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The Intuitool™:
An Ergonomic Laparoscopic Grasper

A harsh learning curve: laparoscopic surgery



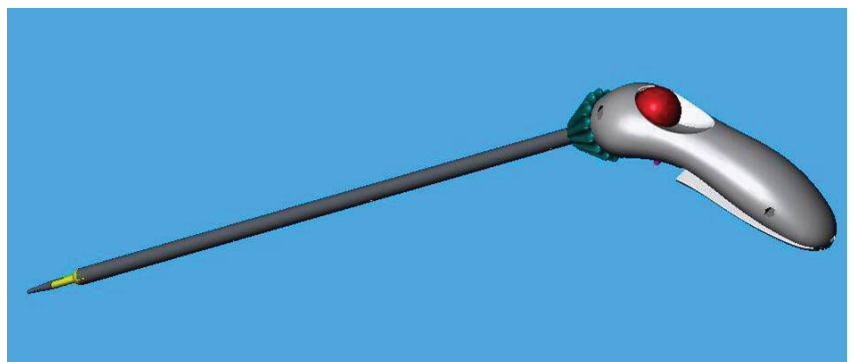
The learning curve of laparoscopic procedures is a significant barrier to its wider adoption [1-7]. Laparoscopic skills are not intuitive and their innovative nature defies traditional surgeon apprenticeship [6]. Despite advances in surgical training, the learning curve for laparoscopic procedures remains steep.



The reality of Laparoscopy [6]

- Smaller incision
- Long instruments
- Visibility limited to instrument tips
- Fulcrum effect
- Two-dimensional visualization
- Limited tactile feedback

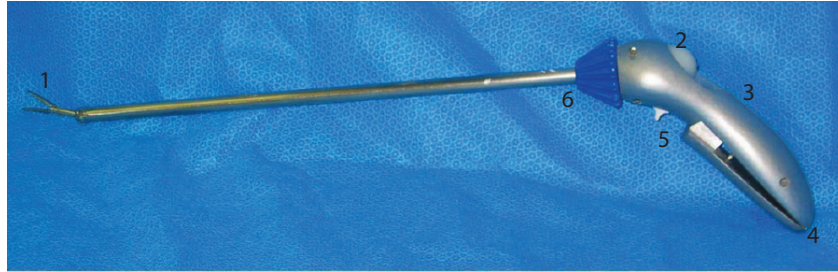
Surgeons and Engineers at the University of Nebraska invented a novel laparoscopic instrument with an intuitive, ergonomic control: the Intuitool™. In addition to reducing discomfort from awkward postures and pressure points, in several studies, the intuitive interface was rapidly adopted by surgeons. Instruments that are more intuitive and easier to adopt are one means to bend the steep learning curve of laparoscopic surgical procedures



Intuitool™ Rendering

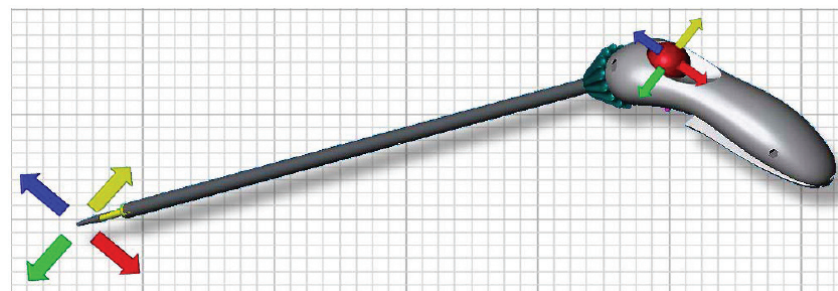
The Intuitool™

The Intuitool™ is a laparoscopic grasper developed in a cross-campus collaboration where engineers with expert knowledge of ergonomics examined the tasks performed by elite surgeons at the University of Nebraska Medical Center. Though it contains many innovative aspects, the Intuitool™ can be summarized by the articulating grasper and the intuitively controlled han-



1. 120 degree articulating grasper 2. Control Sphere 3. Ergonomic Handle 4. Squeeze grip rear-hinged grasper 5. Grasper lock 6. Shaft Rotator

The handle design allows surgeons to operate the Intuitool™ in multiple positions. It is obvious to grasp and the surgeon intuitively understands how to articulate and close the grasper based on his hand position. When the user moves the control sphere forward, the grasper articulates up. Similarly, the grasper articulates left, right or down when the Surgeon moves the control sphere left, right or back.



