Development of a New Irrigation Sucker for Microneurosurgery
—Technical Note—

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Abstract

A new irrigation sucker (Delta Irrigation Sucker®) was designed for microneurosurgery. The Delta Irrigation Sucker® has a unique trigonal pyramid-shape thumb piece, providing a very stable grip. Irrigation is achieved easily by pushing a small button just behind the pressure-regulating pore. Stable hold of the sucker and easy handling of the irrigation button enable irrigation without unsteadiness of the sucker. The Delta Irrigation Sucker® is available in six sizes, with diameters from 1.5 mm to 4.0 mm at 0.5 mm intervals. Irrigation force is provided by a pressure bag, and a normal sterile transfusion set can be used as the irrigation circuit. The Delta Irrigation Sucker® was used in 20 cases of clipping for ruptured cerebral aneurysm, five cases of tumor resection, and three cases of anterior clinoidectomy and opening of the internal auditory meatus. Subarachnoid clot was easily removed and the bleeding points were easily confirmed. Irrigation, controlled by natural finger movement, did not cause unsteadiness of the sucker.

Key words: suction, irrigation, microsurgery, neurosurgery

Introduction

Irrigation is one of the most basic and important procedures in microneurosurgery. Adequate irrigation is indispensable for washing out subarachnoid hematoma during clipping surgery for ruptured cerebral aneurysm, for cooling and cleaning the bone and burr when drilling the skull base bone, for avoiding burning when using bipolar coagulation forceps, and in confirming the bleeding point. In most cases, an assistant performs the irrigation procedure, but timely and precise irrigation is often difficult to achieve in a deep microsurgical field. Various instruments have been considered in order to support the irrigation maneuver,1-7) but the optimum surgical instrument for irrigation has not yet been developed. We have developed a new irrigation sucker of unique shape, and here describe the characteristics of the new irrigation sucker and its clinical usefulness during microneurosurgery.

Design of the New Irrigation Sucker

The Delta Irrigation Sucker® is made of stainless steel and consists of four parts, namely a delta thumb piece, a suction tube, an irrigation tube, and an outlet tube (Fig. 1). The delta thumb piece has a

Fig. 1 Photographs showing the Delta Irrigation Sucker®. a: outlet tube, b: button switch for irrigation, c: delta thumb piece, d: irrigation tube, e: suction tube.
trigonal pyramid shape, with slightly curved lateral walls which make the delta thumb piece easier to hold. The suction tube, 13 cm in length, is angled at 30 degrees at a length of 1.0 cm from the delta thumb piece. The length and angle of suction tube can be tailored. The suction tube is tapered and has a blunt tip to prevent injury to the brain. The irrigation tube, 0.5 mm in diameter, is fixed parallel and above the suction tube but is 5 mm shorter with the tip of irrigation tube beveled to reduce the risk of injury and obstruction of the visual field. Six sizes of Delta Irrigation Sucker® are available, including 2.0 and 2.5 mm diameter sizes most frequently used in microneurosurgery. The sucker weight is about 35 g.

The delta thumb piece can be held in either hand and by the orthodox hold with thumb control or pen hold with index finger control (Fig. 2). The irrigation mechanism is very simple, consisting of a pressure bag and a sterile transfusion set. No additional mechanism such as an electrical pump is necessary. Irrigation can be easily controlled from titration to flush (Fig. 3) by pushing the small button just behind the pressure-regulating pore. The structure of this button switch is shown in Fig. 4. The short outlet tube, 4 cm in length, provides good balance to the Delta Irrigation Sucker®.

**Discussion**

Adequate irrigation is very important in microneurosurgery. In most neurosurgical institutes, a surgical assistant provides irrigation with a syringe and a plastic needle. However, it is often difficult to achieve precise and timely irrigation, especially in a deep operative field. If the chief operator performs irrigation using a syringe, it is time-consuming to change the surgical instruments. When using the irrigation bipolar system, the instrument held in the other hand is restricted to a sucker. The continuous irrigation and suction system is useful when operating in the same operative field, but adjusting the position of irrigation is troublesome if surgical field changes dynamically.

Several types of irrigation suckers are available, such as the Interchangeable Combined Irrigation Sucker® (Fujita Medical Instruments Co., Ltd., Tokyo), the Optoirrigator® (Muranaka Medical...
Instrument, Co., Ltd., Osaka), and the Irrigation Suction Device® (Johnson & Johnson Co., Ltd., Tokyo). However, all of these irrigation suckers are hard to use clinically because of their size, shape, and inadequate position of the irrigation switch. The irrigation switch of the former two suckers, located on the lateral or anterior wall of the thumb piece, must be operated by the index finger, which easily causes unsteadiness of the sucker. The last sucker has a lever switch on the superior surface of the thumb piece, which regulates both suction pressure and irrigation flow. However, the thumb piece is a rectangular parallelepiped shape, and is too big to hold. Also, control of suction and irrigation with one lever is sometimes difficult. Furthermore, all of these irrigation suckers are designed to fit only into one hand, making the pen hold impossible.

