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Technical Note
TMJ Disorders

Novel guide device for temporomandibular joint arthroscopy

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Abstract. Operative arthroscopy of the temporomandibular joint requires the insertion of an arthroscope and a working cannula. The surgical instruments are introduced into the joint space via the working cannula, and are visualized by the arthroscope. While the insertion of the arthroscope is relatively easy as anatomical landmarks such as the tragus–canthus line aid the surgeon, the insertion of the working cannula requires the use of advanced techniques and demands higher levels of surgical expertise. Following is a description of a novel guide device that enables the surgeon to introduce the working cannula into the desired location relative to the arthroscope, and maintains optimal spatial relations between them throughout the procedure.

Key words: temporomandibular joint; arthroscopy; closed lock.

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After inserting the arthroscope into the superior compartment of the temporomandibular joint, the surgeon aims to introduce the working cannula such that it reaches as close as possible to the tip of the arthroscope. For the working cannula to be readily visualized and functional, skin puncture site, angulation of insertion, and insertion depth must be accurate and precise[1]. If the working cannula is improperly inserted such that it becomes difficult or impossible to direct an instrument through it to be visualized by the arthroscope, it becomes necessary to remove and re-insert it, leading to greater trauma and increased surgical risks and morbidity to the patient, as well as excess leakage of saline into surrounding tissues, preventing the joint cavity from being effectively distended[2].

An additional challenge is maintaining the relative orientation of the tips of the arthroscope and the working cannula in three-dimensions throughout the operative procedure, such that the arthroscope can have a continuous and uninterrupted line of sight to the surgical instruments introduced through the working cannula. In the operating theatre, much effort is made to ensure that the relative orientation is unchanged; usually the main surgeon has to hold both the arthroscope and the working cannula steady with both hands, while an assistant surgeon is tasked with introducing and manipulating the surgical tools[3–10].

The author developed a new guide device to help the surgeon properly insert the working cannula and also maintain optimal spatial relations between the arthroscope and working cannula throughout the procedure.

Technique

The guide device in essence is a double parallelogram that the arthroscope and working cannula are mounted on (Fig. 1). After inserting the arthroscope into the joint cavity, the guide device is mounted on the part of the arthroscope remaining outside the joint. The other arm of the guide device receives the working cannula and directs it into the joint cavity.

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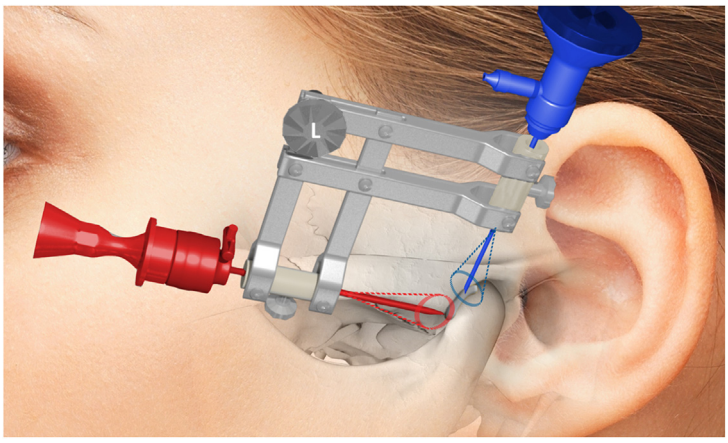

Fig. 1. Illustration showing the arthroscope in blue, the working cannula in red, and the guide device in grey. A locking screw (L) holds both arms of the guide device, and when fastened, it fixates the relations between the two arms. As depicted by the dotted lines, the arthroscope and working cannula maintain some movement when the arms of the guide device are locked by the locking screw (L).

The working cannula in this way reaches exactly the spot where the guide device directs it to, which is a location with optimal spatial orientation relative to the arthroscope, achieving both immediate visualization and ideal relations for instrumentation. After proper insertion of the working cannula by the guide device and visualizing it by the arthroscope, the working cannula can be locked in this fixed orientation relative to the arthroscope, allowing the surgeon to hold the arthroscope and working cannula with one hand using the guide device, and performing the surgical instrumentation with the other hand.

After mounting the arthroscope and working cannula on the guide device and achieving optimal spatial orientations, the arthroscope and working cannula can be moved in three dimensions while maintaining the optimal configuration between them. The guide device, arthroscope, and working cannula, as a single unit, can be moved in three dimensions, as limited by the soft and bony tissues of the temporomandibular joint and surrounding structures. Flexible connectors of the guide device to the arthroscope and working cannula enable additional micro-movements for the arthroscope and working cannula (Fig. 1) without opening or closing the guide device and meanwhile maintaining optimal orientation between them and keeping the working cannula within the visual field of the arthroscope. The guide device may be opened by widening the angle between the arms or closed by narrowing the angle between the arms, while maintaining direct visualization of the working cannula by the arthroscope (Fig. 2).

