Methodology for the video analysis of surgical performance in orthopedic ankle surgery

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Disclosure

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Our disclosures are in the Final AOFAS Mobile App.
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Defining and quantitatively measuring surgeon and operating room team performance remains a scientific and clinical challenge. Evidence-based, objective methods to assess surgical skill have been identified; however, a quantifiable and valid methodology to measure intraoperative performance is lacking. We aimed to determine the optimal approach to audiovisually assess a surgeon and a surgical team, by developing a high-fidelity method to analyze and improve surgeon and team performance.
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Methods – 1

- 24 bilateral ankle surgeries performed between July 2015 and April 2016 in live and simulated operating room settings
- Ilizarov frame application for ankle distraction and total ankle replacement surgery
- Still photography and web-based three-dimensional modeling software were used to determine optimum camera positioning for the first 12 procedures
- Three GoPro® Hero cameras (San Mateo, CA) were used with a variety of mounting strategies to record 12 simulated, matched procedures.
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Methods – 2

• Visualization of surgical team and procedure itself, economy of motion, team member interaction, as well as audible output were necessary to determine whether a particular angle was ideal.

• A multiview box and wireless routers were used for live viewing of surgeries on a high-definition television screen.

• Wireless and mobile technology, as well as video-based editing software were employed to analyze audiovisual output.

• All angles were measured according to bed position, with 0° designating the head of the bed and 180° designating the foot of the bed.
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Figure 1. Still photography images of simulated left Ilizarov frame application and total ankle replacement.

Contralateral IV Pole  | Left Superior Corner  | Right Superior Corner

Right Superior Corner  | Left Inferior Corner  | Left Lateral

Left Superior Corner
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Web-based three-dimensional modeling software (Autodesk 123D Catch)
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Results

• There are optimal camera views specific to surgeon position, operating room table position, C-arm position, and surgery type (laterality) that are measurable in degrees.

• Triangulated placement of multiple cameras, including a head mounted device, are required to assess subtle elements of operating room team performance, including individual strengths and weaknesses, nontechnical skills, and team dynamics.

• High-fidelity recording equipment and video-based editing software facilitate the assessment of characteristics unique to reconstructive ankle surgery.
A head mounted camera was necessary to obtain adequate audio output and to visualize procedural details.
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Discussion

We have found the best camera positions for evaluating surgical performance and surgical team performance for ankle replacement and frame application. We now have a reliable method to quantitatively and qualitatively evaluate and develop ways to improve teamwork and surgical performance. Through better teamwork, surgical outcomes and efficiency, as well as overall job satisfaction may improve.
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