PHYSICAL AND MENTAL DEMAND DURING TOTAL HIP ARTHROPLASTY

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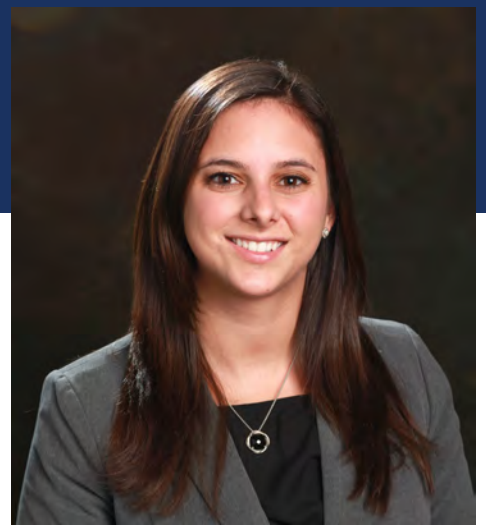
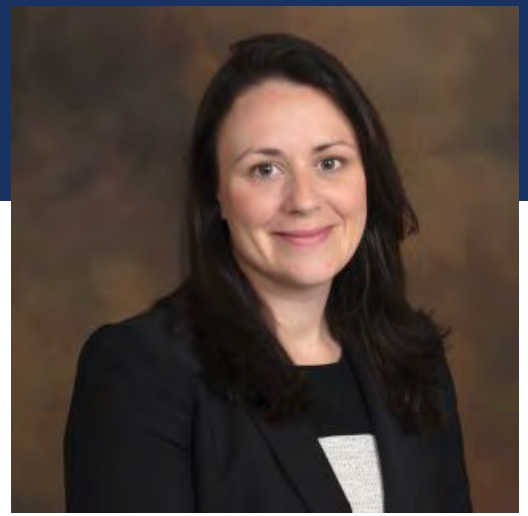
Alexandra L. Valentino, BS; Laura Scholl, MS; Emily L. Hampp, PhD; Kevin Abbruzzese, PhD; Hytham S. Salem, MD; Ryan Smith, MD; Zackary O. Byrd, MD; Michael A. Mont, MD

MICHAEL A. MONT, MD



ALEXANDRA L. VALENTINO, BS



LAURA SCHOLL, MS

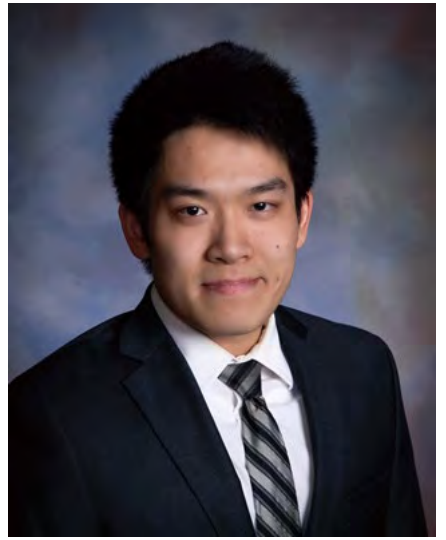
EMILY L. HAMPP, PHD

KEVIN ABBRUZZESE, PHD

HYTHAM S. SALEM, MD

RYAN SMITH, MD

ZACKARY O. BYRD, MD



ZHONGMING CHEN, MD

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TOTAL HIP ARTHROPLASTY

- One of the most successful surgical procedures in modern-day medicine
- Robotic-assisted total hip arthroplasty (RATHA) is a technology intended to enhance acetabular component placement accuracy to plan.[1]
- RATHA has shown improved outcomes over manual THA (MTHA) at both short and midterm follow-up.[2, 3]

WHAT ABOUT SURGEONS?

- MTHA has been shown to be physically demanding and energy consuming[4]
- Effect that it may have on surgeons is worthy of investigation!

