EDITORIAL

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Trends and perspectives in minimally invasive surgery in oral and maxillofacial surgery

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Medical personnels and patients recognize that one of the major advances in surgical technique over the last 20 years has been the growth of minimal access surgery. It is also called "minimally invasive surgery (MIS)" which is a clinical endeavor that preserves associated structures and provides more optimal surgical results with less operative trauma. MIS includes laparoscopic, endoscopic, and most recently, robotic approaches. Although MIS is one of the forefront medical technologies, the history can be traced back to approximately five thousand years. As early as 3000 BC, instruments for viewing body cavities from metal or wood were developed[1] which can be considered as an origin of the MIS. However, major technological developments were achieved from mid-19th century to end of 20th century, based on the advances of lighting sources for endoscopy along with the use of electrocautery for a wide range of MIS procedures. The examples of the development are the first electrolithotripsy in 1855 and the first laparoscopy in humans in 1910 with a cystoscope used to diagnose abdominal complaints. Since then, the first half of the 20th century saw a huge development of MIS, particularly in Europe and North America[2]. Gynecologists mainly led the field, and advances were made in laparoscopic surgery with the surgical procedure of pneumoperitoneum, electrocautery, visualization and optics[3]. Since the late 20th century to present, the rise of robot surgeries revolutionizes the surgical fields along with technical advances of current endoscopy. Most importantly, those innovations have been driven more in partnerships or organizations such as laparoscopic societies, healthcare commercial companies, scientific and educational organizations[4].

What is the current status and trends of MIS in oral and maxillofacial surgery? MIS necessitates advancements in preoperative imaging techniques, planning, intraoperative navigation, and specialized surgical instruments. These advancements are rapidly progressing towards precise surgical procedures with minimal incisions and dissections in this field[5]. Both minor and major areas of oral and maxillofacial surgery are now embracing the development of minimally invasive techniques. A variety of MIS applications within oral and maxillofacial surgery are outlined in Table 1. While the evolution of MIS has largely been driven by the individual efforts of surgeons, it must continue to advance with the support of academic institutions, commercial enterprises, and corporate initiatives, as demonstrated in the developmental history of MIS. Furthermore, training and assessment of surgeons via simulation in a laboratory environment or in peer-reviewed literature is essential. No area of surgical practice is exempt from the influence of the MIS movement.

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Table 1. Minimally invasive surgeries in oral and maxillofacial surgery

Type of oral and maxillofacial surgery	Medical technologies of MIS	Detail of surgery
Head and neck oncology surgery	Robot assisted surgery	Salivary gland tumor resection, neck dissection, transoral robot assisted cancer resection
	Navigation assisted surgery	Skull base, orbital wall oncology surgery Maxillectomy with pterygoid plate involvement
TMJ surgery	Arthroscopic surgery	Diagnostic and operative TMJ arthroscopic surgery (level I and II) Articular disc plication (level III) Benign tumor removal such as synovial chondromatosis
OGS	CAD/CAM assisted OGS	Waferless OGS OGS with VSP OGS with PSP
Maxillofacial trauma surgery	Endoscope assisted open reduction and internal fixation	Condylar neck and subcondyle fracture surgery (intraoral approach)
	CAD/CAM assisted surgery (VSP and PSP)	Midface (zygomatico maxillary complex, blow-out orbital fracture, and frontal sinus) Condylar neck and subcondyle fracture surgery
Salivary gland surgery	Endoscope assisted salivary gland surgery	Sialolithotomy Interventional sialoendoscopy (removal of salivary duct obstructions)
Maxillary sinus surgery	Functional endoscopic sinus surgery	Treatment of chronic sinusitis to restore normal drainage and function of the sinuses
Implant surgery	CAD/CAM assisted surgery	Guided surgery for implant installation (optimizing path of implant installation and avoiding trigeminal nerves)

(MIS: minimally invasive surgery, TMJ: temporomandibular joint, OGS: orthognathic surgery, CAD/CAM: computer-aided design/computer-aided manufacturing, VSP: virtual surgical planning, PSP: patient-specific plate)

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