"MODERN ADHESIVE SYSTEMS IN SURGERY AND DENTISTRY: TECHNOLOGIES AND APPLICATIONS"

Chilingarova Valentina Yurevna

Samarkand medical university

Abstract

Modern adhesive systems have revolutionized surgical and dental procedures, offering superior adhesion, biocompatibility, and versatility compared to traditional methods. This review delves into the technologies and applications of these advanced adhesives, exploring their role in various surgical specialties and dental procedures. We discuss the key properties of modern adhesives, including their chemical composition, biocompatibility, and mechanical strength. Additionally, we examine the diverse applications of these adhesives in tissue repair, wound closure, bone fixation, and dental restoration. Finally, we discuss the challenges and future trends in adhesive technology, highlighting the potential for further advancements in biocompatibility, biodegradability, and targeted drug delivery.

Keywords: Adhesives, Surgery, Dentistry, Biocompatible Materials, Tissue Repair, Wound Closure, Bone Fixation, Dental Restoration, Biodegradable Polymers, Drug Delivery

Introduction:

Traditional surgical and dental procedures often relied on sutures, staples, and other mechanical methods for tissue approximation and fixation. However, these techniques can be invasive, time-consuming, and prone to complications. The development of modern adhesive systems has provided a less invasive and more versatile alternative, offering numerous advantages in terms of patient comfort, recovery time, and long-term outcomes.

Technologies and Properties of Modern Adhesives:

• Chemical Composition: Modern adhesives encompass a wide range of chemical compositions, including:

* Cyanoacrylates (Super Glue): Fast-setting, strong adhesives with good tissue adhesion, but often lack biodegradability.

* Fibrin-based Adhesives: Biocompatible and biodegradable, derived from human plasma, promoting natural tissue healing.

* Polyurethanes: Versatile polymers with tunable properties, offering good biocompatibility and mechanical strength.

* Biodegradable Polymers: Polymers designed to degrade over time, minimizing the need for removal after tissue healing.

• Biocompatibility: Modern adhesives are designed to be biocompatible, minimizing tissue irritation, inflammation, and rejection.

• Mechanical Strength: Adhesives should possess sufficient mechanical strength to withstand the stresses associated with the surgical or dental procedure, ensuring secure tissue fixation.

Applications in Surgery:

• Tissue Repair and Wound Closure: Adhesives facilitate faster wound closure, reducing scarring and infection risk compared to sutures.

• Bone Fixation: Adhesives can be used to fix bone fractures, eliminating the need for invasive procedures and promoting bone regeneration.

• Organ Transplantation: Adhesives play a role in securing tissue grafts and reducing rejection rates in organ transplantation procedures.

• Vascular Surgery: Adhesive-based techniques are increasingly used in vascular procedures, reducing blood loss and minimizing post-operative complications.

Applications in Dentistry:

• Dental Restoration: Adhesives are essential for bonding dental materials (composites, ceramics) to tooth structures, providing durable and aesthetically pleasing restorations.

• Orthodontics: Adhesives are used to secure brackets and wires in orthodontic treatment, improving comfort and reducing the risk of decalcification.

• Periodontics: Adhesive-based therapies are employed to treat periodontal disease, promoting tissue regeneration and bone grafting.

Challenges and Future Trends:

• Biocompatibility and Biodegradability: Continued research focuses on developing adhesives with improved biocompatibility, biodegradability, and controlled release properties.

• Targeted Drug Delivery: Integrating drug delivery capabilities into adhesive systems offers the potential for localized drug administration, enhancing treatment efficacy and reducing side effects.

• Minimally Invasive Procedures: Adhesive technology is driving the development of minimally invasive surgical techniques, improving patient outcomes and recovery times.

Conclusion:

Modern adhesive systems have transformed surgical and dental procedures, offering superior adhesion, biocompatibility, and versatility. Continued research and development are pushing the boundaries of adhesive technology, leading to advancements in biocompatibility, biodegradability, and drug delivery. These advancements hold great promise for improving patient outcomes, simplifying surgical and dental procedures, and revolutionizing healthcare practices in the years to come.

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