



Serial Comanipulation for Laparoscopic Surgery

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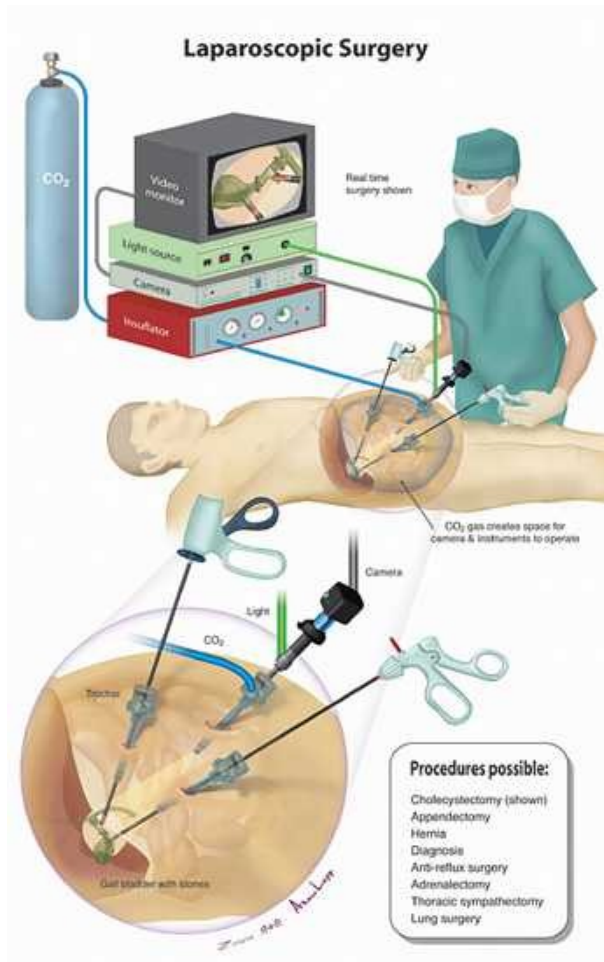
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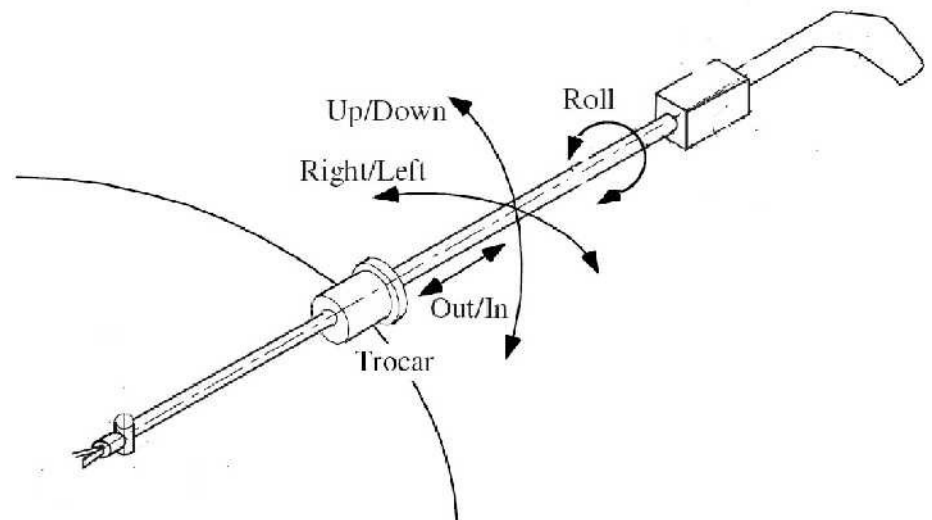
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Minimally Invasive Surgery & Laparoscopy



