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Design of Self-Retaining Surgical Retractor for Medical Application

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Abstract: ***Self-retaining surgical retractors are devices used to hold tissues or organs in place during surgical procedures without the need for manual assistance. These retractors consist of two or more blades that are designed to be inserted into the surgical incision and then expanded to hold the tissues or organs apart. By holding the tissues or organs in place, self-retaining retractors provide a clear and unobstructed view of the surgical site, which is essential for accurate and safe surgical procedures. There are several types of self-retaining surgical retractors available, each with its own unique design and functionality. For example, the Weitlaner retractor features sharp prongs that grip the tissues and hold them apart, while the Gelpi retractor has a self-retaining mechanism that allows the blades to be locked in place once inserted into the incision.***
Self-retaining surgical retractors can be particularly helpful during long or complex surgeries, as they reduce the need for manual assistance and allow the surgeon to focus on other aspects of the procedure. Additionally, these retractors can help reduce the risk of tissue trauma and injury, as they provide a stable and controlled hold on the tissues or organs being operated on.
Keywords: Self-Retaining, Surgical Retractor, Surgery, Tissue Retraction , Organ Manipulation, Tissue injury.

I. INTRODUCTION

Self-retaining surgical retractors are a type of surgical retractor that can be locked in place to maintain the desired level of tissue tension without requiring external assistance. This allows the surgical team to focus on performing the surgical procedure without the need for someone to hold the retractor in place. Self-retaining retractors come in a variety of shapes and sizes, and are designed to be used in specific anatomical regions and surgical procedures. They typically consist of two or more blades or arms that can be adjusted to the desired tension and position for the specific surgical procedure being performed. The blades or arms can be locked in place using a variety of mechanisms, including ratchets, screws, or springs. One advantage of self-retaining surgical retractors is that they can reduce the amount of tissue trauma and damage that can occur when tissues are manually retracted by an assistant or surgical technician. This can help improve patient outcomes and reduce the risk of post-operative complications.
However, the use of self-retaining retractors requires specialized training and expertise, and should only be performed by qualified and experienced surgical professionals. Proper care and maintenance of these instruments is also crucial to ensure their safe and effective use in future procedures.

