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The Shaw Scalpel*: thermal control of surgical bleeding

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ABSTRACT – Hemostasis during surgical procedures has always been a primary concern in patient treatment. The Shaw Scalpel represents a significant development in the surgeon's armementarium to control hemorrhage in soft tissue surgery. It offers immediate hemostasis, improved visibility, and reduced blood loss. Surgery can be performed using a single instrument for simultaneous cutting and sealing of vessels without passing any electrical current through the patient's body. Tissue healing rates are similar to cold steel and significantly better than with electrosurgical techniques.

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Obtaining hemostasis along incision lines generally requires clamping and tying, or electrocoagulation. Since both procedures are time consuming, they are used only for controlling bleeding from larger vessels. When control of smaller vessel hemorrhage has been desired, electrosurgical units have been used. Many surgeons have tended to avoid electrosurgical cutting for a variety of reasons. The passage of radio-frequency electrical current through the tissues can cause significant muscular contractions along the incision during the actual cutting procedure. There is also the need to exercise extreme care that the electrosurgical tip does not touch other metallic instruments, orthodontic wires, brackets, or arch bars, and restorations. Additionally, if good contact is not obtained with the grounding pad, then superficial burns in the region of the pad can occur. Finally, there is the unavoidable electrical interference with patient monitoring displays. The Shaw Scalpel system provides a technologically advanced method of controlling hemorrhage along tissue incision lines and in areas of sharp dissection of the tissue.

Material: the Shaw Scalpel

The power control unit operates on 115 volts, 50-60HZ and provides a pulsed DC current, which is used to heat the scalpel blade from 100°C to 270°C in 10°C increments as selected by the user

* Invented by Robert Shaw, M.D., manufactured by Oximetrix, Inc., Mountainview, California.

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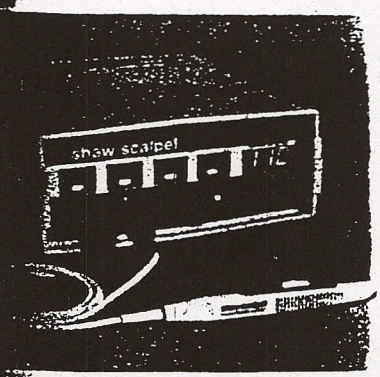
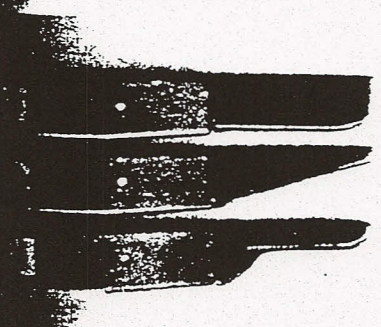


Shaw Scalpel system.



10, 11, 15 Teflon coated scalpel b

(Fig. 1). At present, #s10, 11 and 15 blades are available (Fig. 2) and, since they are equivalent in sharpness to cold steel blades of the same type, they can be used either cold or in the heated mode.

The instrument provides continuous sensing of blade temperature and thereby maintains the temperature within extremely narrow limits. The blade temperature regulating electronics in the system are sophisticated enough to compensate for varying heat losses, depending on the type of tissue being incised and the rate at which cutting is carried out[1].(Fig. 3) With proper temperature settings for different types of tissue, hemostasis is obtained during incision and sharp dissection by a process of thermosealing or thermocoagulation of vessels. There is no electrical current of any type passed through the patient and no ground pad is needed to use the system.

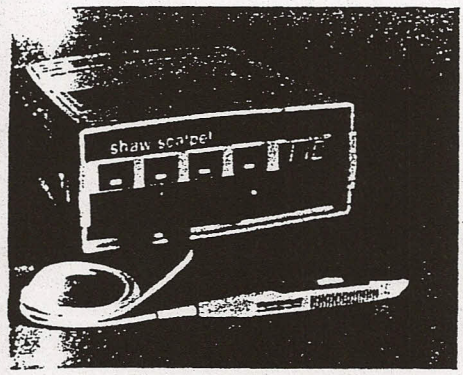


Fig. 1. Shaw Scalpel system.

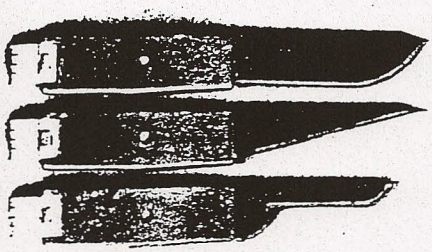


Fig. 2. 10, 11, 15 Teflon coated scalpel blades.

Method

After choosing and inserting the proper blade in the previously gas sterilized scalpel handle, the system can be turned on and, making sure the

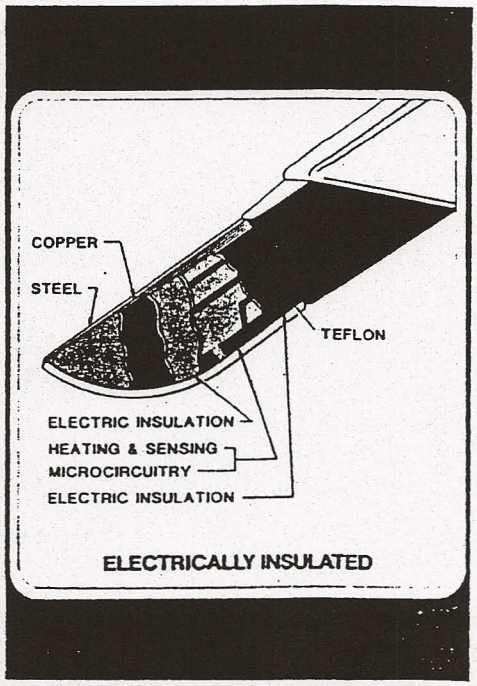


Fig. 3 Blade-structure showing electrically isolated heating and sensing microcircuitry.