The Delta Irrigation Sucker® can be held firmly by nipping the lateral surfaces of the delta thumb piece by the index and middle fingers or by the thumb and middle fingers (which alternate, depending on the hold). Stability of holding is much higher with the Delta Irrigation Sucker® than with a conventional sucker, in which the thumb piece is just held by finger tips. The irrigation switch, a small button just behind the pressure-regulating pore, can be pushed easily by natural finger action just like controlling the suction pressure regardless of hold type. This button responds very quickly and continuously regulates irrigation flow, so an adequate flow can be obtained from titration to flush. The tapered and angled suction tube provides a better microsurgical field and any obstruction at the suction tip can be easily released. The suction tip is blunt to not injure the brain. The axes of suction tube and outlet tube do not coincide in the Delta Irrigation Sucker®, but this does not increase the obstruction of suction.

A Delta Irrigation Sucker® was used in 20 cases of clipping for ruptured cerebral aneurysm, five cases of tumor resection, and three cases of anterior clinoideotomy and opening of the internal auditory meatus. Subarachnoid clot was easily removed and the bleeding points were easily confirmed with the Delta Irrigation Sucker®. Irrigation, achieved by natural finger movement, did not cause unsteadiness of the sucker. Furthermore, suction and irrigation could be achieved simultaneously without any difficulty.

Two minor disadvantages of Delta Irrigation Sucker® are the angle of sucker cannot be changed, and the sucker is a little heavier than a conventional sucker. However neither factor disturbed surgical maneuvers during trial use. The sucker is not heavier than other irrigation suckers available now (Table 1).

The Delta Irrigation Sucker® provides neurosurgeons with a steady hold and comfortable handling for irrigation. Both irrigation and suction can be controlled by natural thumb movement (or index finger movement in the pen hold), which is easier than with other irrigation suckers. The irrigation force is obtained by a pressure bag, and the usual sterile transfusion set can be used as an irrigation circuit, so the system is not expensive. For these reasons, the Delta Irrigation Sucker® is very useful in microneurosurgery.

### Acknowledgment

The design of the Delta Irrigation Sucker® has been registered in Japan. The Delta Irrigation Sucker® can be purchased from Muranaka Medical Instruments, Co., Ltd. The authors have a proprietary interest in this new irrigation sucker.

### References


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**Table 1 Comparison of sucker weight**

<table>
<thead>
<tr>
<th>Type of sucker</th>
<th>Weight (g)</th>
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<tbody>
<tr>
<td>Delta Irrigation Sucker®</td>
<td>35</td>
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<tr>
<td>Interchangeable Combined Irrigation Sucker®</td>
<td>35</td>
</tr>
<tr>
<td>Optoirrigator®</td>
<td>40</td>
</tr>
<tr>
<td>Irrigation Suction Device®</td>
<td>64</td>
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<tr>
<td>Conventional sucker (without irrigation mechanism)</td>
<td>24</td>
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Commentary

The authors present a modification of the irrigation-suction device. The idea is interesting to combine the irrigation with a suction device instead of having it combined with the bipolar device. It is questionable if irrigation mounted on the suction tube could provide the same effect as irrigation mounted on the bipolar forceps. According to my understanding, at the moment of irrigation with a suction irrigator, the hole on the suction tube is open, since the thumb is involved with the button regulating the amount of irrigation. And when the hole on the suction tube is completely opened, then the suction is maximally reduced, and this may create an inefficacy problem in bipolar coagulation, since the tips of the bipolar are not only wet, but might be completely submerged under the fluid. In such a situation, if the surgeon tries to reduce (remove) the fluid (saline and/or blood), then there will not be appropriate irrigation of the tips of the bipolar pincet. The real problem of adequate (correct) irrigation and suction during bipolar coagulation should be met accordingly and appropriately solved, if AVM and/or other well vascularized pathologies are in question. The problem of accurate bipolar coagulation is, of course, of paramount importance in all pathologies, but in particular when the brainstem, the spinal cord, and many other cerebral or cerebellar locations are in question. To fulfill the requirements for accurate and successful bipolar coagulation, in which bleeding(s) should be stopped and no additional collateral damage of the normal brain tissue created, the effect would probably be higher, if the irrigation combined with the bipolar device is left in place providing the well-adjusted irrigation necessary for conducting bipolar coagulation, then the irrigation (jet) mounted on the suction tube may offer good help in cleaning smaller or larger (disturbing) blood clots. The present Delta Irrigation Sucker might have an additional positive effect on conductance of surgical procedures for dealing with AVM and/or well vascularized pathologies. However, the more than slightly greater weight of the instrument is of less disadvantage than is the fact that the instrument is not malleable and the shape cannot be accordingly changed. And at the end, personally I do not agree with too little “hygiene” in the advertisement of the product, as is evident from the paragraph in the Acknowledgment.

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We are all aware of the difficulties of getting the right amount of irrigation at the right time in difficult to reach areas during microsurgery. The authors have described a new suction-irrigation device that would be of great benefit to the surgeon. There are other such devices around but this seems have many advantages that are well outlined by the authors. There is certainly a need for this device and neurosurgeons will need to evaluate it for themselves just as they do the variety of microsurgical instruments that are available.

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