Intuitive control of the grasper by manipulation of the control sphere

The Intuitool™ features:

- 120 degree articulating grasper
- Control Sphere
- Ergonomic Handle
- Squeeze grip rear-hinged grasper
- Grasper lock
- Shaft Rotator

Recongized Design Process

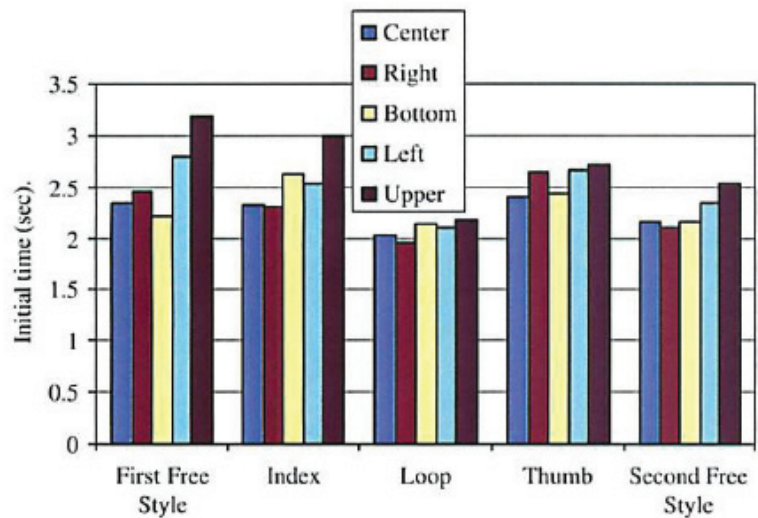
- Human Factors and Ergonomics Society honorable mention for the User-Centered Design Award 2004
- Considered for the R&D 100 award in 2005



Intuitive use bends the learning curve

A study that evaluated different control schemes on a replica of the Intuitool™ found that users rapidly adopted the control means used in the Intuitool™ with a high degree of confidence [8]. Subjects were significantly better (with a confidence level of 95%) with the Intuitool™ interface as opposed to other control schemes.

In a different study looking at target location utilizing different laparoscopic tools, surgeons using the Intuitool™ improved rapidly. Subjects used the tools to touch targets in a simulated abdomen. Even with minimal experience, subjects were able to touch the targets in substantially less time [9]. The rapid improvement of subjects in the test demonstrates the intuitive design of the device is not only easy to pick up but easy to learn.



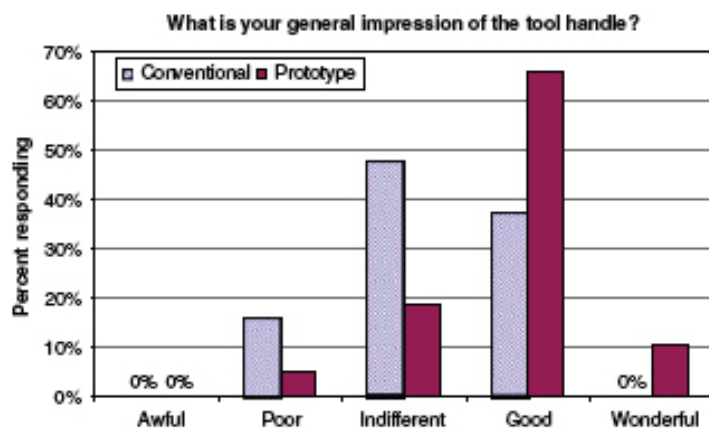
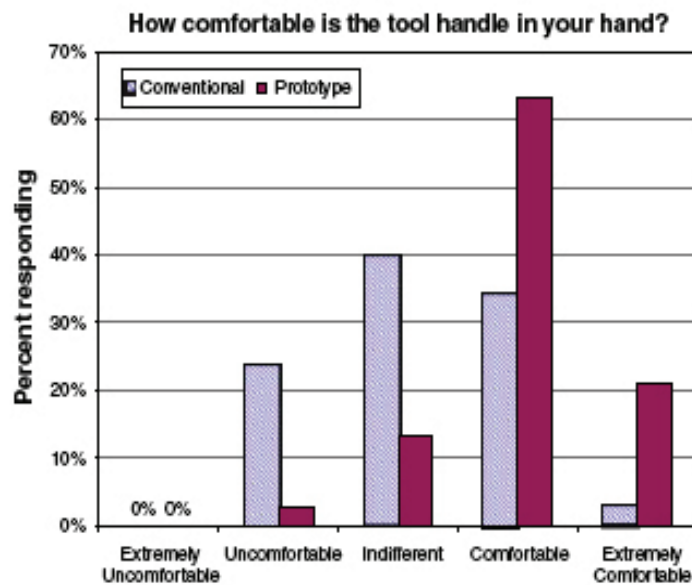
A graph plotting the time taken to accurately touch a target; the different color bars correspond to the position of a target in a simulated abdomen. The bottom axis plots the different positions that subjects held the Intuitool™ in. The participant's significant improvement demonstrates quick familiarization with the Intuitool™: the participants explored new hand postures and increased their comfort and performance of the task. The improvement suggests that even rudimentary education (having the participants assume a series of positions) can quickly improve the participants use of the instrument.

