

耳鼻科領域用箸型手術器具 及び使用部品の自動組立システム

Chopsticks instruments for otology and rhinology surgery and a batch assembly system for the instruments' parts.

耳鼻科内視鏡下手術において、複数の医師で行う手術手技に匹敵する手術を単独の医師が実現できる手術器具の開発を行っている。一般的な耳鼻科領域での手術は3つの手術器具(内視鏡、処置具、吸引管などのサポート器具)を使用するが、助手がサポート器具を持って行うThree hands手術(Fig.1左下)では助手と術者の手の干渉が生じ、2人の間での意志疎通が求められる。1人の術者が片手で内視鏡とサポート器具を箸のように持つ手技(Fig.1右上)では、安定して持つことができずサポート器具の自由な操作は難しい。安定して内視鏡とサポート器具を片手で持つことができ、かつサポート器具を自由に動かせるように内視鏡とサポート器具を関節で接続した構造を提案し(Fig.1右下 [1])、軟性のゴム体を関節として利用し、耳科用箸型手術器具を作製した(Fig.2)。

さらに、医療器具用部品の実装組立を自動的に行う目的で、Raspberry Piを用いて3Dプリンター、ロボット、ディスペンサーを組み合わせたコントロールを行う自動化組立システムを構築し(Fig.3)、実施例として耳科用箸型手術器具の可動性接続部の自動組立を行った。

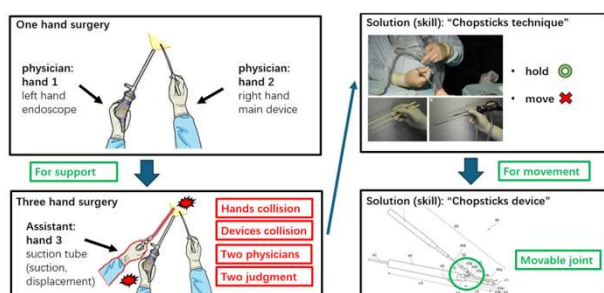


Fig. 1 “One hand” 手術から“Three hands” 手術
“One hand” surgery to “Three hands” surgery

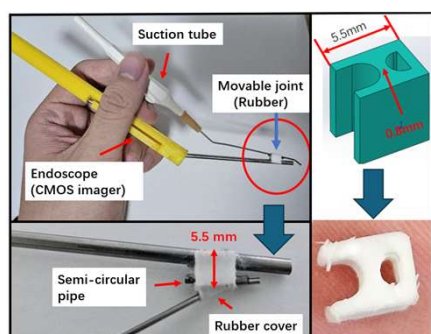


Fig. 2 耳科用箸型手術器具と可動性接続部
Chopsticks instrument for otology surgery and
its movable joint

This study aims to develop surgical instruments that enable a single physician to perform surgical procedures comparable to multiple physicians for endoscopic surgery in the otology and rhinology fields. In general otolaryngological surgeries, three surgical instruments (endoscopes, main device, and support devices such as suction tubes) are typically used. However, in the three hands surgery that an assistant holds the support instruments (Fig. 1, lower left), physical interference occurs between the hands of the assistant and the surgeon, and close coordination between them is required. When a single surgeon attempts to hold both the endoscope and the support device in one hand using a “chopstick technique” (Fig.1, upper right), free movement of the support instruments is difficult because stable holding of the devices is unable. To address this, we propose a novel structure where the endoscope and support instruments are connected with a joint (Fig. 1, lower right [1]). By using a flexible rubber component as the joint, we developed chopsticks instruments for otology surgery (Fig. 2). For rhinology surgery we adapted this concept with modified dimensions and configurations to fabricate rhinology surgery instruments.

In addition, using an integrated automation control of a 3D printer, robot, and dispenser by Raspberry Pi, we constructed an auto-assembly system (Fig.3). As an example, demonstration, the auto-assembly of movable joints in chopsticks instrument for otology surgery was performed.

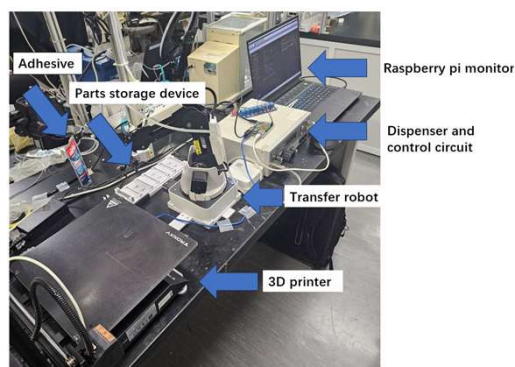


Fig. 3 自動組み立てシステム Auto-assembly system

参考文献

- [1] 特許国際出願，国際公開番号WO 2023/181999 A1，発明者：YAMAUCHI, Daisuke, et al, 発明の名称：Endoscope assembly, and operation-assisting device for tool for treatment or surgery, 国際公開日：2023年9月28日