Resin sealant: a new method of methyl methacrylate cranioplasty

Technical note

AKIRA YANAI, M.D.

Department of Plastic and Reconstructive Surgery. Faculty of Medicine. Juntendo University.
Tokyo, Japan

✔ A new method of cranioplasty is described. The skull defect is exposed and multiple angled holes are drilled in the outer cortical bone around the defect. A resin plate is conventionally molded to fit the defect. After the resin plate is positioned in the skull defect, newly prepared viscous resin putty is injected into the holes around the defect. The viscous resin comes into contact with the margin of resin plate and, when it hardens, a monoblock casting of resin is formed. The resin plate is sealed to the bone. This technique has the main advantage of strength and good cosmetic appearance.

KEY WORDS • cranioplasty • methyl methacrylate • operative technique

CRANIAL bone defects require reconstruction for purposes of both brain protection and esthetics. There have been many articles on the techniques and materials utilized in cranioplasty.2-7,11,14 Methyl methacrylate has proved to be a satisfactory material for the repair of cranial defects, but the conventional method of methyl methacrylate cranioplasty has demonstrated several disadvantages. One of these is irregularity, especially at those locations along the border of the resin plate and the outer circumference of the defect where wire fixation is performed. Another disadvantage is imperfect fixation when the resin plate is a little smaller than desired.

A new method of cranioplasty has been devised to overcome these disadvantages. Furthermore, the cosmetic results obtained also are an improvement.

Operative Technique

Following exposure of the cranial defect, all tissue is removed from the edges of bone in order to achieve good coaptation with the implant. Numerous small holes 1 to 3 mm in diameter are drilled through the skull around the defect, and angled downward toward the defect (Fig. 1a). Shallow grooves are drilled from some of the holes to the rim of the bone. The dura mater is then anchored to the calvaria with nylon suture which is passed through these holes and laid in the grooves (Fig. 1b). The knots involved in this will be buried in a later procedure. A resin plate is molded to the defect in the usual manner. Numerous holes also are made in the plate on the principle that this promotes the ingrowth of connective tissue and ensures better drainage of fluid collecting between the plate and the dura mater.

After the resin plate has been set in the cranial defect, it must be affixed to the bone face. This is accomplished with the use of methyl methacrylate resin. A new resin sealant is prepared by mixing a liquid monomer and a polymeric powder. The consistency of the mixture changes with time: liquid, viscous, paste, solid. The resin sealant is placed in a syringe while it is still in a viscous state, and is injected into the angled holes prepared in the skull around the defect in which the resin plate is now positioned (Fig. 1c). A slender syringe with a Teflon needle is available for this procedure. The injection into the holes of the resin sealant is continued until the resin emerges from the lower ends of the holes and fills the gap between the resin plate and the bone face. The grooves created in the holes and the nylon suture knots mentioned above are also buried by the resin sealant. During the short time it takes for the sealant to harden, the resin plate is firmly held in place with the fingers while the sealant is irrigated with a coolant. Firm fixation is achieved when the resin seal-
Methyl methacrylate cranioplasty

Fig. 1. Steps in resin-sealant cranioplasty. a: Holes are drilled at an angle and shallow grooves are formed: coronal view (upper) and superior oblique view (lower). b: The plate is placed in position after anchoring of dura mater. c: Resin sealant is injected into each angled hole. d: The plate is perfectly sealed into place: coronal view (upper) and superior oblique view (lower).

Discussion

Methyl methacrylate has received wide acceptance as a material for use in cranioplasties.\cite{1,2,9,10,13} Its advantages are multiple; however, it also has some drawbacks.\cite{3,4,14} One is its exothermic nature. In our method, the methyl methacrylate plate is formed by the conventional method in which the dura mater is covered with cotton strips moistened in saline, and the area is irrigated with a coolant to protect the dura mater and adjacent tissue from heat produced in the polymerization process.\cite{4,12,13} When the resin sealant is applied, the area is again irrigated with a coolant to protect the dura mater from heat. There have been some reports stating that it is safe to allow methyl methacrylate to harden in situ against the dura mater provided that there is irrigation.\cite{1,4,8,12,13} In our method, only the resin sealant is allowed to harden in place against the dura mater, but only a small quantity is involved and irrigation is continued until the resin hardens. In our method of methyl methacrylate cranioplasty, therefore, there is no danger of thermal injury.

The characteristics of this technique are: 1) it is a simple procedure, involving little modification of conventional methods; and 2) the implant is form-fitting and sealed into place; there is no movement regardless of the formation of the bone face. This resin-sealant method of cranioplasty utilizes the phenomenon that the resin seal will adhere to the already solidified resin plate if it is applied before polymerization has commenced.

Acknowledgment

I wish to thank Dr. Yasuichi Ueda for introducing me to the phenomenon of resin adherence 18 years ago when I was a practicing neurosurgeon.
A. Yania

References

*Manuscript received October 4, 1990.*

*Address reprint requests to: Akira Yania, M.D., Department of Plastic and Reconstructive Surgery, Faculty of Medicine, Juntendo University, 2-1-1, Hongo, Bunkyo-ku, Tokyo, 113, Japan.*