Free Style (both first and second) were the positions chosen by subjects in the study, the Index, Loop and Thumb positions were specific positions subjects were directed to hold the instrument in. The decreased time to touch the target between First and Second Free Style shows quick improvement and demonstrates the intuitive nature of the Intuitool™.

An enthusiastic reception

Finally, in a study of 38 laparoscopic surgeons on the comfort of the Intuitool™, when compared to a conventional tool, over 80 percent commented on the comfort of the tool and 89% expressed interest in working with the tool to better learn how to operate it [10].

UNeMed is currently offering licensing opportunities in all fields for the Intuitool™ and opportunities for collaborative development of other intuitive surgical devices. Please contact Joe Runge at UNeMed with any questions or for more information or visit unemed.com for more exciting technologies.



Results of a survey of thirty-eight laparoscopic surgeons from across the US attending advanced laparoscopic training courses at the UNMC. The authors compared a conventional grasper to a prototype of the Intuitool™.

Surgeon response [12]

- The articulation would be very useful during procedures, more important than rotation.
- Helpful to get around and over tissue.
- Fantastic!
- Good idea. I like that.
- Nice. Allows much more versatility.
- Yes, I see it as a benefit.
- It would help get into smaller areas.
- Simple and intuitive.
- Improved tool experience.
- Very clever. Great feature to have. I would use it 50% to 95% of my time.



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Meet the inventors

Dmitry Oleynikov, M.D. FCAS



Dr. Dmitry Oleynikov M.D., FACS is an associate Professor of Surgery, the Co-Director of Education and Training Center for Minimally Invasive and Computer Assisted Surgery Initiative, the Medical Director for the Nebraska Medical Center's Minimally Invasive Surgery Program (MIS) and the Joseph and Richard Still Faculty Fellow in Medicine. He has extensive experience in minimally invasive and videoendoscopic surgery and is currently engaged in research in Laparoscopic and Esophageal Surgery. Esophageal motility, and robotic surgery.

Dr. M. Susan Hallbeck, P.E., C.P.E. is a Professor of Industrial and Management Systems Engineering. She also holds a courtesy appointment in Surgery at UNMC. She is the director of the Innovative Design and Ergonomic Analysis Lab and the coordinator of the award-winning FINDER group - collaboration among physicists, chemists, electrical, materials and industrial engineers for detection of neutrons for homeland security. She has been a guest researcher at the National Institute for Working Life in Sweden and a NASA summer research faculty at NASA-Ames Research Center. Dr. Hallbeck is a founding member of the Center for Advanced Surgical Technologies and the Center for Ergonomics and Safety Research. She is also a member of the Nebraska Center for Materials and Nanoscience. Her current multi-disciplinary research in the IDEA Lab includes: Development of laparoscopic surgical tools; Methodology standardization for operating room medical device usability; Development of a neutron detector for homeland security; Investigation of single and double mouse clicks on computer user workload and Evaluation of a 7/8 piano keyboard



M. Susan Hallbeck, P.E., C.P.E.



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Development status

- Non-functional prototype
- Patent pending
- Initial project in examining improved ergonomics in laparoscopic surgery



