

Biomechanical Stability Analysis of Locking System in Poly-axial Pedicle Screws

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Key words : Poly-axial, Pedicle Screw, Torque, Locking System, Biomechanical Stability

1. (Cobb Angle),  $\mu$  (Surgical Management) [1]. / (Pedicle Screw) [2,3]. (Mono-axial) / (Poly-axial) [4,5]. (MIS) [6]. (Minimally Invasive Surgery) (Rod) [7]. (Construct Stiffness) Derotation (Rod) (Stability) (Set Screw) (Housing) (Set Screw) (Rod)

Table 1 Profile Combinations of Locking System in Poly-axial Screw

| Profile | Variation | mm   | mm       | mm  |
|---------|-----------|------|----------|-----|
| Type 1  |           | 13.5 | M10 2.2  | 6.0 |
| Type 2  |           | 13.5 | M10 2.2  | 6.3 |
| Type 3  |           | 14.0 | M9.5 2.2 | 6.0 |
| Type 4  |           | 14.0 | M9.5 2.2 | 6.3 |

2. (Trapezoidal Screw) Fig. 1 (A) (B) (C)

(Jig) MTS 858 Table Top System (MTS System Corp., Minneapolis, MN, USA) (12N·m) (Normal), (15°) (P-type) 5 (A=13.5, B=M10×2.2, C= 5.7) (Fig. 3). SPSS(Statistical Package for Social Science, Ver 9.0K, Chicago, USA) p 0.05



Fig. 2 Torque Tests by MTS System

Table 1 Titanium-alloy



Fig. 1 Three Design Factors(A · B · C) of Locking System in Poly-axial Pedicle Screw

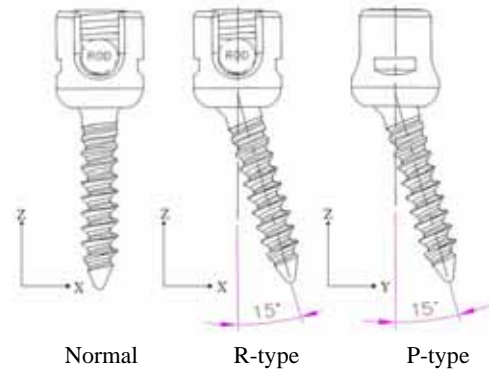


Fig. 3 Schematic Diagram of Three Insertion Types in Poly-axial Screws

3.

| Type   | Mean Torque (N·m) | Standard Deviation (N·m) |
|--------|-------------------|--------------------------|
| Type 1 | 26.5              | 0.7                      |
| Type 2 | 19.9              | 2.3                      |
| Type 3 | 23.2              | 1.6                      |
| Type 4 | 26.1              | 0.5                      |

(p<0.05)

Table 2

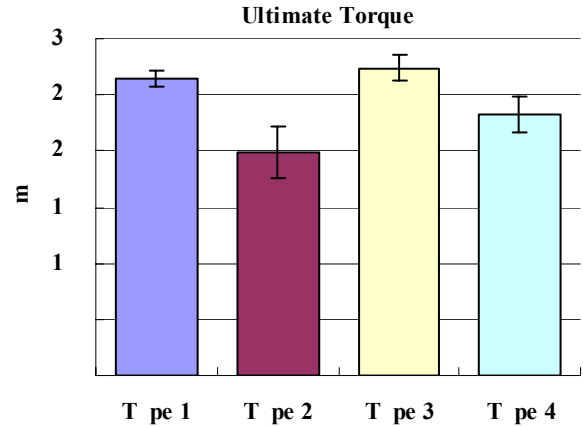


Fig. 4 Comparison of Ultimate Torque of Locking System in Poly-axial Screw

(Fig. 4).

Normal, R-type 24.8±1.4N·m, P-type 26.1±0.5N·m

Normal

(Fig.

5).

4.

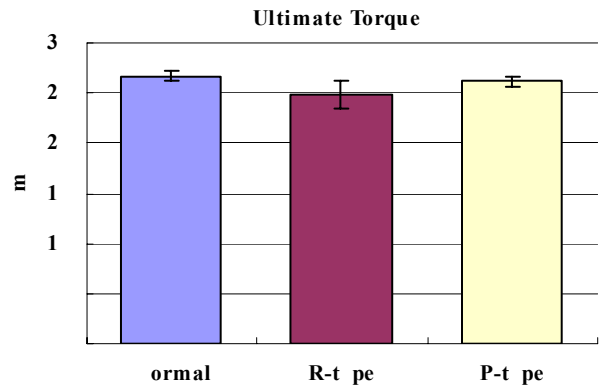


Fig. 5 Comparison of Ultimate Torque of Three Insertion Types in Poly-axial Screw

1.  $\Gamma$

2. /

3. (Set Screw)  $\Gamma$

ATC (10014102)

Table 2 Ultimate Torque of Locking System in Poly-axial Screw

| specimen | T pe 1 | T pe 2 | T pe 3 | T pe 4 |
|----------|--------|--------|--------|--------|
| No. 1    | 25.5   | 19.6   | 28.5   | 25.4   |
| No. 2    | 26.1   | 23.7   | 27.9   | 21.8   |
| No. 3    | 27.4   | 19.8   | 27.0   | 21.6   |
| No. 4    | 26.7   | 18.7   | 25.8   | 23.4   |
| No. 5    | 26.9   | 17.5   | 27.9   | 24.0   |
| AVG      | 26.5   | 19.9   | 27.4   | 23.2   |
| STD      | 0.7    | 2.3    | 1.1    | 1.6    |

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