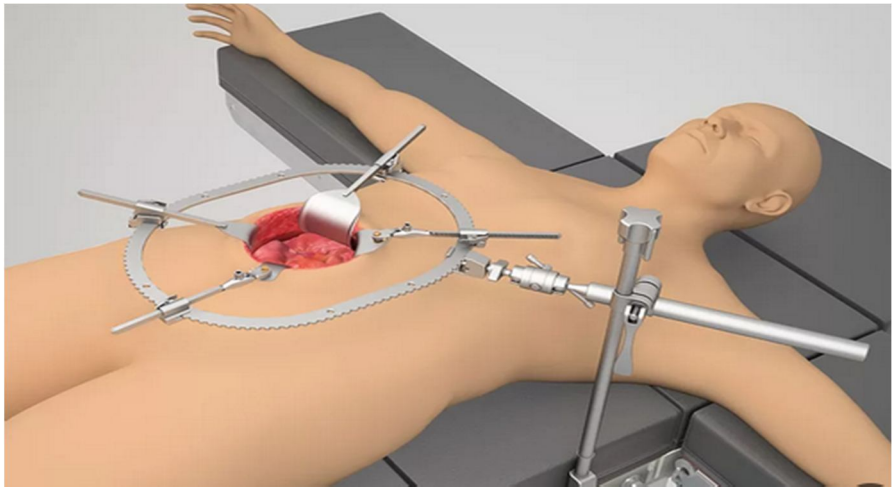


Fig 1. Schematic Diagram of Self-Retaining Surgical Retractor

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II. LITERATURE SURVEY

1) "Clinical evaluation of self-retaining retractors in different surgical procedures" by Ghazanfar Ali et al. (2019). The study evaluated the use of self-retaining retractors in different surgical procedures and concluded that they are an effective and safe alternative to traditional retractors.
2) "Self-retaining retractors in spinal surgery: A systematic review" by Anirudh Ramesh et al. (2020). The study reviewed the use of self-retaining retractors in spinal surgery and concluded that they offer several advantages over traditional retractors, including reduced surgical time and improved visualization.
3) "Self-retaining retractors in laparoscopic surgery: A systematic review" by Davide Lomanto et al. (2021). The study reviewed the use of self-retaining retractors in laparoscopic surgery and concluded that they are a safe and effective tool that can reduce surgical time and improve surgical outcomes.
4) "A novel self-retaining retractor for laparoscopic cholecystectomy: A prospective randomized controlled trial" by Xinhua Zhang et al. (2021). The study evaluated the use of a novel self-retaining retractor in laparoscopic cholecystectomy and concluded that it was safe and effective, and could reduce surgical time and improve surgical outcomes.
5) "Comparison of a self-retaining retractor and a handheld retractor in thyroid surgery: A randomized controlled trial" by Taisuke Konno et al. (2022). The study compared the use of a self-retaining retractor and a handheld retractor in thyroid surgery and concluded that the self-retaining retractor was a safe and effective alternative that could reduce surgical time and improve surgical outcomes.

III. METHODOLOGY

Following steps will be followed developing surgical retractor

1) Literature survey for bench marking
2) Discussion with experts / Surgeon
3) Problem definition framing: Weight , cost , time, repair life, transportation, sterilisation , storage and handling
4) Already exist product analysis : visual inspection, understanding IPR Patent search and details Conceptualization/ Design
5) Concept discussion for validation and finalization
6) Detail Design & analysis : Reverification with user
7) Material and manufacturing planning
8) Prototype building.

Self-retaining surgical retractors can be made from various grades of materials depending on their intended use and the specific requirements of the surgical procedure.

a) *Stainless Steel*

- 300 series stainless steel: This includes grades such as 304 and 316 stainless steel, which are commonly used in surgical instruments. These grades offer excellent corrosion resistance, strength, and durability.

b) *Titanium*

- Grade 5 titanium (Ti-6Al-4V): This is the most commonly used grade of titanium in surgical instruments. It has high strength, good biocompatibility, and is lightweight.

c) *Aluminum*

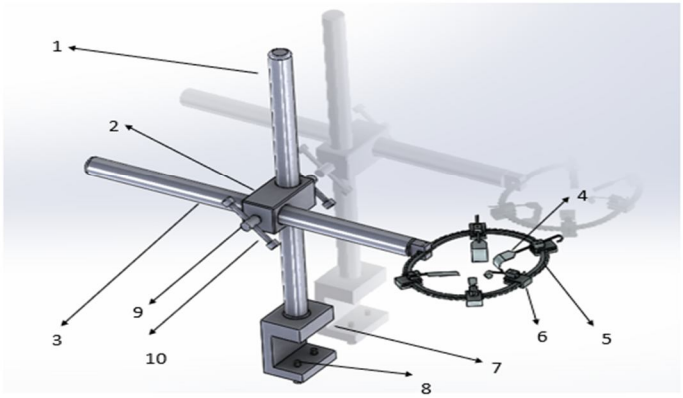
- 6000 series aluminum: Aluminum alloys within the 6000 series, such as 6061 and 6063, are commonly used in self-retaining retractors. These alloys offer good strength and corrosion resistance while being lightweight.

d) *Polymer-based Materials*

- Polyetheretherketone (PEEK): PEEK is a high-performance polymer with excellent mechanical properties and biocompatibility. It is commonly used in self-retaining retractors for its radiolucency and durability.
- High-Density Polyethylene (HDPE): HDPE is a lightweight and durable polymer that is often used in surgical instruments for its biocompatibility and sterilizability.

