

## COMPARISON OF INSERTION TIME, PULLOUT STRENGTH AND SCREW-MEDIA INTERFACE AREA OF INDONESIAN CUSTOMIZED PEDICLE SCREW WITH DIFFERENT CORE AND THREAD DESIGN WITH COMMERCIAALLY AVAILABLE PEDICLE SCREW

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### Abstract

#### Background

Indonesian vertebral morphology has been shown to have difference with the western population. Developing customized pedicle screw based on previous study of Indonesian vertebral morphometry, will give better outcome related to the anatomical similarity.

#### Materials and Methods

This was an experimental study. We have developed 3 different types of pedicle screws (v-thread cylinder-core, square-thread cylinder-core and square-thread conical-core). The thread diameter was calculated from pedicle width of Indonesian population (6 mm). We used commercially available pedicle screw as control group (6,2 mm). The insertion time were recorded, the pullout strength test were performed, the interface area were calculated and the results were analyzed statistically.

#### Results

We evaluated 4 groups of pedicle screws that consist of 15 customized pedicle screws and 5 commercially available pedicle screws. The insertion time were significantly difference between v-thread cylinder-core pedicle screw (22,94 s) with commercially available pedicle screw (15,86 s) ( $p < 0,05$ ). The pullout strength were significantly difference between commercially available pedicle screw (408,60 N) with square-thread conical pedicle screw (836,60 N) ( $p < 0,05$ ). The square-thread conical-core group have the highest interface area (1486,21 mm<sup>2</sup>).

#### Conclusion

This study showed that our institution has been able to develop customized pedicle screws that have smaller diameter than commercially available pedicle screw. The data comparison showed that the square-thread conical-core customized pedicle screw group has comparable insertion time and has better pullout strength than commercially available pedicle screw.

**Keywords** : pedicle screw, pullout strength, insertion time, interface area

**PERBANDINGAN INSERTION TIME, PULLOUT STRENGTH, DAN SCREW-MEDIA INTERFACE AREA DARI PEDICLE SCREW YANG DISESUAIKAN DENGAN UKURAN TULANG BELAKANG ORANG INDONESIA DENGAN BERBAGAI DESAIN CORE DAN THREAD DENGAN PEDICLE SCREW KOMERSIAL**

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**Abstrak**

**Latar Belakang**

Anatomi tulang belakang populasi Indonesia berbeda dengan populasi negara Barat. Penelitian sebelumnya telah membuktikan bahwa anatomi pedikel populasi Indonesia ternyata lebih kecil. Pembuatan *pedicle screw* yang disesuaikan dengan ukuran tulang belakang orang Indonesia diharapkan akan memberikan hasil operasi yang lebih baik.

**Material dan Metode**

Kami melakukan penelitian eksperimental dengan membuat 3 kelompok desain *pedicle screw* (*v-thread cylinder-core*, *square-thread cylinder-core* dan *square-thread conical-core*) dengan ukuran diameter *thread* yang disesuaikan dengan ukuran pedikel orang Indonesia (6 mm). Kami menggunakan *pedicle screw* komersial sebagai grup kontrol (diameter *thread* 6,2 mm). Kami mengukur *insertion time*, *pullout strength*, dan *screw-media interface area*, kemudian hasil yang didapatkan dianalisa secara statistik.

**Hasil**

Kami berhasil meneliti 4 grup *pedicle screw* yang terdiri dari 15 *customized pedicle screw* dan 5 *pedicle screw* komersial. Hasil uji *insertion time* berbeda secara bermakna pada *pedicle screw* dengan desain *v-thread cylinder-core* (22,94 detik) dengan *pedicle screw* komersial (15,86 detik) ( $p < 0,05$ ). Hasil uji *pullout strength* berbeda secara bermakna antara *pedicle screw* komersial (408,60 N) dengan grup *square-thread conical-core* (836,60 N) ( $p < 0,05$ ). *Pedicle screw* dengan desain *square-thread conical-core* memiliki *screw-media interface area* yang tertinggi (1486,21 mm<sup>2</sup>).

**Kesimpulan**

Penelitian ini menunjukkan bahwa institusi kami berhasil membuat suatu *customized pedicle screw* buatan sendiri dengan diameter *thread* yang lebih kecil dibandingkan dengan *pedicle screw* komersial. *Customized pedicle screw* dengan desain *square-thread conical-core* memiliki hasil uji *insertion time* yang setara dengan *pedicle screw* komersial dan memiliki nilai *pullout strength* yang lebih baik dibandingkan dengan *pedicle screw* komersial.

**Kata kunci** : *pedicle screw*, *pullout strength*, *insertion time*, *interface area*