

## SUBMISSION PREVIEW: VERIFICATION OF MOTION CAPTURE SOFTWARE FOR SIMULATED RETROPUBIC TROCAR PASSAGE

### Verification of Motion Capture Software for Simulated Retropubic Trocar Passage

Submission ID: 1803550

Submission Type: **Abstract**

Previous Presentations or Publication: **No**

Submission Status: **Active**

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**Disclosure:** Does Disclose

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- Research grant from Intuitive Foundation (Grant recipient - no salary)

**Conference Registration**

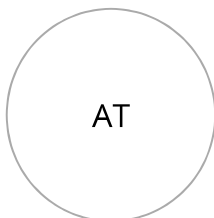
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**Conference Registration**

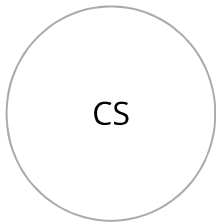
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- Intuitive Foundation (Grant)

**Conference Registration**

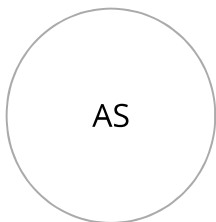
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**Disclosure:** Nothing to Disclose

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**Disclosure:** Nothing to Disclose

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**Keywords**

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1. Midurethral sling
2. Bladder perforation
3. Surgical simulation
4. Motion capture
5. Surgical education

**Abstract**

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## Topic Category

Submission Title: Verification of Motion Capture Software for Simulated Retropubic Trocar Passage

- Surgical education

## Presentation Category

- Scientific Table Talk

## Objectives

To verify a novel software utilizing motion capture to identify bladder penetration during simulated retropubic trocar passage.

## Methods

We printed a midurethral sling pelvic simulation model based on a segmented MRI from a woman with stress urinary incontinence. We fixed a rigid body with seven 8-mm retroreflective markers to a retropubic trocar and six 8-mm retroreflective markers to the pelvic model. A medical student was given instructions to maintain contact with the suprapubic bone and exit at marked sites 2cm lateral to the midline and passed the trocar 5 times on both sides. We used a 12-camera OptiTrack Flex 13 motion capture system for continuous tracking at a frame rate of 120 Hz, using Motive motion capture software (Natural Point Inc, Corvallis, OR). Using MATLAB (The Mathworks, Inc., Natick, MA), we developed novel software to interface with Motive and locate the position of the trocar tip relative to the locations of the pelvis, bladder, bowel, and blood vessels. Our primary error category was penetration of the bladder. Secondary error categories included penetration of the iliac vessels, trocar passage anterior to the suprapubic bone, and deviation from a predefined safe pathway. We generated 3D plots for each trial which included the pelvis, internal organs, and the motion path of the trocar tip. Two raters manually reviewed each frame of each 3D plot and identified “jumps” outside of the trocar tip’s expected trajectory, defined as points inconsistent with the trend of adjacent points. We calculated rater agreement.

## Results

Motion capture data included 742 frames from 9 trocar passes. Review of the 3D plots indicated that out of 69 frames penetrating the bladder, 92.0% were identified as within the trocar tip’s trajectory by the novel software. Out of 425 frames within the ideal path, 89.8% were within the trocar tip’s trajectory. Out of 227 frames outside of the ideal path (i.e.: close to bone but not maintaining contact) but not penetrating the bladder, 93.6% were within the trocar tip’s trajectory. There was no penetration of the iliac vessels. Out of 21 frames anterior to the suprapubic bone, 76.2% were within the trocar tip’s trajectory. Overall, the software was 90.8% accurate in identifying trocar tip trajectory. Rater agreement was 92.9%.