PRIOR STUDY ON TOTAL KNEE ARTHROPLASTY[5]

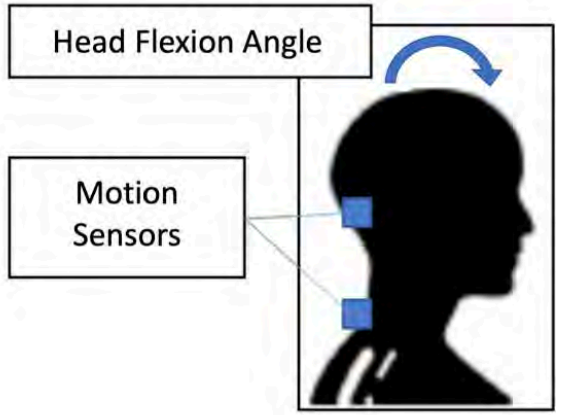
J Knee Surg. 2021 Jan 28. doi: 10.1055/s-0040-1721412. Online ahead of print.

Effect of Manual versus Robotic-Assisted Total Knee Arthroplasty on Cervical Spine Static and Dynamic Postures

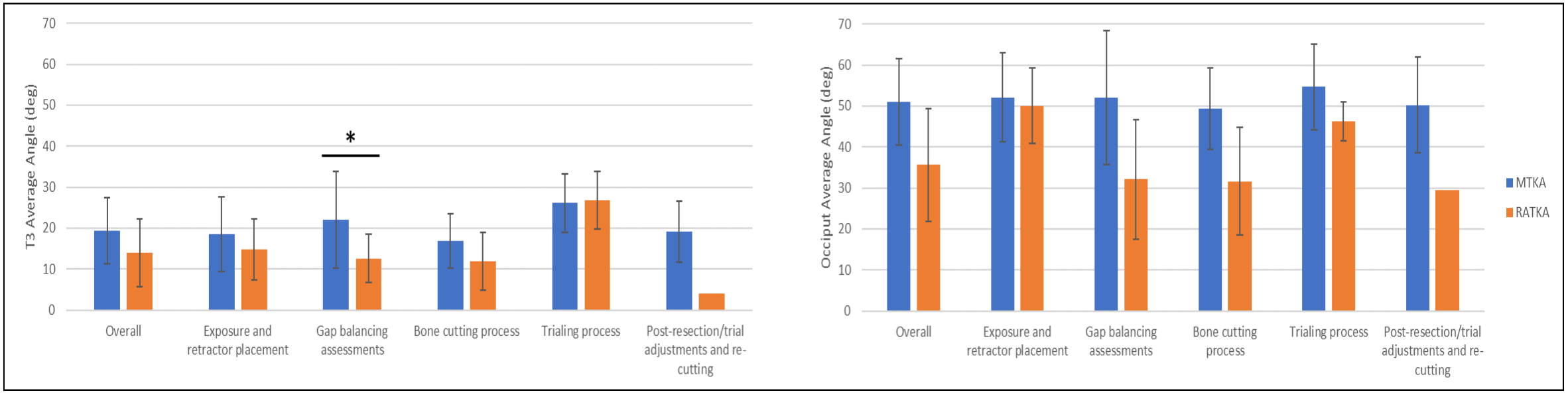
Laura Y Scholl [1], Emily L Hampp [1], Vincent Alipit [1], Nipun Sodhi [2], Manoshi Bhowmik-Stoker [1], Jonathan Dropkin [3], Antonia F Chen [4], Michael A Mont [5]

Affiliations + expand

PMID: 33511589 DOI: 10.1055/s-0040-1721412



SURGEON ERGONOMICS[5]



PHYSICAL AND MENTAL HEALTH[4]

- Energy expenditure during total hip arthroplasty (THA) similar to moderate exercise
- Physical fatigue shown to decrease mental alertness and impair performance

Surgeon Energy Expenditure During Total Joint Arthroplasty

Sharkey PF, Danoff JR, Klein G, Parvizi J.
J Arthroplasty. *2007*

ROBOTIC-ARM ASSISTED TOTAL HIP ARTHROPLASTY

- Reamers held within a haptic boundary
- Allows for single-stage acetabular reaming
- May enable surgeons to experience lower levels of mental and physical demands

PURPOSE

To assess how the use of robotic-assisted total hip arthroplasty (RATHA) can influence mental and physical demand when compared to manual total hip arthroplasty (MTHA) using:

