Empirical Impressions Technique for Artificial Eye Fitting

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ABSTRACT

Using an impression of the anophthalmic socket to facilitate the design of an artificial eye is common practice today. The Modified Impression technique was described in the American Journal of Ophthalmology, February 1969, by Lee Allen and Howard E. Webster [1]. It is a highly successful method that involves taking an impression of the socket using an impressing tray, then making a wax casting of the impression, and final modifications to the anterior aspect of the wax model (Fig.1).

A different technique has been in use in our office and elsewhere for more than 15 years, also with a high degree of success. We've dubbed if the "Empire/Impression" method. It involves similar steps to the Modified Impression system, but in different order: first a wax model of the anterior aspect of the eye is designed and modified; second, an impression is made of the socket, using this wax model as an impression tray.

The primary advantage of this method is efficiency. It involves one less laboratory procedure, hence making a "one-day custom eye" a reality. Although this process can be used in almost any case, the Modified Impression technique may work better for certain

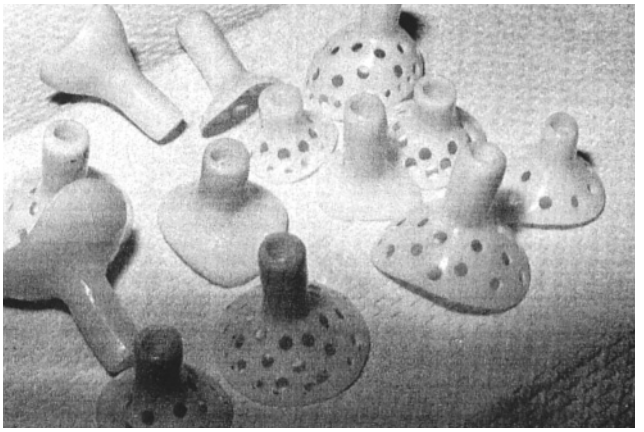

Figure 1. A selection of ipression trays used in the Modified Impression technique.

highly irregular sockets where "reading" the fornices by empirical means may be difficult. Either method requires a highly skilled and experienced fitter to make appropriate modifications to the anterior aspect of the prosthesis.

INTRODUCTION

As for back as World War II, the U.S. Army dental techniques, who invented the plastic artificial eye, did some experimenting with impression fitting using collagen as their impression material. At the earliest stage of experimentation it was realized that, by itself, the impression could not design the front of an artificial eye. That is to say, the impression does not give the form required to manipulate the eyelids to their proper opening and shape. The impression does, however, provide several other important benefits.

One benefit of the impression is to fill in and design the posterior surface of the artificial eye. This eliminates open space and voids where stale tears can pool leading to copious discharge. In many cases the impression can enhance the motility of the artificial eye, as well as indicated the type, size, and position of the implant. As a diagnostic tool, the impression can also determine the depth and shape of the fornices as well as socket irregularities, such as adhensions. In some eye sockets the impression may even provide some support for the prosthesis.

THE WAX FITTING SHELL

We begin our fitting procedure with a basic wax fitting shell. The shell has an average curve and is sized fairly large (Fig.2). Embedded on the apex of the wax shell is an aluminum iris button. This basic wax shell is merely the starting point for designing the anterior of the eye. Because it is wax, it can be easily modified to be larger, smaller, flatter, or steeper. The only tools needed to shape the wax carving knife, a wax spatula, and Buffalo alcohol

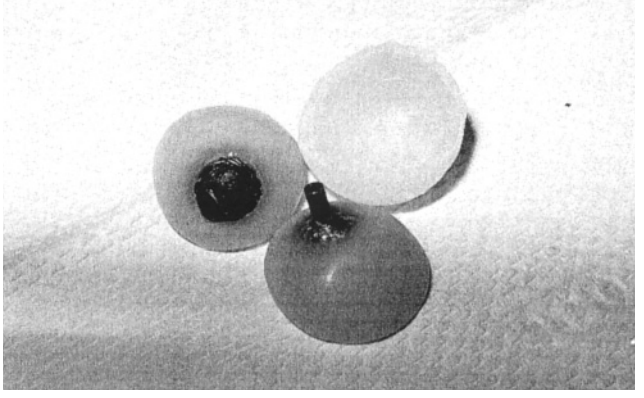

Figure 2. Basic was fiting shells, having an "average" size and curvature.

