drawback of this method of treatment is that it is restricted by the supply and morbidity of the donor sites related to harvesting bone tissue (Stevens 2008).

Allografts

Allografts are an alternative but less favoured method of treatment for the promotion of bone repair. The donor bone for this treatment is harvested from another patient and requires the recipient to take daily immunosuppressive drugs (Basha et al. 2015). The challenges with this treatment are: limited amount of availability, risk of disease transmission and infection (Basha et al. 2015).

Biomaterials for bone repair

Biomaterials were traditionally defined as inert and would not interact with the hosts biological chemistry; wood is one such material that was once used to replace lost tissue after a trauma (e.g., Prosthetics) (Lee and Mooney 2011). However, as research into synthetic materials has progressed it has led to a new definition of what is currently accepted as a biomaterial.

Biomaterials are defined *"as material intended to interface with the biological systems to evaluate, treat, augment or replace any tissue, organ or function of the body*" (Lee et al. 2011).

It is proposed that advancements in science, engineering and technology enable the limitations of the previous two treatments to be overcome by the use of a biomaterial substitute (Basha et al. 2015). The materials that are used for bone treatment must be osteoconductive (promote bone growth and encourage ingrowth of surrounding bone) and be able to integrate into surrounding bone (Kalfas 2001). Previous biomaterials can be categorized into four generations (Table 2) (Basha et al. 2015).

While the first-generation materials had excellent mechanical properties, they were not bioresorbable or bioactive and had to be surgically replaced as they have a limited lifetime. The scaffolds developed by the second generation of materials proved to be too brittle for load bearing conditions and the polymeric scaffolds also lacked bioactivity and adequate mechanical strength. By combining scaffolds with other materials third generation biomaterials were developed. The third-generation classification of biomaterials that benefit from combined the strength, stiffness and osteoconductivity of ceramic scaffolds with the flexibility, toughness and resorbability of the polymer scaffolds. Further advances incorporated osteogenic cells and growth

Table 2. The Four Generations of Biomaterials.

Generation	Biomaterials
First generation	Metal and alloy bone grafts
Second generation	Bioactive ceramic and bioresorbable polymer scaffolds
Third generation	Composite scaffolds
Fourth generation	Polymer-ceramic composite scaffolds with an incorporation of osteogenic cells