Transoral laser surgery is evolving - and so is the tech behind it

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Transoral laser exoscopy for upper aerodigestive tract cancers

BY CESARE PIAZZA, CLAUDIA MONTENEGRO, DAVIDE LANCINI, GABRIELE ZIGLIANI AND FRANCESCA DEL BON

Over the past decade, technological advancements in minimally invasive surgery have driven the development of innovative tools and visualisation systems. Among these, the emergence of the exoscope has significantly impacted on head and neck surgery. Arising from the constant development and optimisation of endoscopic cameras, exoscopy is based on external digital devices that provide high-definition, magnified and 3D visualisation. Initially, this technology was adopted in selected surgical settings, primarily within neurosurgery, gynaecology and urology. Its use in otorhinolaryngology has expanded more recently, as growing evidence in the literature highlighted its applicability in different areas, such as transoral laryngeal and oropharyngeal surgery, otoneurosurgery and microvascular reconstruction. Transoral laser exoscopic surgery (TOLES) currently represents the most common application and offers several recognised advantages [1].

Evolution from microscopy to exoscopy

Historically, traditional transoral laser microsurgery (TOLMS) has been a cornerstone in minimally invasive laryngeal procedures. Nevertheless, it presents several limitations, including suboptimal illumination and monocular visualisation through small-bored laryngoscopes, reduced ergonomics and poor collaboration / didactics due to a single-operator view. As a matter of fact, the major disadvantage of traditional microscopy is the physical distance between the surgeon's eyes and the laryngoscope inlet, which can compromise ergonomic posture and reduce hand precision, especially during fine manoeuvres. Moreover, transitions between different anatomical subsites (e.g. supraglottic to glottic or subglottic) require frequent repositioning and refocusing of the microscope, contributing to interruptions of the surgical workflow. Furthermore, the limited shared view creates restrictions in team-based surgery, as the microscope field can only be seen properly through the eyepiece, precluding the sharing of



Figure 1: Intraoperative TOLES setup. The VITOM 3D exoscope system with the robotic harm ARTip Cruise (both Karl Storz, Tuttlingen, Germany) is positioned on the right side of the first operator (*), while the CO2 laser is connected to the micromanipulator from the left side (+). The HD-3D monitor is positioned in front of the first surgeon and is perfectly visible also by the assistant surgeon, nurse, anaesthesiologist, and visitors. S = first surgeon, A = assistant surgeon, AN = anaesthesiologist, N = surgical nurse.



Figure 2: Perfect illumination and 3D visualisation through a small-bored laryngoscope used to resect a right vocal fold cancer extending close to the midline of the posterior commissure (*). Note that the endotracheal tube has been moved forward to adequately expose the target.