4 DoF Instruments used in Laparoscopy



Advantages and Disadvantages of Laparoscopy

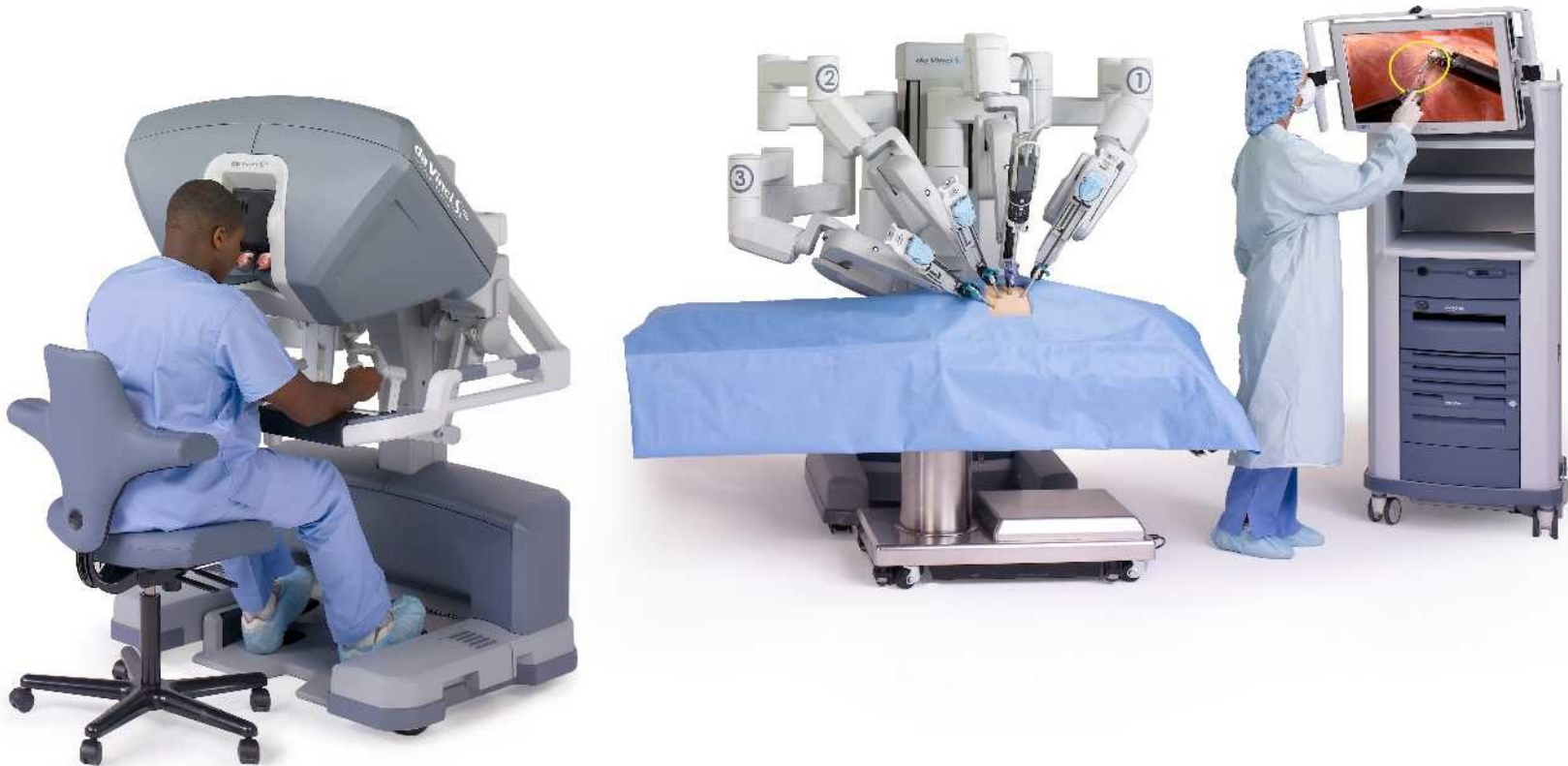
Advantages (for the Patient)

- Fewer scars
- Less post operation pain
- Faster recovery
- Less post operation complications

Disadvantages (for the surgeon)

- Non dexterous instruments
- Hand eye coordination problem
- Longer operation time

Teleoperation



« da Vinci Surgical System » is a robot for teleoperation.

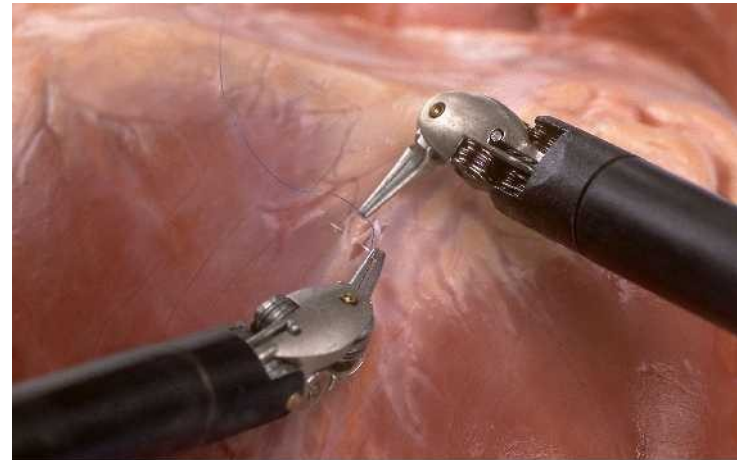
Teleoperation

da Vinci's 6 DoF instruments give the surgeon the dexterity he needs.



