Right-angle Dissector Scissors Hybrid Surgical Instrument

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Function:

The client, Dr. Emily Hartmann, is a plastic and reconstructive surgeon at the University of Wisconsin School of Medicine and Public Health and performs regular reconstructive surgery. Careful dissection around vascular and neurological structures during surgery requires precise instruments and the right-angle forceps is often utilized to tease away or present soft tissue for an assistant to cut or cauterize. However, if the surgeon is operating in a deep hole where the assistant cannot reach, the surgeon has to use the non-dominant hand to cut or cauterize, which is a challenge since the non-dominant hand is often occupied with another forceps. A hybrid instrument incorporating scissors in the right-angle forceps is to be developed. It has to remain blunt-tipped in order to perform delicate dissection and should be applicable in various operative situations as well as available in various lengths.

Client requirements:

- Incorporate a cutting scissors in existing right-angle forceps
- Maintain dissector function while adding cutting function
    - Remain blunt-tipped on outside edges
    - Sharpened on inside edges
- Compatible with current surgical protocols
    - Surgical grade-stainless steel
    - Autoclavable
    - Ability to be sharpened
- Ambidextrous function
- Surgeon-customizable
- Operational and storable under normal operating conditions
    - Temperature approximately 20°C
    - Relative humidity approximately 50%
- Adaptable for different forceps sizes
    - Currently using: Kantrowitz Forceps, delicate 90° jaw, 19.1cm
- Weight under 100g
- Under $500 budget

Design requirements:

1. Physical and Operational Characteristics

a. *Performance requirements*: The device should be able to withstand repeated surgeries and the standard autoclaving process in between. The blade should allow for regular sharpening if required.

b. *Safety*: The device should maintain blunt outside edges so as to avoid inadvertently cutting tissue. The device must be made of surgical-grade stainless steel and withstand temperatures present during the autoclaving process.

c. *Accuracy and Reliability*: In the closed position, the device should function in the same manner as an unmodified right-angle dissector forceps. Throughout the lifespan of the device, the surgeon should be able to cut with accuracy and precision and not damage any blood vessels near the surgical site.

d. *Life in Service*: The device should last as long as an unmodified right-angle dissector forceps and be replaced only when damaged.

e. *Shelf Life*: There should be no major concerns regarding shelf life as the device is autoclaved after every use and stored in a sterile environment.

f. *Operating Environment*: The device is to be used in a surgical setting, specifically in reconstructive plastic surgeries. It should therefore be inert to all human tissue, fluids, and surgical equipment present in surgery. While in operation, the device should allow for cleaning whenever needed. The client should be able to open and close the device to whatever degree desired and the device should not malfunction even upon contact with debris.

g. *Ergonomics*: The device should be relatively simple and straightforward to operate, similar to the right-angle dissector forceps. It should be ambidextrous and should not interfere with the surgery in any way.

h. *Size*: The device should be almost identical to the unmodified right-angle dissector forceps. The current design is adapted to the forceps of length 19.1cm, but it should be adaptable to forceps of various sizes.

i. *Weight*: The device should weigh similarly to an unmodified right-angle dissector forceps in order to allow the surgeon to comfortably utilize it. The total weight of the device should not exceed 100g.

j. *Materials*: The device should be comprised of surgical-grade stainless steel and be non-allergenic, biocompatible, and hemocompatible. It should be able to withstand regular sterilization processes between surgeries without any change in its physical and chemical properties.

k. *Aesthetics*, *Appearance, and Finish*: The device should be clean, simple, and resemble a surgical device. Additionally, the client can choose to personalize the device using colored parts or components.

2. Production Characteristics

a. *Quantity*: Currently the client requires 1 device, but in the future could request additional devices to be manufactured.

b. *Target Product Cost*: The total cost of the device (including materials and manufacturing) should not exceed $500.

3. Miscellaneous

a. *Standards and Specifications*: No FDA-approval is required for the device.

b. *Customer*: Client requests a reusable surgical instrument without any removable parts (i.e. the cutting blade should be built-in). The device should preferably be customizable according to preference if desired.

c. *Patient-related concerns*: The device has to be sterilized between uses, as per standard surgical protocol.

d. *Competition*: There are currently no existing products on the market addressing the problem.