

Restoration of Pullout Strength of the Failed Pedicle Screw: Biomechanical Comparison of Calcium Sulfate vs Polymethylmethacrylate Augmentation

Guler U.O; Derincek A; Hersekli M.A.

Orthopaedics and Traumatology Department, Baskent University, Turkey



SPINEWEEK 2012 RAI AMSTERDAM 28 MAY - 1 JUNE



This research work is a sponsored study by Cezmed and Orsem Med, Adana, Turkey. They had no role in the study design, data collection, data analysis or writing of the report

None of authors has no conflict of interest relating to this publication



SPINEWEEK 2012 RAI AMSTERDAM 28 MAY - 1 JUNE



Background & Aim

The use of pedicle screws in the treatment of vertebral diseases has been increasing in the last two decades; however, loosening, pulling out or failure of pedicle screws are relatively frequent problems

The aim of the present study was to compare PMMA and CAS bone cements, used for the augmentation of a failed pedicle, by performing biomechanical pull-out strength testing



Material

Thirty lumbar vertebrae (L1-L5) were obtained from six calf cadavers

X-ray and the bone mineral density (BMD, g/cm^2) of each vertebra was taken in anterior and posterior direction

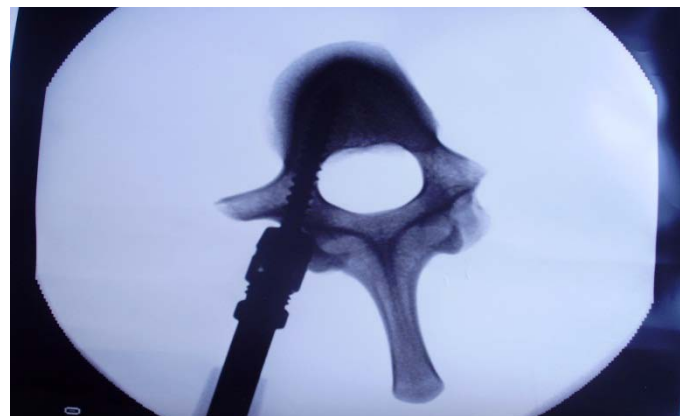


Method

First Step (primary screw pull-out test)

Left or right pedicular trajectories were formed under flouroscope for each vertebra randomisely

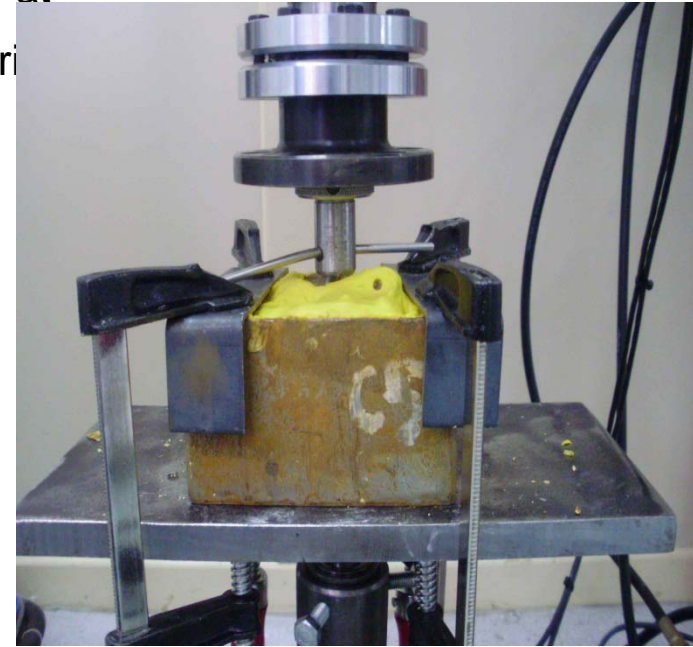
Polyaxial self-tapping, same diameter and length titanium pedicle screws were placed into all vertebrae



Method All vertebrae were embedded into cement

Pull-out tests were performed for axial POS at

5 mm/min displacement using a material testing instrument



Method

Second Step (revision screw pull-out test)

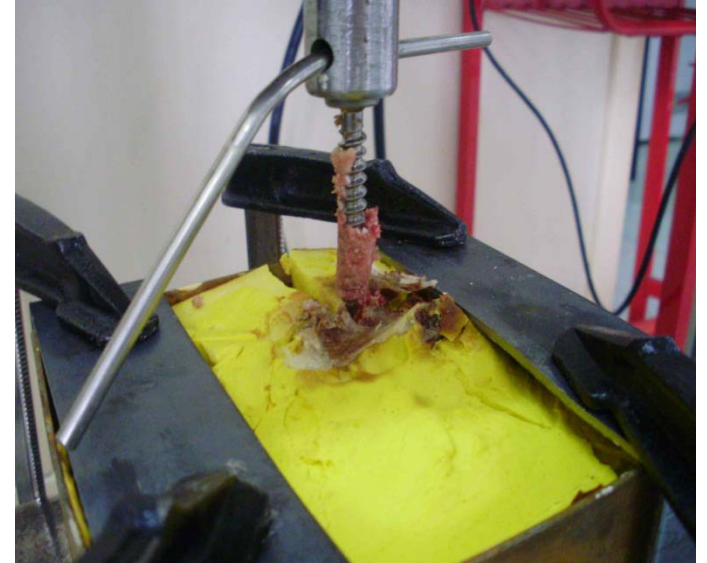
All vertebra were randomly divided into two groups; 2 or 3cc of CAS or PMMA cement injected into the damaged pedicle holes without any pressure

Then the same pedicle screws that had been used for pullout testing were inserted without drilling or tapping



Vertebrae were placed into the testing machine again as done in primary screw pull-out tests and revision pull-out test were successfully concluded

The polyaxial head of one PMMA-augmented screw was observed to detach from the screw body during the pull-out process at 6415N and this specimen had to be excluded from the study





CAS Group



PMMA Group



SPINEWEEK 2012 RAI AMSTERDAM 28 MAY - 1 JUNE



Results

Groups	Mean of primary pull-out strenght (N)	Mean of revision pull-out strenght (N)	p*
Calcium Sulfate	2441.3±936.4	2499.5±1425.1	>0.05
PMMA	2876.6±926.6	3745.5±1299.2	<0.05
p**	>0.05	<0.05	

p*: test of Wilcoxon, p**: test of Mann-Whitney U, p <0.05 is the statistics significance level



Results

In group 1;After CAS augmentation, the mean \pm SD POS was 2499.5 ± 1425.1 N. No statistical difference was found between the primary and revision screws POS($p=0.865$)

In group 2;After PMMA augmentation,the mean \pm SD POS was 3745.5 ± 1299.2 N. The increase between the primary and augmented values of the second group was found statistically significant ($p=0.047$)

Also, a statistically significant difference was found ($p=0.026$) between the mean POS values of group 1 and 2 after augmentation

When BMD values were compared with the primary and revision pull-out values, a positive correlation was observed only between BMD and primary screw pull-out values, which was found statistically significant in Pearson correlation test ($r=0.578$; $p<0.05$)



Conclusion

Although PMMA, as a material of pedicle screw salvage, has been recognized as the golden standard due to its easy availability, low cost and superiority of augmentation, the use of materials which give no exothermic reaction and have high biocompatibility, consequently has lower risk of complication are future promising