Teleoperation

Teleoperation resolves the Problem of hand eye coordination.



da Vinci's Advantages & Disadvantages

Advantages

- Dexterous instruments
- Intuitive hand eye coordination
- Ergonomic interface

Disadvantages

- High cost: \$ 1.5 to 1.75 M + maintenance and training costs
- Bulky
- Long and difficult to put in place
- No haptic feedback
- Surgeon is far from the patient

Serial Comanipulators

RealHand from Novare Surgical

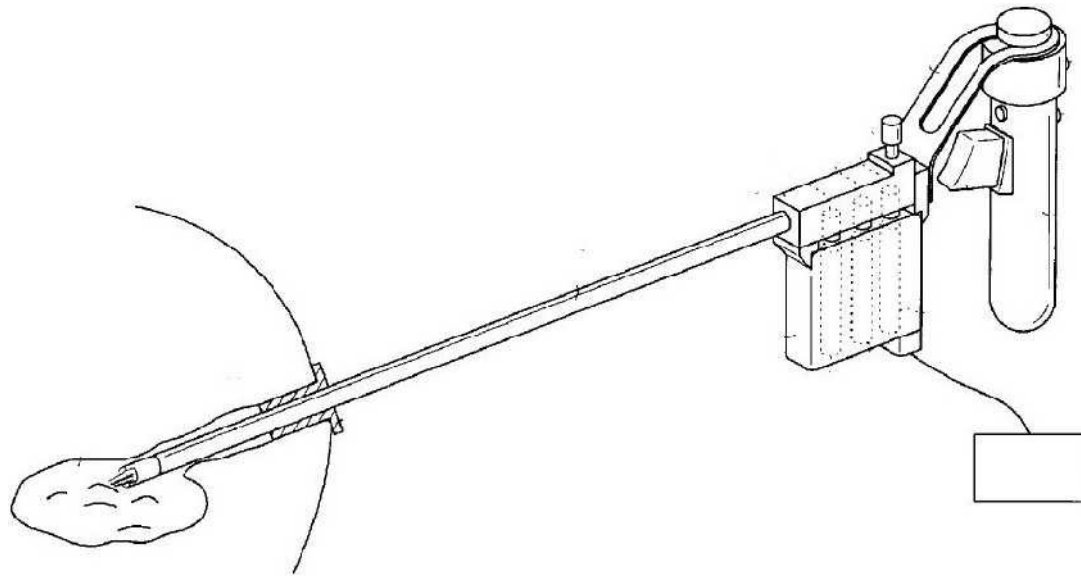
- Has had some success in single incision laparoscopy
- Not useful for precise operations
- Effector has low stall torque
- Costs \$ 400 and it's disposable
- Non intuitive control results in a long learning curve



Robotic Serial Comanipulators

Robot developed at Toshiba Medical Systems

Heavy and big: not usable for surgeons



Towards an Optimal Comanipulator

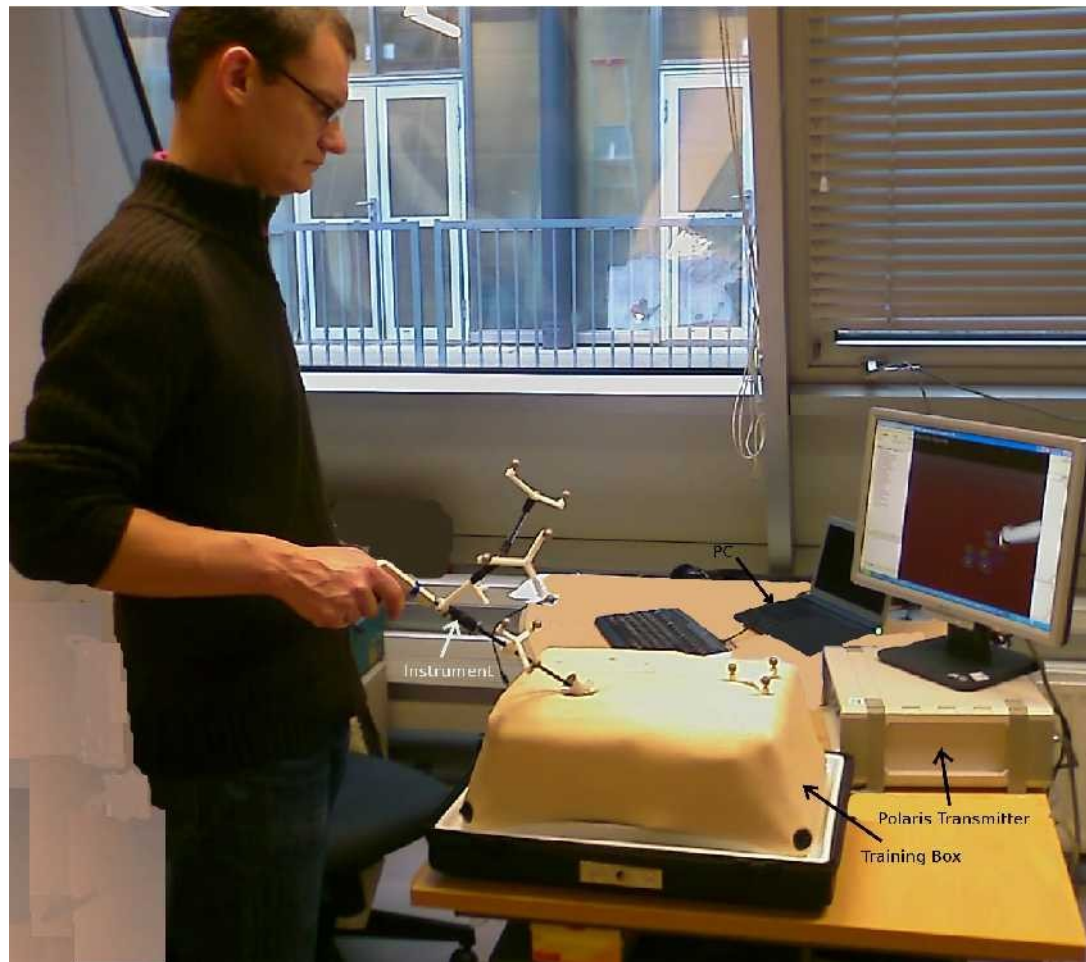
- Dextrous
- Precise
- Lightweight
- Ergonomic interface
- Affordable
- Modular
- Easy to put in place