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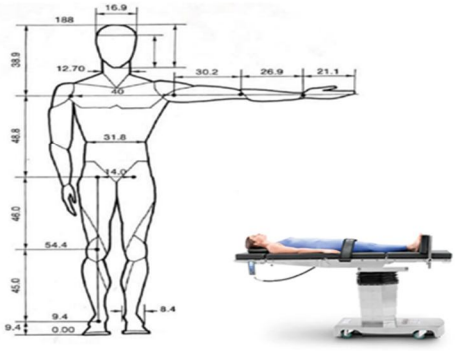
SURGICAL RETRACTOR DESIGN



1) Table Mounting Component
2) Post Coupler
3) Horizontal Cross bar
4) Retractor Blade
5) Retractor Ring
6) Fixed Ratchet
7) Fixture(table post)
8) Fixing Clamp

Fig 2. Solid Work Design

6 Ft Body



Operating Bed



Fig 3. Standard Size of Human Body And Operating Bed

IV. RETRACTOR RING

This Retractor Ring Inspired By Pediatric Universal Ring Retractor Set

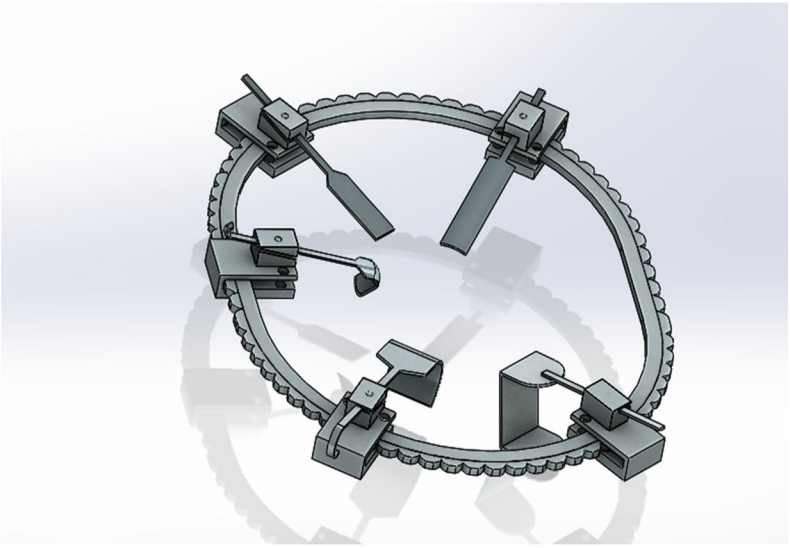


Fig 4

A. Available Retractor Rings in Market

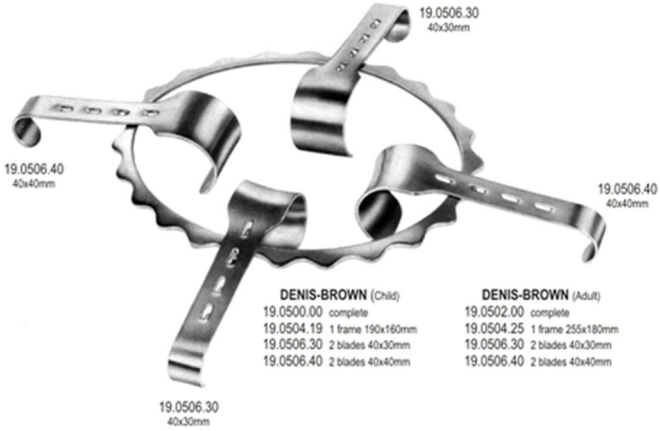


Fig 5. Denis Browne

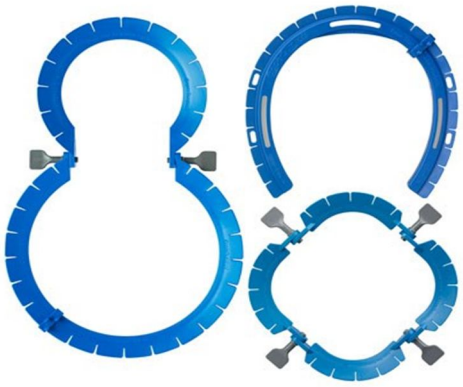


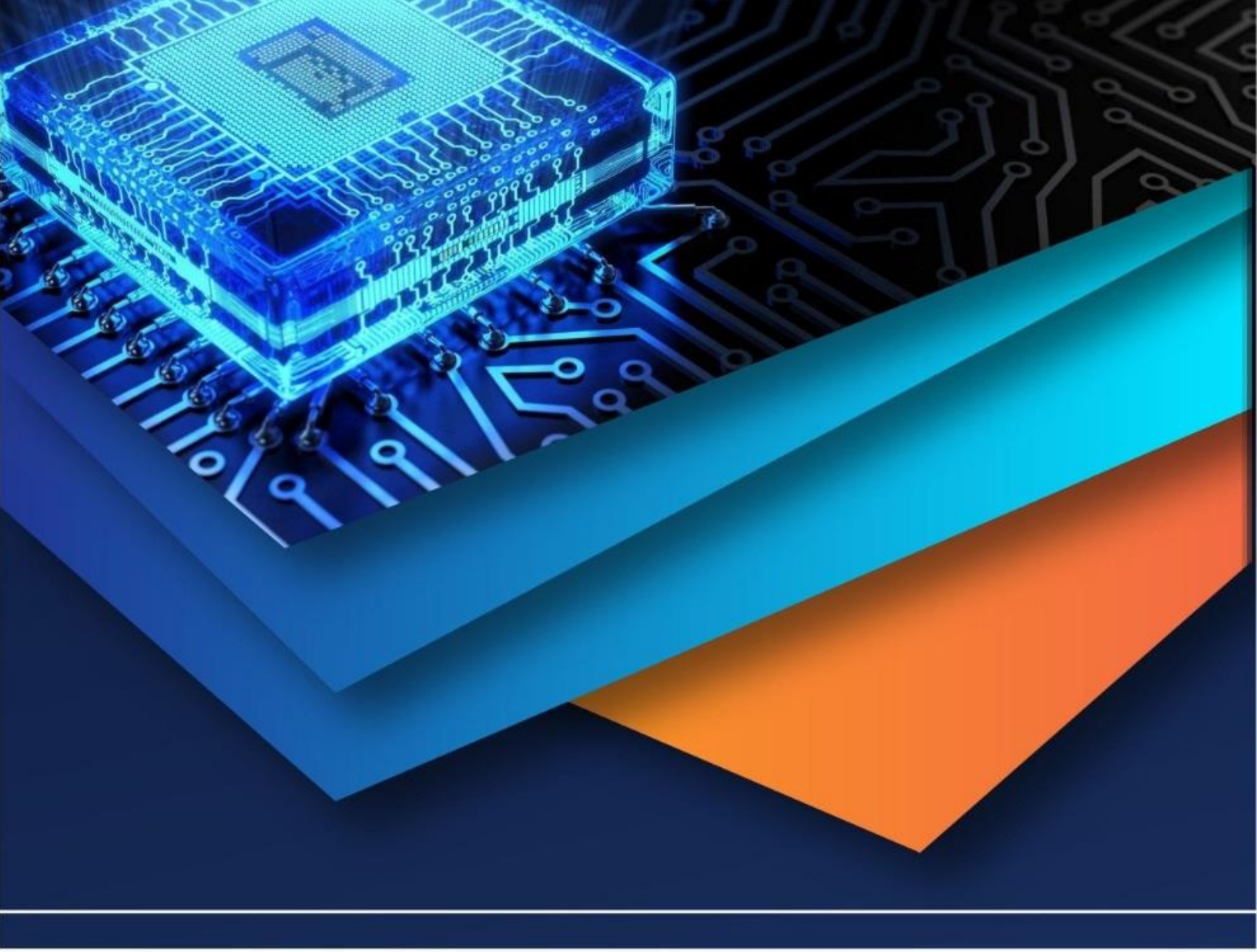
Fig 6. Lone Star Retractor Ring

V. CONCLUSION

Self-retaining surgical retractors are used to retract tissues and skin. Doctors utilize these retractors to hold the patient's skin during surgery. This paper aims to eliminate excessive parts used in surgical retractors. The retractor is designed with fewer parts, reducing the overall weight. This makes it easier for surgeons to handle during surgery, enhancing their ability to operate effectively. Moreover, the reduced number of parts contributes to cost reduction, which plays a significant role in the market. The primary objective was to minimize the number of parts used, resulting in cost reduction and improved usability for surgeons during operations.

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