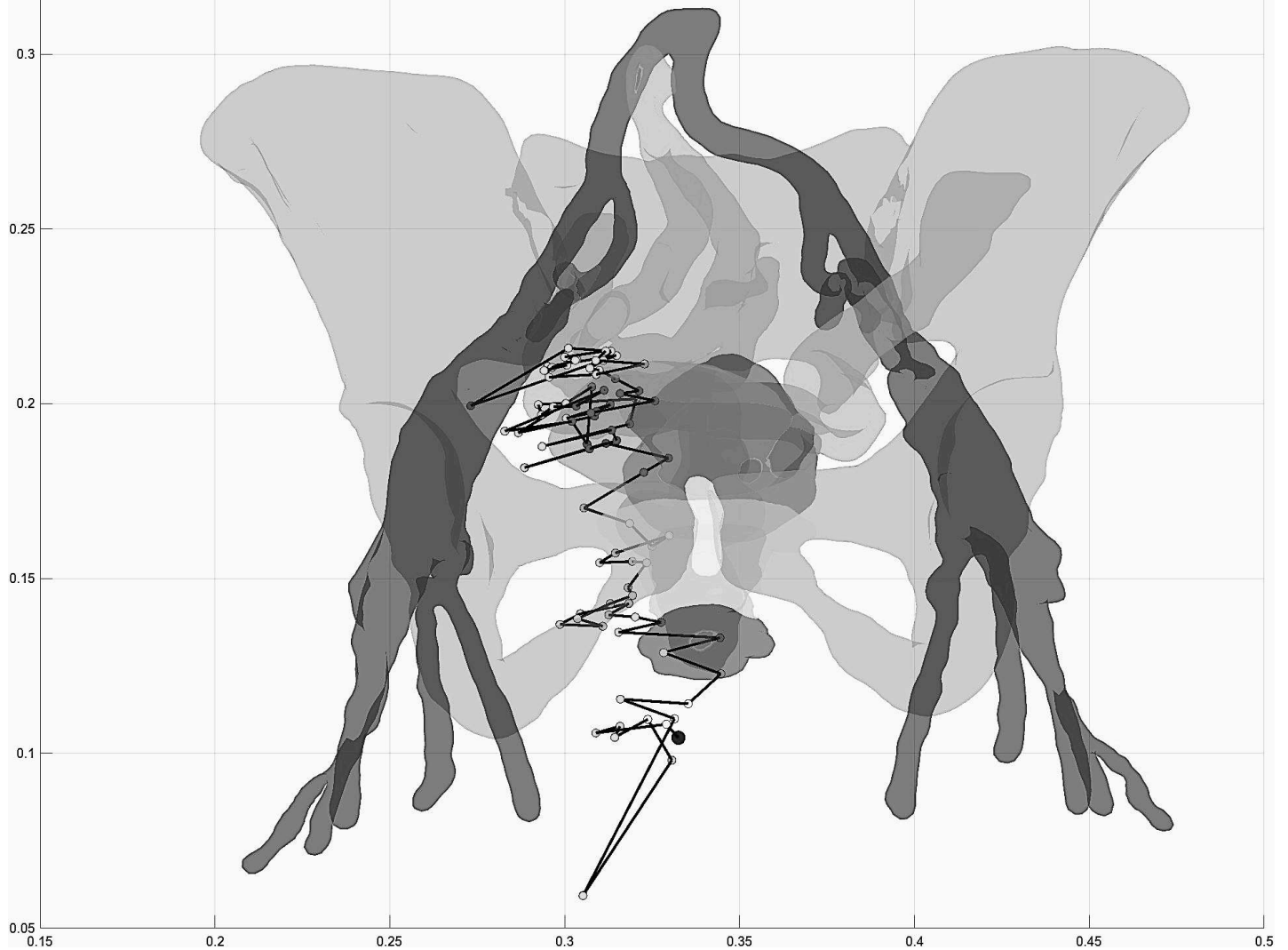
Figure Legends: 1) 3D Plot demonstrating motion path of trocar tip during trial 3, penetrating bladder but not the bowel or the iliac vessel

2) Correlated Error bar: 20 frames of bladder penetration.

## Conclusions

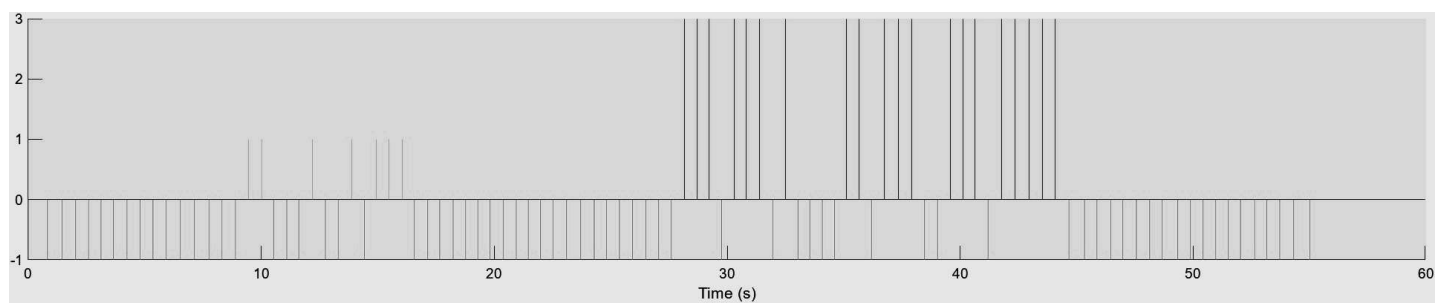
Our novel software program utilizing motion capture was accurate in identifying bladder penetration as well as other retropubic trocar locations. We plan to incorporate this software into a midurethral sling surgery simulation with live feedback.

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Motion Path of Retropubic Trocar Tip

Trial3 - Bladder Pass - 3DPlot Black and White version.jpg



Error Bar with 20 Frames of Bladder Penetration

Trial3 - Bladder Pass - ErrorPlot Black and White version.jpg

## Institutional Review Board Waiver and Funding Sources

Which of the following applies to your research?

Use human subjects and is IRB approved

Please enter the unique IRB identifier number (if applicable).

2019360

**Is this study exempt from IRB review?**  
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No

**Was this research supported by an NIH grant?**

Yes

**Was this research funded by the AUGS Foundation (Formerly the PFD Research Foundation)?**

No

**Was this research supported by industry? If no, write "no". If yes, please provide the name(s) of the funder(s).**

no

**Was this research supported by any other funding sources? If yes, please provide detail.**

no

## General Acknowledgements

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