

Surgeons experience less fatigue utilizing DePuy Synthes KINCISE™ System for simulated broaching than with conventional broaching



Authors: Elisabetta Ferrari¹, Mariam Khan¹, Robert Wallbank¹, Jack Mantel¹

Affiliations: ¹DePuy Synthes, Leeds, UK

1. Introduction

•Conventional broaching in Total Hip Arthroplasty (THA) involves repetitive mallet swings to impact a surgical handle and prepare the bone for implantation¹. This action may cause fatigue and musculoskeletal disorders in surgeons².

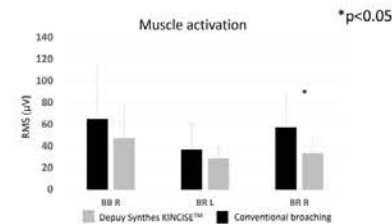
•An alternative method is by using an automated impaction device: *DePuy Synthes KINCISE™ System*.



Aim: to compare user performance during conventional broaching and DePuy Synthes KINCISE System impactions.

3. Results

•Decreased RMS during DePuy Synthes KINCISE System for the most active muscles during conventional broaching (BB R, BR L, BR R) and significant for BR R, involved in swinging the mallet and triggering DePuy Synthes KINCISE System ($p=0.018$)⁴



4. Discussion

•Decreased fatigue suggests that DePuy Synthes KINCISE System may reduce the burden on the user for the most active muscles during broaching^{3,4}.

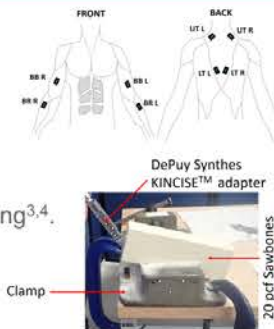
•DePuy Synthes KINCISE System impactions don't involve mallet swinging, resulting in lower level of activation and fatigue for the most involved muscles (forearm muscles)^{3,4}.



2. Methods

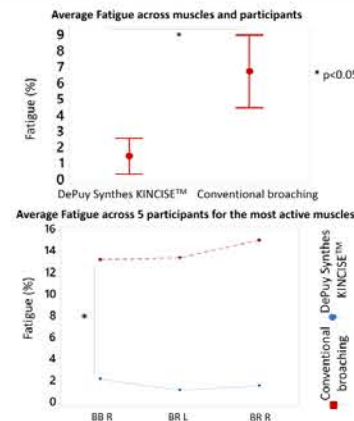
•Experimental Protocol

- »Surface Electromyography (sEMG) from 8 muscles
- »Seven (n=7) surgically trained users.
- »Simulated anterior approach set-up
- »Broaching tasks: sets of 100 continuous simulated impactions on Sawbones to reach equivalent broaching progression (as marked on the broach after 100 conventional impactions), repeated with conventional and DePuy Synthes KINCISE System broaching^{3,4}.



•Significant decrease in fatigue for 5/7 participants ($p=0.001$) for DePuy Synthes KINCISE System impactions.^{3,4}

• Fatigue was affected by the impaction modality (for the most active muscles) with significantly lower fatigue for DePuy Synthes KINCISE System broaching (BR L $p=0.01$, BR R $p=0.001$, BB R $p=0.007$)^{3,4}



5. Conclusion

•This study highlighted the positive impact of DePuy Synthes KINCISE System by showing measurable benefits, in terms of decreased active involvement of the most engaged muscle group, leading to less burden and fatigue.

• Further study: full surgeon kinematics (posture, performance) during interaction with surgical instrumentation.



• Data Analysis

- Muscle activation: Root Mean Square (RMS) of sEMG signal amplitude⁵.
- Fatigue: percentage change between start and end of broaching task⁵

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Please refer to the instructions for use for a complete list of indications, contraindications, warnings and precautions
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References:
1. Preutenborbeck M, Reuter J, Ferrari E. Quantitative characterisation of impact events during femoral broaching in total hip arthroplasty. Medical Engineering & Physics. 2020. 76:13-19.
2. Epstein S, Sparer E, Tran B, Ruan Q, Dennerlein J, Singhal D, Lee B. Prevalence of work-related musculoskeletal disorders among surgeons and interventionalists: a systematic review and meta-analysis. JAMA Surgery. 2018. 153(2).
3. DePuy Synthes KINCISE System vs Manual broaching An EMG investigational study. Windchill TR-000003079. 3/1/2019.
4. EMG investigation during manual and automated broaching. Windchill TR-000003298. 4/29/20.
5. Gallina A, Merletti R, Vieira T. Are the myoelectric manifestations of fatigue distributed regionally in the human medial gastrocnemius muscle? Journal of Electromyography and Kinesiology. 2011. 21: 929-938