

THE ADVANTAGES AND DISADVANTAGES IN CASTING GOLD INLAYS UNDER HIGH PRESSURE WITH THE PRESENTATION OF A SIMPLE ELECTRICAL HIGH-PRESSURE CASTING DEVICE.*

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I wish to preface this paper by giving to Dr. Taggart, of Chicago, full credit, so far as I am concerned, for the suggestion of the use of a gas pressure in connection with the casting of dental restorations. I will, however, show an electric arc furnace with which I made cast restorations about four years ago, not, however, with sufficient success to continue its use, though some of the solid gold crowns made with it are being worn and giving good service.

The advantages in casting gold inlays or any dental restorations or fixtures are, that you can in one simple operation reproduce, in the minutest detail, all of the exactness in shape, contour, occlusion, adaptation and finish that you can relatively easily prepare in wax; I say relatively easily, for the wax is not only very easily moulded and carved, but lends itself so easily to the securing of contact surfaces, both with the adjoining teeth of the same jaw and the occluding surface of the teeth of the other jaw. The desirability and advantage of the casting method over building up under the blowpipe will be in proportion to the much or little exact difficult detail to be secured.

For example, an inlay having no occluding surface or a very simple contour will be very easily produced under the blowpipe without investing and with less trouble than to invest for casting. On the other hand, a large restoration involving, besides an accurate adaptation to the surface to which it is to be attached, an adjustment to the contact surface of one or both of the adjoining teeth and an exact and difficult occlusion with the opposing teeth, will be produced by the casting method in a fraction of the time required to build it too large in every direction and grinding or filing to the exact

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size. In general, the advantages of a casting method are in proportion to the amount of difficult detail required.

In restoring, for example, the mesial, distal and occlusal surfaces of a molar, the impression will not only give in accurate detail all the surfaces and margins of the cavities, but also the mesial and distal contacts with the adjoining teeth, which of course will not draw until these surfaces are properly formed. The occluding surface is secured by the patient biting into the wax while in place. Just here is one of the greatest disadvantages of the casting method, viz., the difficulty of removing any mouldable substance without distortion. Of course very much depends on the shape of the walls and margins of the cavities and the position of the adjoining teeth, but the writer finds that in the majority of such cases, if not in all such, a better restoration can be secured by the use of a very thin platinum matrix under the wax. In fact, I use a platinum foil-lined wax impression for nearly all inlays, whether made directly with the blowpipe or cast. The detail of producing is very simple, the cavity being prepared so that an impression can draw a piece of pure platinum about one-three-thousandth to one-six-thousandth of an inch in thickness, according to the case, is carried into the cavity with cotton and pliers, and being so thin and soft adapts with very great facility and ease without so much tendency to puncture or tear as the thicker. No attention is paid to prevent folds or laps, it being so thin. It is removed and orange sticky wax (not yellow) is warmed and dropped into it and partially chilled and replaced into the cavity and packed to place with ball and and ball-headed burnishers and also by the patient biting on tough, soft rubber. The wax carries the thin platinum very accurately to every margin and surface and is carved and moulded to produce the contour and contact point or points, also occlusion. Unless for casting, the contour and contact points and occlusion are not necessary. Before removing it is chilled with a stream of cold water, which hardens it so dense that it will retain its shape very perfectly unless the cavity has undercuts. This wax answers very well for casting from, though does not leave as clean a cast as a colorless was if burnt instead of being melted out by absorbing while heating the still wet instrument, in which case the steam forces it all out.

The wax alone, as an impression medium, as suggested by Dr. Taggart, will not, in the writer's hands, produce so perfect margins from the casting method, as when the very thin platinum is used with it because the thin wax forming the angles has not the strength to retain the exact detail. It should be said that it is usually more difficult to draw impressions of approximal cavities if the contour and contact point are accurately made than where they are removed from the impression before drawing. It is relatively easy to make a very accurate artistic occluding surface, including a proper masticating surface, while the impression is still in the cavity. By having the patient not only bite into the wax, but make the movements of mastication, the general surface is secured which can, while in place, be modified into a normal crown form with specially formed instruments to produce the sulci. Some of the final finishing and forming can be done best after removing from the mouth.

In the casting furnace presented here I occasionally cast two or three such pieces at one cast, connecting them together to one common gate like a bunch of cherries with short stems and with no extra trouble.

Another disadvantage in casting over the blowpipe is the slight additional trouble of specially investing. This is not a serious item since with this apparatus any average office girl can do it and make the cast as good as the operator himself, and thus saving his time and turning her service into profit at a much higher rate than her ordinary duties can do.

