Posterior Spinal Fusion Using Bone Graft Substitutes

N.K. ANJARWALLA*[1], P ROBBINS[2], J HUCKER[1], S.P.F. HUGHES[1]

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Introduction

Posterior and lateral mass fusion are recognised treatments for spinal instability. Bony fusion is often enhanced by autograft harvested from the iliac crest. This is associated with a significant morbidity[i] and has stimulated the development of bone graft substitutes, such as Bioglass 45S5 a melt derived glass, composed of sodium, calcium, silicon and phosphate. *In vitro* Bioglass® is known to stimulate osteoblast proliferation and the production of bone nodules[ii]. Animal studies have shown Bioglass® to be as efficacious as autograft[iii].

Hypothesis

Bioglass® can be used as a bone graft adjunct reducing the need for autologous bone graft. It is a safe material and the success of fusion should not be affected.

Aims

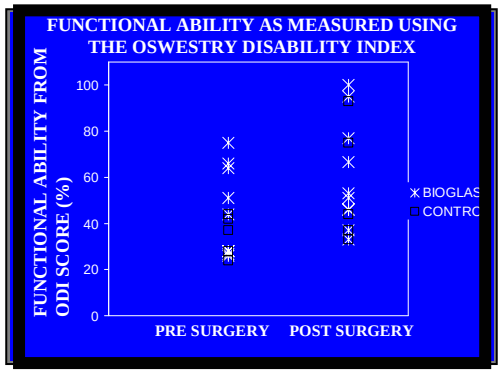
To show Bioglass®
- may safely be used as a bone graft adjunct
- is a safe material to use in posterior spinal fusion

Method

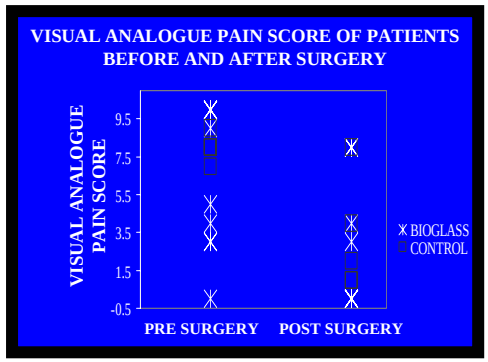
Patients were recruited from our pre-admission clinics. Having obtained written consent they were randomly allocated to;
Group 1 - fusion supplemented with autologous bone only
Group 2 - autologous graft on one side of their spine and a 50/50 mixture of graft and Bioglass® on the other.
Patients were assessed by an independent observer; function using the Oswestry Disability Index, pain using visual analogue scales, X-rays were performed on all patients and bone densitometry on some. This was repeated at 1, 3, 6 and 12 months post operatively.
Outcome was graded as excellent, good, fair or poor - determined by their return to work, regular activities, analgesic requirement and neurological deficit. Surgery was performed exclusively by two spinal surgeons in our unit. Randomisation occurred in theatre. Post operatively patients were mobilised with the assistance of a physiotherapist and discharged when deemed safe.

15 patients have been followed up for greater than 6 months. Control group n= 5. All female. Average age 46 ± 15years. In the study group which received autologous bone on one side and a mixture of autologous bone and Bioglass® n= 10. 5 were female and the average age was 50± 24yrs

Results

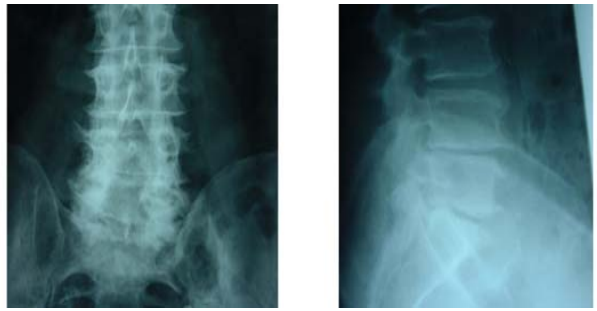


Plot of the change in functional ability of patients (100% being fully functional) in the plot above, and change in the level of pain, in the plot below, before and after surgery in the two groups. There was no significant difference between the two groups.



	BG	CONTROL
EXCELLENT	5 (50%)	2 (40%)
GOOD	1 (10%)	1 (20%)
FAIR	1 (20%)	1 (20%)
POOR	2 (20%)	1 (20%)

Table of results showing the outcome of fusion in the control and study group -BG. A 60% excellent/good outcome is comparable with other authors[iv]. Within the Bioglass group there was a significant improvement in pain ($p < 0.05$ t test) and function ($p < 0.01$)



X-rays of a patient who received autograft on one side and a mixture of Bioglass® and autograft on the other demonstrating fusion at 6 months. There was no evidence of pseudarthrosis in any of the patients.

Summary

The results of surgery from this study produced a 60% good or excellent result. We have shown that the preliminary results of spinal fusion using a mixture of autograft and Bioglass® is equally successful as autograft alone. There were no adverse reactions to the material.

Conclusions

There is a need for a safe alternative to autologous bone graft. The use of allograft is associated with a risk of infection transmission[v]. Recombinant technology will soon make Bone Morphogenetic Proteins widely available for clinical use. These proteins, that are able to stimulate bone formation and fusion[vi], require a carrier. We propose that a combination of these proteins with a bioactive material such as Bioglass®, that is also able to act as a bone graft adjunct may well be a successful alternative to autologous bone graft.

References

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*n.anjarwalla@ic.ac.uk
1. Department of Orthopaedics, Charing Cross Hospital, ICSM
2. Academic Department of Imaging, Hammersmith Hospital, ICSM