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The Correlation between Sagittal Alignment and the Outcome of Cervical Total Disc Replacement

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Introduction: We set out to investigate whether restoration of the cervical sagittal profile after total cervical arthroplasty (TDA) affects the clinical outcome. We also investigated the role of the cervical TDA in restoring sagittal alignment of the cervical spine.

Material and methods: N=130 consecutive patients, with degenerative disease associated with chronic neck pain and radiculopathy, were prospectively investigated after inserting a Prestige LP cervical TDA. The pre and post-operative Neck Disability Index (NDI), SF-36, Visual Analogue Score (VAS), Hospital Depression Score (HDS) and Hospital Anxiety Score (HAS) were recorded. All patients had x-rays of the cervical spine pre-operatively, immediately post-operatively, and at 1 and 2 years post-operatively.

The angle of the FSU, (angle of the disc space formed preoperatively by natural endplates and postoperatively by the plates of the prosthesis), and the overall cervical alignment, (C2-C7 Cobb angle) were measured.

All measurements were performed by one observer (ICC = 0.89).

Results: Results were obtained in n=130 patients. The mean age at surgery was 51.12+/−0.84yrs, and there were 66 males and 64 females. N=75 underwent 1-level TDA, and n=56 underwent 2-level TDA. The mean follow up was 28+/−0.35 months. There was a significant improvement in all outcome scores measured: NDI (49.14±1.63 pre-op versus 25.24±1.68 post op: p=0.002), VAS neck pain (6.99±1.90 pre-op versus 2.94±2.43 post-op (p=0.012), VAS arm pain (6.76±1.88 pre op versus 3.04±0.27 post-op (p=0.007), HDS (9.08±4.53 pre-op versus 4.54±0.37 post-op (p=0.025), HAS (8.18±0.44 pre-op versus 4.85±0.39 post-op (p=0.009), SF-36 bodily pain score 29.52±1.38 pre op versus 49.77±1.87 post-op (p< 0.001), SF-36 mental health score (50.87±1.630 pre-op versus 62.47±1.79 post-op (p=0.045).

There was significant improvement in the sagittal alignment:

• The mean FSU angle pre-op was (2.1140±.42679) versus FSU of TDA (post-operative) of (3.2950±.51563), p=0.039

The mean cobb angle (C2-C7) pre-op was (5.2580±1.20780) versus post-op (15.2680±.97112), p< 0.001

There was significant statistical correlation between the FSU angle and the Cobb angle C2-C7, both pre operative and post operative.

Pre operative the correlation was (r=0.409, p< 0.001) and post operative (r=0.446, p< 0.001)

Effect of post operative Cobb angle on outcome and ROM

There was significant statistical correlation between total cervical alignment (C2-C7) post operatively and the followings:

• Improvement in NDI (r=0.322, p=0.002)
• Improvement in VAS neck pain (r=0.237, p=0.023)
• Improvement in SF-36 bodily pain (r=0.266, p=0.01)
• Improvement in HDS (r=0.341, p=0.001)
• ROM Neutral/extension (r=0.225 p=0.007)

Effect of post-operative FSU angle on outcome and ROM

There was no significant statistical correlation between the post-operative local FSU alignment and any of the improvement outcome:

• ROM Neutral/extension (r=0.275 p=0.32)
• ROM neutral/extension (0.118, p=0.33)
• Total ROM (r=0.140 r=0.247)
• Improvement in NDI (r=0.20, p=0.103)
• Improvement in VAS neck pain (r=0.008, p=0.95)
• Improvement in SF-36 bodily pain (r=0.022, p=.860)
• Improvement in HDS (r=0.016, p=0.89)

Conclusion: Cervical TDA restored and maintained sagittal balance at 2 years in the cervical spine. The restoration of sagittal balance correlated with significant improvements in both clinical and functional outcomes. Although there was no significant correlation of the FSU angle with the outcome it obviously allowed for the appropriate movement at the index level to achieve a good sagittal balance.