- Surgeon biometrics measured intra-operatively via sensors to collect:
  - Heart rate
  - Activity
  - Time
  - Energy expenditure
- Task duration
- Surveys to compare mental and physical demand

Hexoskin.com

METHODS

Surgeon Experience

- Two surgeons, both in fellowship training at the time
- Surgeon 1: performed 20 RATHA
- Surgeon 2: performed 1 cadaveric RATHA

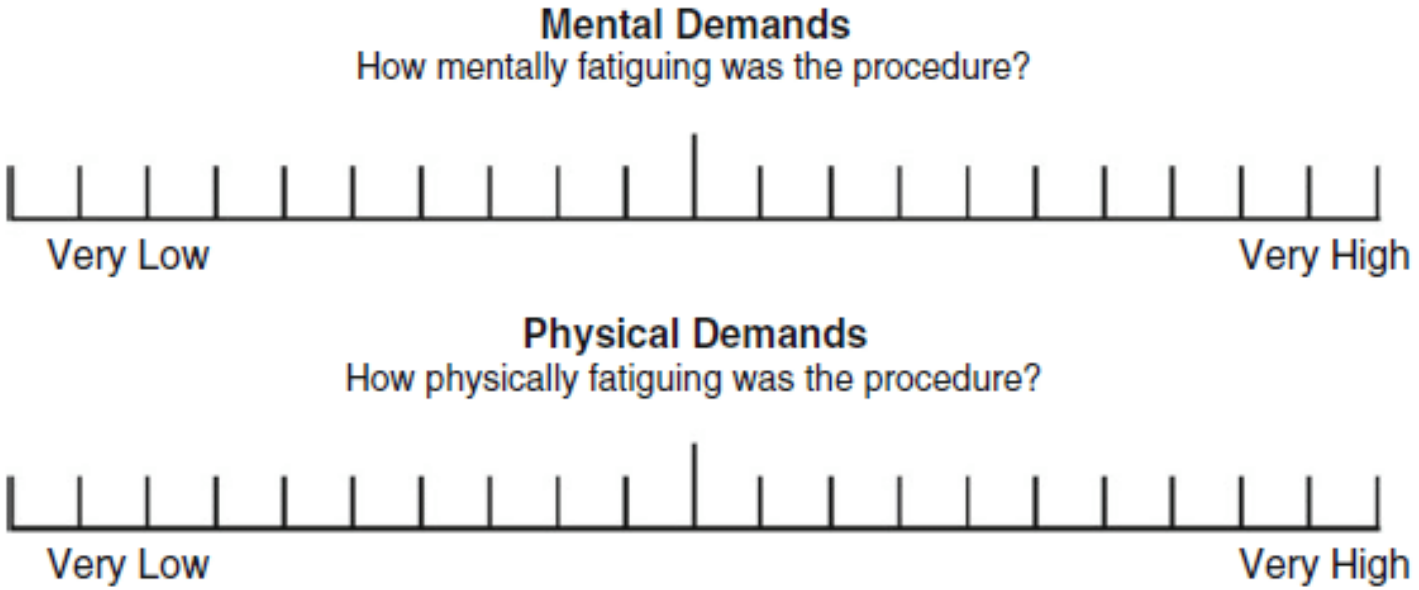
Methods

- 12 THAs (6 cadavers) randomized by BMI and laterality
- Manual THA performed first followed by robotic-arm assisted on contralateral side
- Biometric shirt (Hexoskin) collected biometric data
- Post surgery, a modified Surgery Task Load Index (SURG-TLX) questionnaire[3] was administered to assess mental and physical demand

- Student's t-tests and Mann-Whitney U tests performed to assess statistical significance between groups

QUESTIONNAIRE

- Surgeons completed a modified Surgery Task Load Index (SURG-TLX) following each surgery