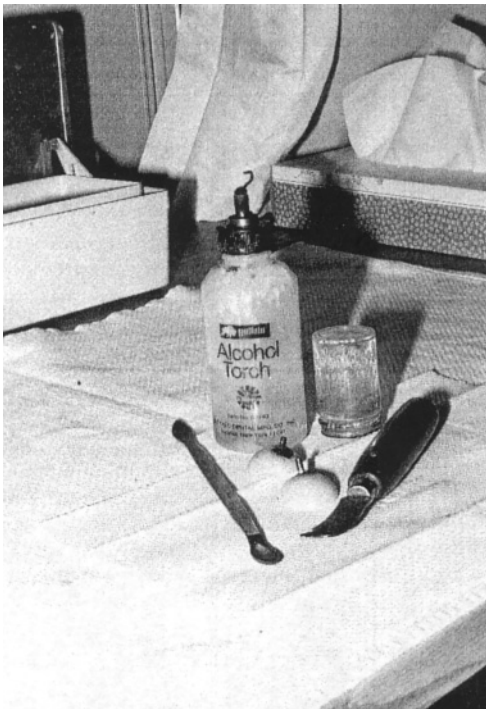

Figure 2. Tools required for designing a wax fitting shell include a wax carving knive, alcohol torch, and wax spatula.

torch (Fig. 3). This type of torch is particularly handy. By squeezing the plastic body of the torch, a needlepoint flame is produced that can be easily aimed for heating and flame polishing the wax.

To make the wax fitting shells, a two piece silicone mold was devised (Fig.4). Four "ideal" eye shapes with attached iris bottoms and stems were fabricated in methyl-methacrylate plastic and cast in Dow Corning 3310 RTV Silicone Rubber (Midland, Michigan). A large upper denture flask was used to make this silicone mold because it could accommodate four eye shapes. The silicone is slow setting and it takes several hours for each half of the mold to set. However, once a silicone mold is completed, it should give many years of service as it can be reused many times.

Wax fitting shells are made by placing aluminum iris buttons, stem down, in the stem hole of each cavity, and pouring molten wax into the silicone mold, then closing the top half (Fig.5). Within minutes the wax is cooled and the four shells can easily be popped out of the mold. The wax pre-fab shells do not make the product any less custom, because they are only the starting point of the prosthesis design. Before coming up with this idea, our techniques originally started with a plain sheet of wax. A great deal of tedious work was required just to produce something resembling an eye shape.

The wax we use is dental inlay with "toothtint" coloring. The aluminum iris button is anodized to be back. The resulting fitting shell is aesthetically pleasing and easy to evaluate while being worn by the patient.

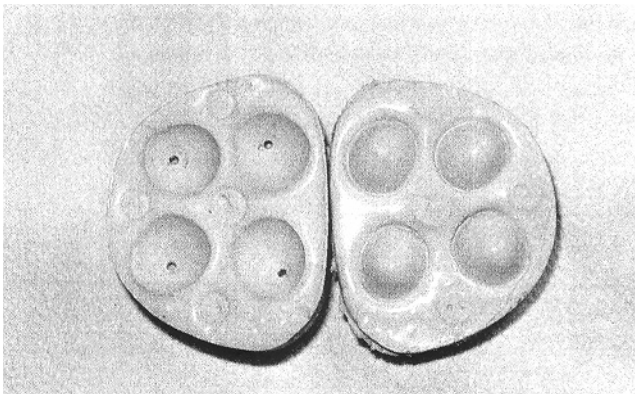

Figure 4. Silicone mold used toake basic was shapes.

THE ALUMINUM BUTTON

As mentioned, each wax shape has a "dummy" aluminum iris (Fig.6). It serves to locate the pupil and iris position, as well as providing a handle for insertion and removal. The advantage of the aluminum button is that it heats up quickly and evenly in a flame; therefore as the surrounding wax softens from the heat of the button, it can be easily shifted to a different position. This also replaced a much more tedious process of using plastic iris buttons which are difficult to reposition. The aluminum button can be adapted to almost any fitting technique. One ocularist who uses the Modified impression technique reports that the aluminum button cuts one-half hour off of his fitting time.

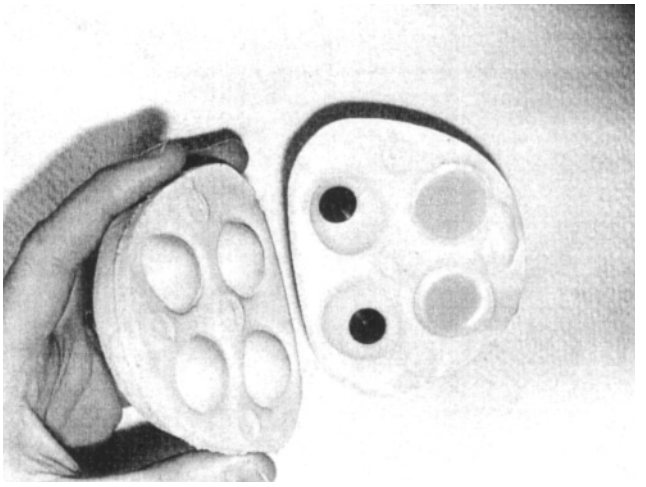

Figure 5. Making basic wax shapes. Aluminum buttons have been placed in each cavity. Molten was is poured into each cavity and the mold is closed.

