Bioactive glasses are a group of reactive glass-ceramics that have been investigated for decades because of their bio-compatibility (ability to be incorporated in the human body with little resistance or rejection). They are often used as implant material to help repair and replace bone and other tissue that has been damaged or is diseased. BioGlass is a commercially available type of such bioglasses. It was developed at the University of Florida by Professor Larry Hench, who first called it 45S5 glass. It was originally created in response to the army’s request for a material that would help soldiers badly injured in the Vietnam War to regenerate bone (HU Yong-cheng 2003).

The chemical composition of BioGlass consists of 45% silica, 24.5% CaO, 24.5% Na2O and 6% P2O5 which allows this material to easily react and bind to the aqueous medium found in and surrounding bone. These elements are heated to exactly 1350°C to form a homogeneous silica-network glass (HU Yong-cheng 2003). BioGlass also has a Young’s modulus of 30-35GPa, which is very close to that of cortical bone. It also has phosphorus and silicon-essential elements of mineralized bone which allows it to bind to bone and promote regeneration.

BioGlass has been used for decades both alone and in conjunction with other bio-materials in order to help accelerate healing in everything from teeth, to the orbital floor of the skull, to the tiny bones of the middle ear, to even the femur and hip joint. However, it has only been FDA approved for osteostimulation in 2005. Before and after 2005 several countless studies have been done to test the safety and effectiveness of this bio-material (Tregonning 2001).

A study was performed in 2003 on 12 white New Zealand rabbits to test levels of inflammation, infection, implant resorption, and bone formation. These rabbits were split into 3 groups, one which used BioGlass, one which used a collaboration of bio-materials including BioGlass, and the last which was the control. The results showed that while the rabbits with BioGlass had markedly lower levels of infection and inflammation, and had higher levels of implant resorption and bone formation. However, the combination of BioGlass with other bio-materials proved to be even more effective in the aforementioned ways, but also provided adequate volume augmentation which BioGlass alone failed to do (Amato 2003).

Another study experimented with BioGlass to determine whether it was beneficial to use it in impaction grafting in hip arthroplasty (hip replacement). Again there were three groups of patients: one had only traditional implant material, one had BioGlass added to the bio-materials used, and one was the constant. The results of this experiment showed that while the results of using traditional bio-materials were significantly better than the results of the control group, the patients who had BioGlass incorporated in their implant had inconsistent results. Not only were there low levels of implant resorption and bone regeneration on the site of the implant, but there was a significant rise in inflammation which indicates a rejection by the body (Tregonning 2001). In conclusion, BioGlass did not prove valuable in use on larger implant sites such as the hip joint.

A third experiment was done on a much smaller level with slightly different results. In 2009, the effectiveness of BioGlass in the reconstructive process following the removal of impacted molars in 14 subjects. The conclusion of this experiment was that BioGlass did provide an increase in clinical cortical bone attachment compared to traditional bio-materials in grafting. It also showed slight increases in bone regeneration compared to the traditional grafting methods (Neville 2009). The positive results of this study may be attributed to the fact that the recovery sight of an impacted molar removal is much smaller than that of other surgical sights such as the orbital floor or surface of hip articulation.

Works Cited