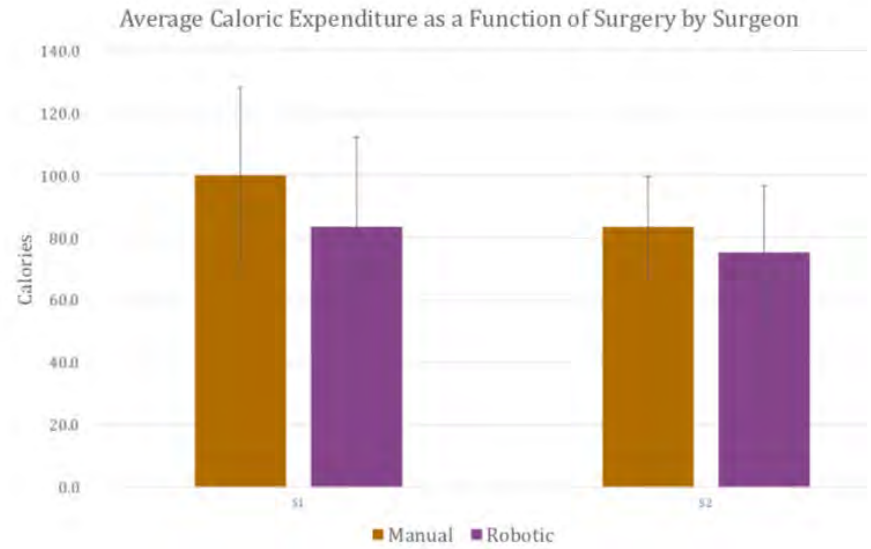


WEARABLE TECHNOLOGY

- Allowed for the measurement of biometric parameters including caloric expenditure and heart rate

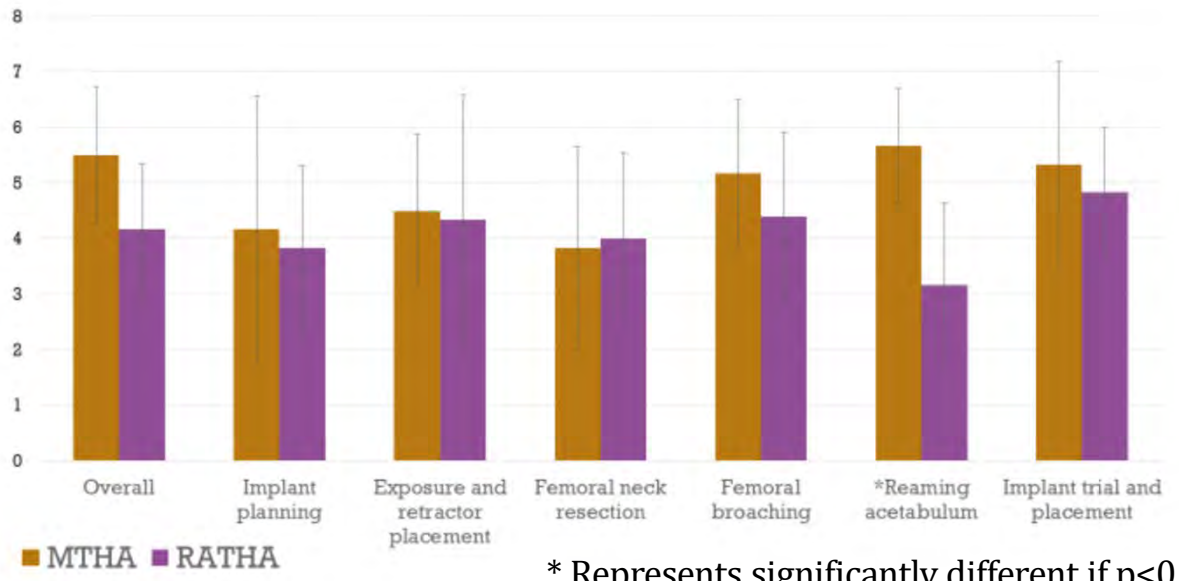
BIOMETRIC DATA

- Caloric expenditure was 83.5 with RATHA and 100 with MTHA
- Surgeon one: 16.5% decrease
- Surgeon two: 9.8% decrease
- Mean heart rate: 1.4% increase with RATHA
- Each surgeon decreased task duration with RATHA compared to MTHA
- Mean task duration for acetabular reaming and shell impaction was:
  - 11 minutes with RATHA
  - 12 minutes with MTHA



