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Title: Biomechanical Assessment of a New Surgical Method Instead of Kyphoplasty to Improve the Mechanical Behavior of the Vertebra; A Micro Finite Element Study

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1 What did this study explore?

In this study a new method in treating vertebrae is suggested by setting the hexagonal porous structure instead of the rigid bone cement mass in the KP. Micro finite element modeling (FEM) was performed based on micro computed tomography (μ CT) of ovine trabecular cube.

2 How did the authors perform all experiments?

Two L1 ovine vertebral bodies were chosen for the VP and KP procedures. Cement augmentation was performed according to common instructions in the literature. The VP and KP procedures were performed by needle insertion through the pedicle. Poly methyl methacrylate (PMMA) was used as the bone cement. The volume fraction of consumed PMMA is 20% of the whole vertebral volume. The cement distribution was checked by CT scanning of the samples after cement augmentation. To reconstruct three dimensional micro structure of trabecular bone, a micro computed tomography (μ CT100, SCANCO Medical AG, Switzerland) was used for a specimen treated by VP and KP.

3 How did the authors process all experimental data?

To evaluate the regional variations of stress distribution inside vertebrae, each specimen was subdivided to 9 smaller cubes with the size of $5*5*5 \text{ mm}^3$ in 3 layers. Then the model was imported into the analytical software ABAQUS 6.14. to simulate the experimental testing conditions, a displacement load was applied as 1% compressive strain on the longitudinal direction with the full constraints at the bottom of each trabecular cube.

4 How did the authors deal with the pre-study hypothesis?

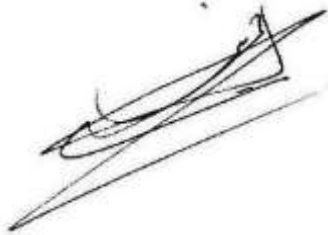
There is a pattern among designed implants, in which the thickness of structure decreases simultaneously with growing the spacing diameter from model 1 to 4. The hexagonal porous implants were designed in the way to replace the cement mass on one cube in four models with two groups of materials: steel and titanium. The porous structure is set in the space already occupied by the cement mass. The symmetric circle pattern was used to construct the hexagonal structure equivalent to the experimental study, already performed.

5 What are the novel findings of this study?

Novel findings of this study contains two main points: 1) after implementing geometrical parameters of the hexagonal structure, the amount of maximum Von Misses stress in the construction decreases 2) the influence of type of material (steel or titanium) on the amount of maximum Von Misses stress is less obvious than the impact of implant geometry.

Thank you for publishing our manuscript in the *world journal of orthopedics*.

Sincerely yours,

A handwritten signature in black ink, appearing to read 'Nima Jamshidi', with a stylized flourish at the end.

Nima Jamshidi

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