Force Transmission In Offset Broach Handles Used For Hip Replacement:

Comparison Of Three Different Designs



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Disclosure of conflict of interest

- M
- R
- Some of the authors are consultants from Stryker
 - The company provided no financial support for the present study

Introduction

- Double offset broach handles are used:
 - in minimal invasive direct anterior total hip arthroplasty
 - to facilitate the preparation of the femoral canal

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Introduction

Aim of the study:

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Quantify the differences in force and impulse transmission between two versions of double offset broach handles and a single offset broach handle.



Materials & Methods



 Two types of double offset broach handles were compared to a single offset broach handle (all Stryker, Mahwah, NJ-USA)



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Materials & Methods

- 30 measurements for five different falling heights for each broach handle
- Measurement of the force variations by a load cell
 - Obtainment of the maximum force peak
 - Calculation of the impaction impulse
 - Non-parametric U-Test



Materials & Methods

 Calculation of the impaction
Theoretical model: impulse



 $\vec{I} = \int_{t}^{t_2} f \mathbf{I} dt$

=mu-1E

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- Mass concentrated in one point
- No friction
- No Loss of energy









🖬 A 📓 B 📓 S 📓 T



Results

Broach handle S has a 18% higher force peak than B and 36% higher than A

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- S has a 24% higher impulse value then B and a 19% higher impulse value then A
- A had higher impulse values (5%) and lower maximum force values (18%) compared to B



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Conclusion

 the single broach handle has the highest force peaks in the direction of the tip, followed by broach handle B (22% lower than S) and A (36% lower than S)

- higher instantaneous force peaks could increase the risk of bone fracture
- contact surface during the impact could be a determining factor in reducing the maximum force peak

Elastic properties of the broaches were not known



R

Conclusion

- impulse values are very similar between the two double offset broach handles (A has 6% higher impulse value than B) and different compared to the single offset broach handle (S had 31% higher impulse value then B and a 19% higher impulse value then A)
 - the introduction of the lateral lever arm has a measurable effect in double offset broach handles
 - less kinetic energy is transmitted in the direction of the tip





Thank you!