MENTAL DEMAND

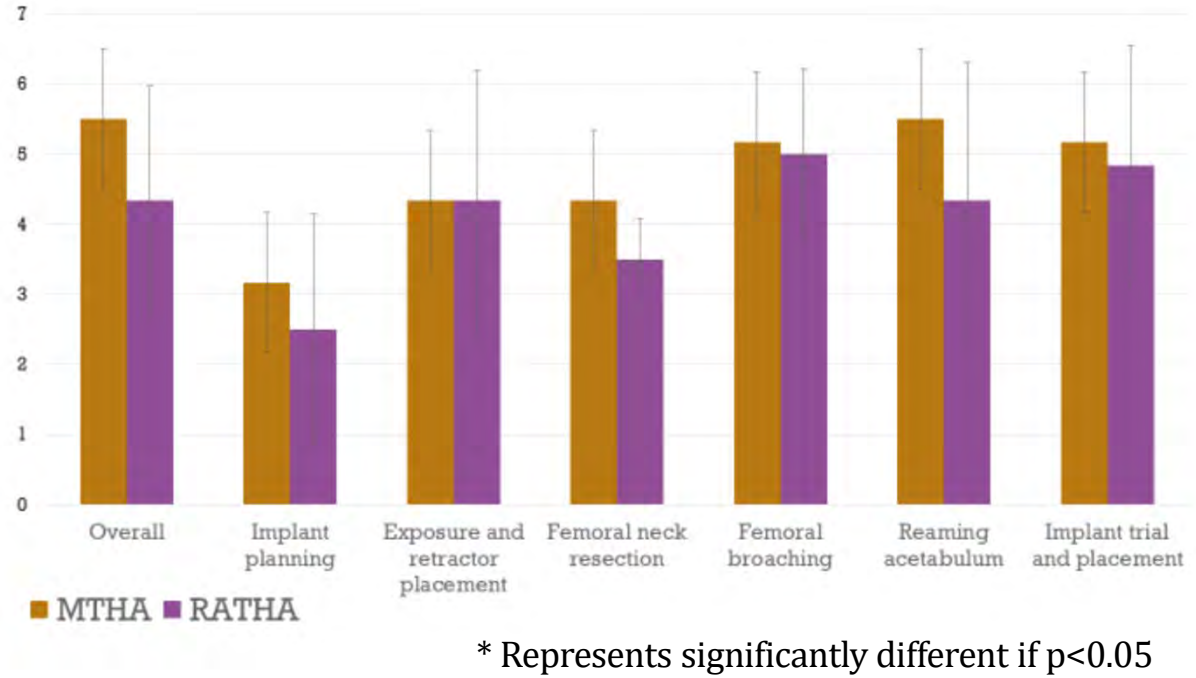
- Overall mental demand was 5.5 for MTHA and 4.2 for RATHA
- Mental demand during acetabular reaming significantly higher with manual ($p < 0.01$)
- Beside femoral neck resection, lower mental demand during RATHA for all other tasks



* Represents significantly different if p<0.05

PHYSICAL DEMAND

- Mean physical demand for MTHA was 5.5 and 4.3 for RATHA
- Besides exposure and retractor placement, lower physical demand during RATHA for all other tasks



* Represents significantly different if $p<0.05$

LIMITATIONS

- Small sample size
- Surgeries performed on cadaveric specimens

CONCLUSIONS

- Data suggests RATHA may reduce surgeon energy expenditure compared to MTHA.
- RATHA may reduce time to perform acetabular reaming and implant insertion.
- Single stage reaming in RATHA may enable surgeons to have decreased mental demand.
- Further investigation into relationship between surgeon experience and energy expenditure is needed.
- Robotic assistance for THA may reduce physical and mental demand which may lead to an improved surgical experience.

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THANK YOU!

Dr. Mont is a paid-consultant of Stryker Orthopaedics. The opinions expressed by Dr. Mont are those of Dr. Mont and not necessarily those of Stryker. Individual experiences may vary.