Another advantage of this method of casting is that, since the labor of finishing is reduced to a minimum, there is consequently a very great saving of time, gold and finishing materials. In other words, the operator can produce a restoration with a value which, in proportion to his time and energy expended, will return him a hundred per cent. larger profit. This will be more particularly true in the construction of bridges than inlays, but just here comes in a new and very important difficulty.

With the method as suggested by Dr. Taggart, the casting temperature of the boiling point of the metal is so high of necessity that only pure gold can be used without change, and alloyed gold is rapidly changed by the oxidation and evaporation of the alloys. For example, if we heat 18k. gold to its

so-called boiling point it is not 18k., but very much more, the alloy rapidly burning out, a matter so serious that it becomes at once a serious objection to the making of bridges by the casting method, as he uses it. I have found that the temperature at which good casting can be done is very closely in inverse proportion to the pressure at which it is done, so that if it takes a temperature of 2800° F. to get a good cast with pure gold at 25 lbs. pressure, an equally good cast will be obtained at 2300° from 80 lbs. pressure or at 2100° from 150 lbs. pressure per square inch. This is one of the important features of the device here presented. There are several disadvantages in the use of the oxyhydrogen flame as compared with the electric current such as, much greater difficulty in using, expense and giving out of the supply of oxygen and the injury to the eyes of looking on the incandescent gold and surrounding investment and the application of pressure from a large supply source. In the device here presented all these are reduced to a minimum or eliminated. The only effort required is the turning of the switch, and the gold need only be melted to just a little beyond its melting point. The pressure is obtained from chemicals, and the temperature is indicated by a pyrometer.

The following is a detail description: The investment and crucible are contained in a rotating air-tight head. The gold is melted with the crucible in a vertical position, and when ready to cast (as indicated by either the pyrometer or by removing the safety valve and looking directly at the melting gold, with or without colored glasses), a capsule of a few grains of a suitable chemical, I will use here four grains of smokeless gunpowder, placed in the inverted tube; and it cannot fire until the head is turned over, which when done allows the gold to turn into the gateway of the mould, and at the time it is there the powder falls into it or on a firing pan, and the pressure rushes up to anything desired, thus forcing the gold into every detail. At 500 lbs. the gold will be forced all through the investment in the form of minute hairs and almost microscopic beads and globules; at 150 lbs. it will strain the mould, and at 80 to 125 lbs. will produce most beautiful results at but little above the melting point of the gold used. The needle of the pressure gauge indicates accurately the pressure attained and how rapidly it decreases. The safety valve ab-

solutely prevents all possibility of accident from explosion, for the device is constructed to withstand 2,000 lbs. per square inch and the safety valve blows off at 300 lbs. If the charge is not sufficient to raise the safety valve there is no noise, the needle of the pressure gauge showing the explosion. If the charge raises the valve it blows just like a little steam boiler blowing off.

I have made several different designs, using different principles. One automatically injects a jet of water into the hot muffle at the moment the ingot is poured, and it produces excellent results. Its disadvantages are that the water is mussy.

DISCUSSION.

Dr. E. Ballard Lodge: Until recently the dentist employed the founder's art chiefly in such operations as the making of his plaster of paris casts, pouring the limpid material into his impression; or, in the making of the die from fusible metal, zinc, or babbitt, and pouring the moulten metal into the prepared mould; or, the production of rubber or celluloid plates, which is essentially a casting operation; or, in the making of Watt's metal and aluminum plates or dentures. The last-named, viz., the casting of aluminum dentures, more nearly simulates the procedure under consideration than any of the other casting operations in dentistry, inasmuch as it makes use of pneumatic pressure to force the metal to the uttermost parts of the mould.

We are living in a marvelous age. Dentistry, since its birth, always in the forefront of progress, continues to advance with triumphant strides, and there seems to be no halting place. Not a decade ago the gold shell-crown was supposed to be the climax of perfection for the restoration of badly broken-down molars, but now such practice, while valuable in extreme cases, is only indicated when a gold inlay is not feasible and the places in our practice where the gold inlay is the thing par excellence are very frequently met with.

I would not, by this seeming fondness for gold inlays, have it appear that there is not still a large field, even in quite extensive cavities in the molar teeth for the use of that restoration method which has stood the test of time, viz., the gold-filling; but in cases of teeth in that condition, where formerly the thing indicated was either a plastic filling or a gold shell-crown we now have a valuable recourse in the gold inlay.

Until recently gold inlays have been made either with or without investment, by the blowpipe method. The advantages of the cast-gold inlay are admirably set forth in our essayist's paper, and