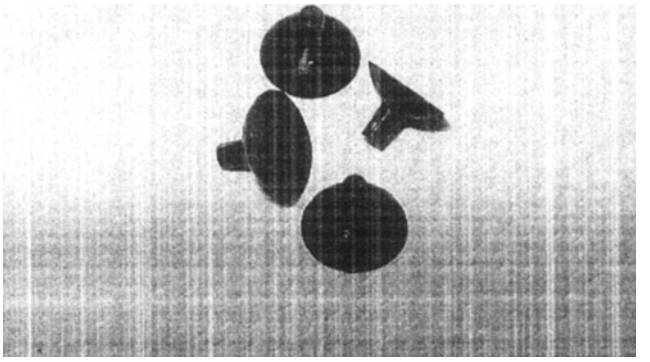

Figure 6. Aluminumiris buttons.

THE FITTING

As previously stated, we begin by designing the anterior surface of our artificial eye. The patient's socket is "read", which means making a close visual examination. The ocularist then takes a wax fitting shell and begins designing a shape to fit that eye socket. The process becomes a matter of trial and error: (which any type of fitting involves) trying the shape in, making modifications, trying it again (Fig.7). This is the "empirical" part of the fitting. Obviously, the more experience the ocularist had in reading sockets and working the wax, the more proficient he or she will be. The ocularist should have a through knowledge of fitting principles, particularly the modifications detailed by Mr. Allen for such problems as superior sulcus, ptosis, and warped tarsus [1]. Walter Tillman summarizes the fitting this way:

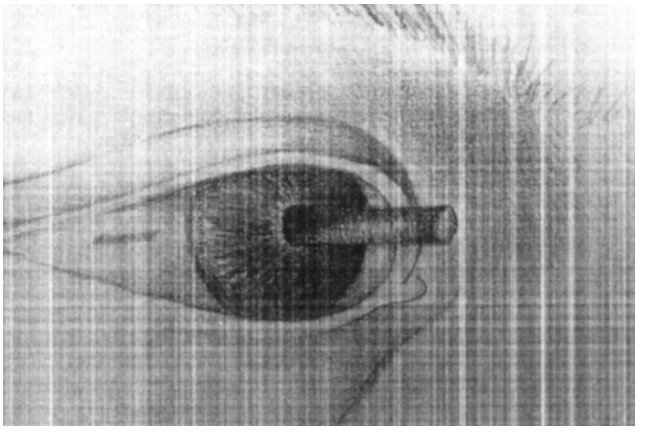

Figure 7. The was shape istried and evaluated.

> We often must reinsert the wax shell several times as the aluminum iris button (imbedded in the wax shell and simulating the iris) must be aligned with the patient's remaining eye. When I am satisfied with the position of the iris, the width and the height of the eye opening, the periphery of the shell and the contour of the eyelids, I make two relief holes in the wax shell. I am now ready to take the impression of the socket. [2]

In other words, the wax shell can now be used as an impression tray.

One other tip: during the fitting process be sure to draw a horizontal axis across the front of the wax shape with a marking pen. This will help you to evaluate the way your shape is sitting in the socket and will alert you to any rotation problem.

THE IMPRESSION

At least two release holes are made along the horizontal axis to permit excess impression material to escape.

A high quality ophthalmic impression material should be used; several brands are available. Presently we are using an alginate sold by the Ocular Prosthetic Center of Rochester, N.Y. An adequate amount of alginate powder is scooped into a rubber mixing bowl, then cold water is added form a fine stream from the faucet, and the mixture is well spatulated. The alginate should be mixed to a creamy consistency; if is either too runny or too thick the resulting impression will not be accurate. The back of the wax shell is filled with alginate, the patient is asked to tilt his head back and look down. (This makes insertion easier.) Once the shell is in place, the patient is asked to return his head slowly back to a normal position. While the ocularist is still holding the shell by the stem, the patient is asked to look up and down, then back and forth. This often helps to distribute the alginate evenly around the eye socket. Next, the patient just looks straight ahead for about two minutes until the alginate has set. The completed shape is then removed and checked (Fig.8). If there are any large cavities caused by using an insufficient amount of alginate , a new impression should be taken. Occasionally, the impression will indicate more extensive fornices than the ocularist had designed in the wax shape. These extensions can be incorporated into the design by simply reinforcing them from with wax.

