

## ABSTRACT

Odontoid peg fractures are the most common injuries of the cervical spine in the elderly. Anterior screw stabilisation in type II odontoid peg fractures improves survival and function in these patients but may be complicated by failure of fixation.

The purpose of our study was to determine whether cement augmentation of a standard anterior screw provides biomechanically superior fixation of type II odontoid fractures in comparison to a non-cemented standard screw. In the second part of the study the aim was focused the role of bone cement amount and its quality to the stiffness of odontoid and vertebrae body junction.

Twenty human cadaveric C2 vertebrae from elderly donors (mean age 83 years) were obtained. Anderson and D'Alonzo type II odontoid fracture was created by transverse osteotomy and fluoroscopy guided anterior screw fixation was performed. The specimens were divided into two matched groups. The cemented group (n=10) had radiopaque high viscosity polymethylmethacrylate cement injected via Jamshidi needle into the base of the odontoid peg. The other group was not augmented. A V-shaped punch was used for loading the odontoid in an antero-posterior direction until failure. The failure state was defined as screw cut-out or 5% force decrease. Mean failure load and bending stiffness were calculated.

The mean failure load for the cemented group was  $352 \pm 12$  N compared to  $168 \pm 23$  N for the non-cemented group ( $P < 0.001$ ). The mean initial stiffness of the non-cemented group was  $153 \pm 19$  N/mm compared with  $195 \pm 29$  N/mm for the cemented group ( $P < 0.001$ ). Finite-element method was used to achieve different scenarios of cement augmentation in the second part of the study.

Cement augmentation of an anterior standard screw fixation of Type II odontoid peg fractures in elderly patients significantly increased load to failure under anterior posterior load in comparison to non-augmented fixation. This may be a valuable technique to reduce failure of fixation. Our second study has shown that the low porous cement was able to significantly influence the stiffness of the augmented odontoid fixation in vitro. Our results suggest that only a small amount of non-porous cement is needed to restore stiffness at least to its pre-fracture level and this can be achieved with the injection of 0.7-1.2 ml of cement.