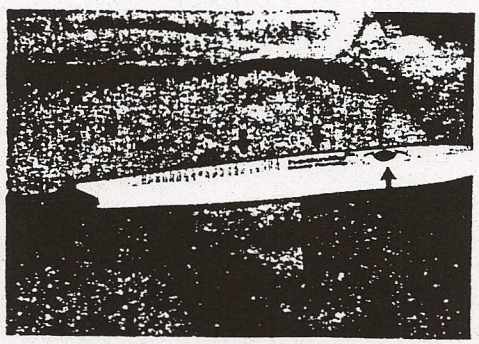


Fig. 4. Blade handle showing black button for incremental temperature adjustment, white on-off switch, and black bar for 270°C thermocoagulation activation.

white switch on the handle is in the OFF position, the temperature can be chosen by depressing the black button on the side of the handle momentarily, or by setting it on the main unit. Temperatures can be set in 10°C increments beginning at 110°C and going up to 260°C. Once the 260°C reading is reached, depressing the black button again momentarily will return the setting to 110°C. Once the desired temperature has been chosen, blade heating can be activated at that specific temperature by turning the white switch on the handle to the ON position. During the cutting procedure, if thermocoagulation of larger vessels or point thermocoagulation is desired, depressing the black handlebar with the white switch on will raise the temperature instantaneously to 270°C and release of the handlebar will drop it automatically to the pre-existent setting (Fig. 4). Vessels exceeding 1.5 mm in size usually must be clamped and tied, or controlled with a radio-frequency electrosurgical unit in the coagulation mode[2,3]. Suggested temperatures for various tissues and regions are listed in Table 1. Some experience is necessary before the system can be used to full advantage. The temptation to cut very quickly as with a cold surgical scalpel must be overcome, since inadequate hemostasis will result.

The degree of hemostasis depends on the amount of heat delivered to the tissues (the total caloric input). The caloric input is a function of the temperature of the blade edge, the time of contact, the area of contact, and the vascularity of the area[2]. To improve hemostasis, the surgeon can increase the temperature or slow down his rate of cutting in order to prolong contact of the heated surface with the tissues. As with any instrument, if used improperly, harm can result. If one delivers excess heat to the tissues, ther tissue damage can result, the degree of damag being proportional to the amount of excess heat The art of using the heated scalpel system is easil mastered.

As cutting proceeds, the blade will accumulat some coagulant. Since the blade is teflon coated this is easily removed by wiping with a dry towel Removal of debris may be facilitated if the black bar is pressed to raise the temperature instantaneously to 270°C. Several precautions are necessary with the heated blade. The entire brown teflon coated surface is heated; therefore, care must be taken not to allow that surface to touch tissues which are not part of the surgical incision and, therefore, should not be subjected to thermal injury (such as lip, mucosa, or skin). When not using the instrument, it should not be placed on any rubber or plastic surfaces, since the heat will cause surfaces to melt or char. The blade and handle should be stored in a pocket made from a surgical towel drape.

Fig. 5. Initial Risdon skin incision at 110°C.

Table 1

Tissue	Suggested temperature	Time
epidermis dermis	110°C	make a shallow dermal incision; use the same cutting pressure and speed as with a regular scalpel
oral mucosa	180–200°C	make a shallow incision; use the same cutting pressure and speed as with a regular scalpel
submucosa subcutaneous tissue, fat, muscle, fascia, small blood vessels	220–260°C	use the same cutting pressure as with a regular scalpel use a longer, more deliberate cutting stroke
large blood vessels, bleeders	270°C	the entire blade provides hemostasis; seal blood vessels with lateral pressure, maintaining contact until hemostasis is achieved

Subcutaneous incision at 240°C coagulation of vessel accomplis (arrow).

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Fig. 6. Subcutaneous incision at 240°C. Note thermocoagulation of vessel accomplished at 270°C. (arrow).

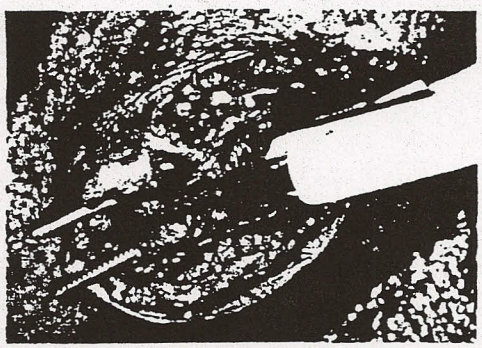

Fig. 7. Separation of platysma fibers at 240°C.

Once the time and temperature characteristics of the unit have been mastered, several other features of the system will be noticed. With intraoral incisions, although hemostasis has been obtained in the incision, once periosteum and tissue flaps are elevated, normal bleeding will occur from these areas. Other than protecting adjacent tissue from contact with the hot blade, there is no contraindication in cutting down on metallic objects, such as hemostats, during dissection procedures (Figs. 5-7). Wound closure proceeds in the normal fashion. Healing rates are similar to cold steel and significantly better than with electrosurgical techniques[2].

Conclusion

The Shaw Scalpel represents a significant advance in soft tissue surgery. It offers immediate hemostasis, improved visibility and reduced blood loss along soft tissue incisions and in regions of sharp dissection of soft tissues. Surgery can be performed using a single instrument for simultaneous cutting and sealing of vessels without causing any nerve or muscle stimulation and without passing a current through the patient's body. Additionally, the instrument will not cause electrical interference with patient monitoring displays as does electrosurgical equipment.

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