Towards an Optimal Comanipulator

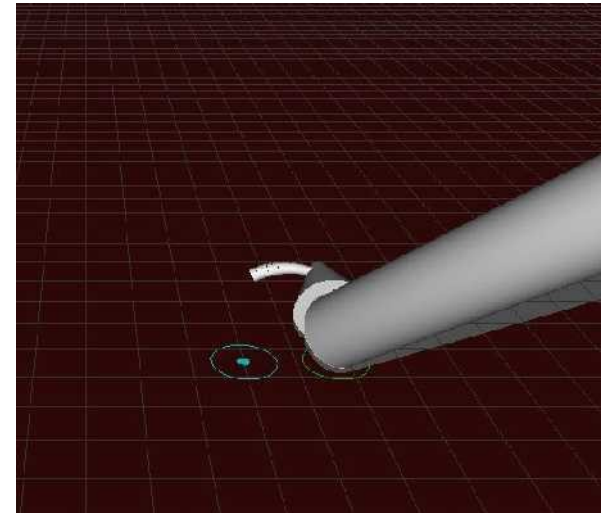
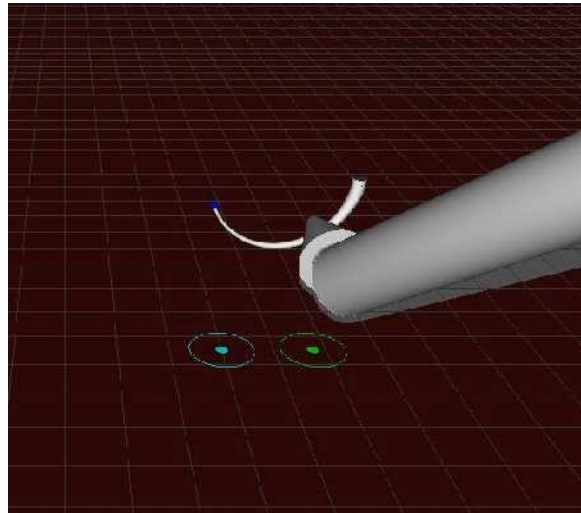
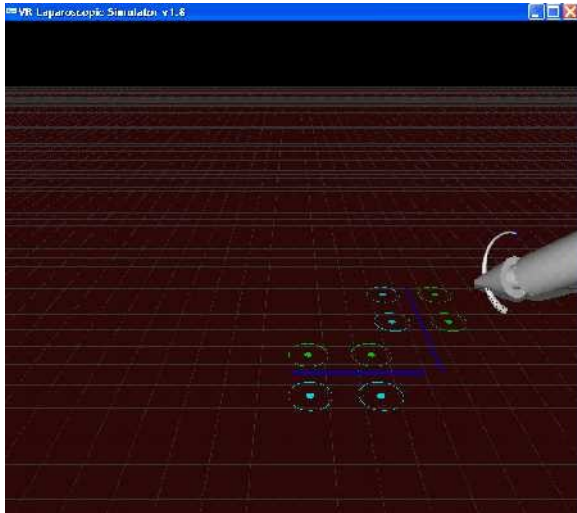
Challenges

- i. Finding the best way of coupling the surgeon's gestures to the end effector's movements
- ii. Mechanical design and realization

Simulator



Test & Evaluation



Simulating a suturing movement. Suturing includes all elementary gestures in laparoscopy.

Next Steps

- i. Completing the evaluations
- ii. Making a prototype to validate simulation results

Thank you for your attention.