The guide device can be mounted and dismounted at any time during the operation; before and after introduction of both the arthroscope and the working cannula. The device was made of stainless steel and autoclavable polymeric materials (Octopus Technological Solutions Ltd., Israel, and Blumenfeld Consulting & Projects Ltd., Israel). It is protected by a pending patent.

The Institutional Review Board and Ministry of Health approved this study. Patients treated with the device signed an informed consent form, in accordance with the Ministry of Health Ethics Committee requirements. The operative procedure performed was lysis and lavage, which included the insertion of a blunt obturator through the working cannula and performing visually guided stretching of the capsule and ligaments, mobilization of the disc, and subsynovial injection of steroids. No attempt was made to perform more complex procedures such as disc repositioning and sutures.

Discussion

The ideal puncture site of the working cannula may lie at any point within a diameter of approximately 2 cm in front of the skin puncture site of the arthroscope. In addition to the location of the entry point, determinimg the angulation vector and the insertion depth are two other factors that add to the complexity of the procedure[3].

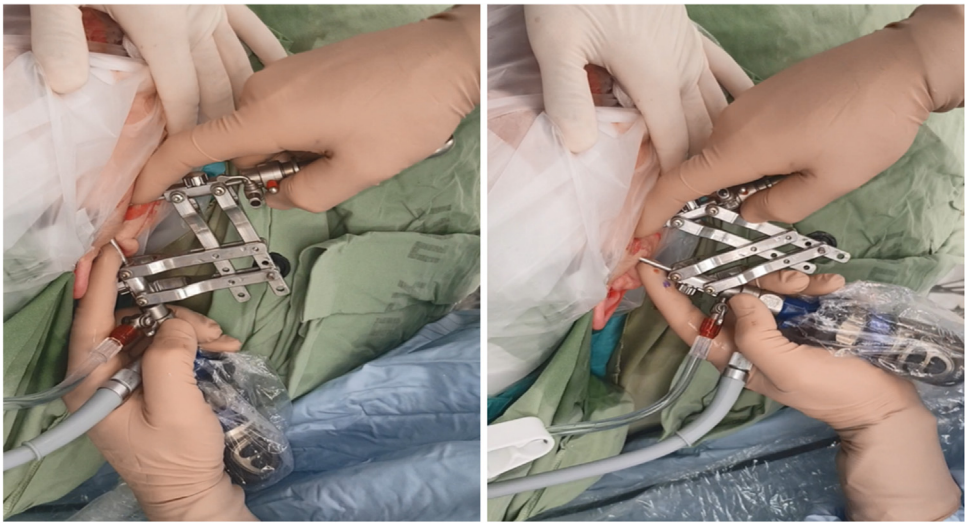

Fig. 2. The angle between the two arms of the device may be widened or narrowed, changing the relations between the arthroscope and the working cannula, while keeping their tips in close proximity thanks to the double parallelogram design.

The present guide device proved effective in guiding the working cannula into the area with optimal spatial orientation relative to the tip of the arthroscope. Entering the joint cavity from the first attempt into the desired location adds safety and predicatbility to the two-puncture technique. Minimal violation of joint capsule correlates with improved hydrodistention of joint cavity and subsequently improved visualization. The ability to fixate the relations between the arthroscope and working cannula while maintaining the ability to perform micro-motion of both, prevents unnecessary scuffing of joint tissues while manipulating the instrument in the small joint space.

Novice surgeons will probably benefit the most from the device. For most surgeons, the device could be used selectively in complex cases, such as in narrow joints. Experienced arthroscopists, however, may find this additional armamentarium unnecessary. As previously mentioned, the device was used for arthroscopic lysis and lavage only, and has not been tried with discopexy and other advanced techniques.

Overalll the use of the guide device for arthroscopic lysis and lavage added predictability and accuarcy to the surgery, shortened operation time, and decreased morbidity.

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Competing interests

The inventor of the patent is the author (W.A. Abboud); the applicant of the patent is Tel-Hashomer Medical Research Infrastructure and Services Ltd.

Ethical approval

Ethical approval was given by the Institutional Review Board SMC-4657-17 and the National Ministry of Health 20185263. The approval is attached.

Patient consent

Written consent forms were obtained from patients.

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