INJECTING THE ALGINATE AS AN ALTERNATIVE METHOD

Rather than applying the alginate on the back of the wax shell, provision can be made for using a syringe to inject the alginate while the wax tray is in the socket. There are two ways to do this. One is to enlarge one of the release holes (using in the lateral canthal area) enough to accommodate the tip of a syringe. The second way involves a recent innovation to the aluminum iris button. A special aluminum button was made that has a threaded removable stem (Fig.9). When the stem is removed, this leaves a hole all the way to the back of the wax shell, through which alginate can be injected. This is particularly helpful for taking impressions of young children, some of whom are quite uncooperative.

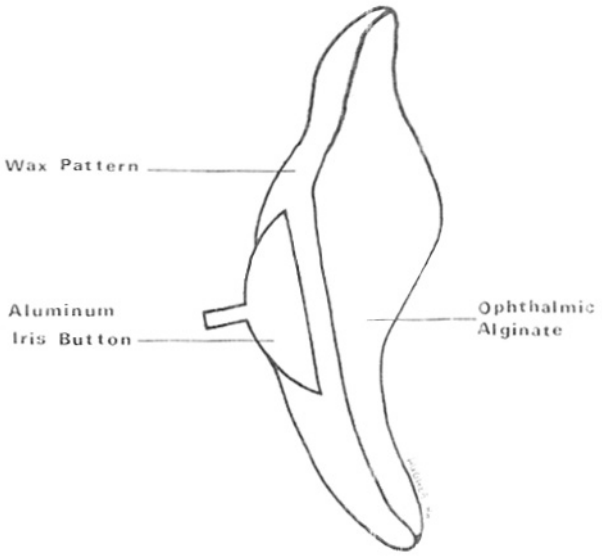

Figure 8A. A graphic depicting completed fitting with modified wax shape and impression.

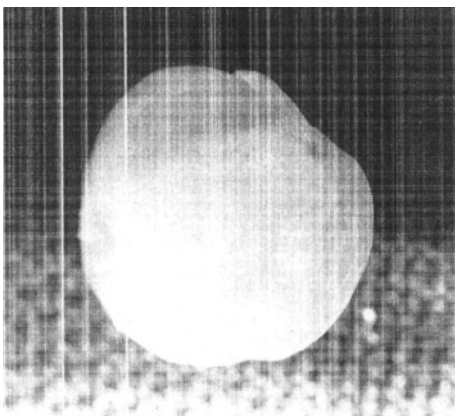

Figure 8B. Completed fitting: posterior view shows impression.

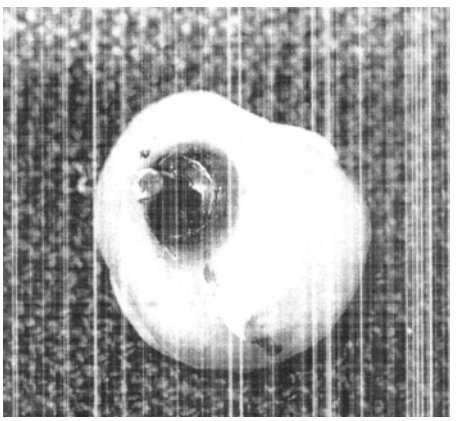

Figure 8C. Completed fittings: front view of wax shape.

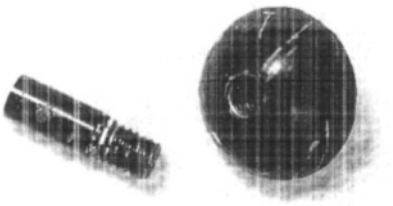

Figure 9. Aluminum button with threaded removable stem.

CONCLUSION

Artificial eye making requires a system of fitting and manufacture. A system has been presented that has proven to be efficient while providing excellent results. Although some ocularists will prefer one technique over another, being well versed in all techniques will better equip them for the variety of cases we see.

Acknowledgment — The technique described in this article was essentially the invention of Joseph LeGrand Sr., with assistance from his associates of that time: Tom Dean, Joseph Michael, and Walter Tillman.

REFERENCES

1. Allen L, Webster HE: Modified impression method of artificial eye fitting. *Am J Ophthalmol* 1969; 67: 189
2. Tillman WT: *An Eye for An Eye*. Pittsburgh, Walter T. Tillman, 1987: 104.