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The Past and Present of Surgical Instruments

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Surgical instruments are specially designed tools or devices for performing specific actions during a surgery or operation. Some surgical instruments are designed for general use in surgery, while others are designed for a specific, particular procedure. Surgical instruments are divided into: graspers, such as forceps; clamps and occluders for blood vessels and other organs; needle drivers; retractors used to spread open skin, ribs and other tissue; distractors, positioners and stereotactic devices; mechanical cutters (scalpels, lancets, drill bits, rasps, trocars, Ligasure, harmonic scalpel, surgical scissors, rongeurs etc.; dilators and specula, for access to narrow passages or incisions; suction tips and tubes, for removal of bodily fluids; sealing devices, such as surgical staplers; irrigation and injection needles, tips and tubes, for introducing fluid; powered devices, such as drills, cranial drills and dermatomes; scopes and probes, including fiber optic endoscopes and tactile probes; carriers and applicators for optical, electronic and mechanical devices; ultrasound tissue disruptors, cryotomes and cutting laser guides; measurement devices, such as rulers and calipers.

In the past, medical equipment has not always looked as beautiful as now. Medical engineers have not had the technology yet to design and manufacture instruments to work with. And no one was particularly worried about the appearance of the instruments. Before the advent of modern surgical laser instruments, a surgical saw was used to amputate

limbs and viscera. The saw consisted of a rounded, ergonomic handle, as well as a curved, serrated blade to facilitate manipulation with the surgeon's device. The Tonsil Guillotine was invented in 1828. This was an updated model of a uvula-removing device, and was the standard for tonsillectomies for over 80 years after that. The doctor would reach into the patient's throat, skewer the tonsil with the device's fork, and cut the tissue away with the guillotine's blade. By the late 19th century a mild anesthetic of cocaine solution was injected before use [1].

The current level of development of surgical equipment is significantly different from surgical instruments in the past. In modern conditions, tools that provide high quality of various surgical operations are more widespread. For example one can emphasize the features of the manufacture of surgical instruments using diamond particles. The use of such modern approaches is possible even in the manufacture of conventional scalpels and injection needles by depositing diamond particles or special treatment on them, which allows us to increase the wear resistance and durability [2].

Future surgical equipment is collaboration between conventional equipment and computer technology that improves the accuracy and efficiency of operations that we have never seen before. Three years ago, Nasa teamed up with American medical company Virtual Incision to develop a robot that can be placed inside a patient's body and then controlled remotely by a surgeon. Augmented reality (AR) differs from virtual reality in that the users of AR do not lose touch with reality, while AR puts information into eyesight as fast as possible. With these distinctive features, it has a huge potential in helping surgeons become more efficient at surgeries. Whether they are conducting a minimally invasive procedure or locating a tumor in liver, AR healthcare apps can help save lives and treat patients seamlessly.

Surgical robots are the opening in surgery. The most commonly known surgical robot is the da Vinci Surgical System. It features a magnified 3D high-definition vision system and tiny wristed instruments that bend and rotate far greater than the human hand. With the da Vinci Surgical System, surgeons operate through just a few small incisions. The surgeon is 100% in control of the robotic system at all times; and they are able to carry out more precise operations than previously thought possible.

Recently, Google has announced that it started working with the pharmaceutical company Johnson&Johnson in creating a new surgical robot system. With their AXSIS robot, Cambridge Consultants aim to overcome the limitations of the da Vinci, such as its large size and inability to work with highly detailed and fragile tissues. Their robot relies on flexible components and tiny, worm-like arms. The developers believe it can be used later in ophthalmology, e.g. in cataract surgery.

Minimally invasive surgery can be performed with a magnetic surgical system. This is a technological platform that uses gallbladder magnetic retraction during laparoscopic surgery.

The intelligent surgical knife (iKnife) was developed by Zoltan Takats of Imperial College London. This knife works by using an old technology where an electrical current heats tissue to make incisions with minimal blood loss. With the iKnife, a mass spectrometer analyzes the vaporized smoke to detect the chemicals in the biological sample. This means it can identify whether the tissue is malignant in real-time. The technology is especially useful in detecting cancer in its early stages and thus shifting cancer treatment towards prevention [3].

The development of medical equipment, especially in recent years, has been responsible for an increased level of medical service, which has led to a decrease in mortality during and after surgical intervention. Improvement of modern

medical equipment has touched upon all areas of medicine. Every year there are new highly specialized devices that enable diseases to be more accurately diagnosed and detected at an early stage. It results in timely and successful surgical treatment of many conditions which used to be untreatable. The future of public health largely depends on the new scientific equipment developments that will be successfully introduced into medical practice.

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