

Thirtieth Anniversary of the Triple Tray!

Thirty years ago, July 9, 1980, US Patent No. 266,269 was issued to S. Rand Werrin, DDS, for the Dental Bite Tray. Since that time, more patents were issued and *more than 100 million Triple Trays* in various shapes and sizes have been sold worldwide, making them one of the most popular impression trays utilized in the world. Dr. Werrin, in an interview with our editor-in-chief, Dr. Damon Adams, describes how he created and developed the concept, sharing some of his thoughts about taking impressions using this technique.

Dr. Adams: *How did you get the idea for triple trays, Rand?*

Dr. Werrin: In 1979, when I first conceived of the idea for the posterior Triple Tray, my goal was to invent something really useful. At

patients' mucosa, and the inserts were too thick and stiff, creating interdigitation problems with the opposing occlusion. The metal that was being used at that time would become corroded after just a few autoclaving cycles. At this time a plastic impression tray was introduced that was almost identical to the metal tray, but unfortunately it also had sharp edges and a taut fabric mesh. The tray was later discontinued. Since necessity is the mother of invention, I created a tray that curved ergonomically around the teeth and had a thin and pliable mesh that was included in all future Triple Tray designs (Figure 1). The very thin and pliable mesh is one of the main characteristics that would end up making the Triple Tray so effective. I have encountered many instances where a patient has a deep overjet, an overbite, or a steep cusp-to-fossa relationship: the mesh's forgiving ability to adapt to various tooth relationships keeps the plastic sidewall from springing or deforming after the impression is removed from the patient's mouth. In comparison, other trays that have a rigid plastic or nylon mesh can create a spring back of the sidewalls since they are not malleable.

On June 26, 1980, I received the United States Patent for a dental impression tray. I could not have imagined, nor could I have predicted, the impact that this would have on modern day restorative dentistry with approximately 100 million Triple Trays sold worldwide today.

Dr. Adams: *Who were the people who originally encouraged you to develop this product?*

Dr. Werrin: In the 1970s, Dr. Gordon Christensen, founder and co-director of Clinical Research Associates (now the CR Foundation), used the expression "do it better, easier, and faster," or another way of putting it, "Don't work harder, work smarter." Later in 1992, in his newsletter, he stated, "...the double-arch impression procedure has proven to be the fastest, easiest, and best procedure for one or 2 restorations." This technique reduces appointment time, minimizes errors of occlusal relationships, and permits the taking of impression with the patient's mouth closed. Patients are comfortable and at ease, with most gagging problems eliminated. And since less impression material is needed, impression material costs are reduced. Many of the stiffer/rigid addition-reaction silicone and polyether impression materials work well with this technique to produce accurate and consistent results.

My longtime partner, Dr. Charles J. Miller, was prophetic when he said, "The better the operator, the less complex the approach." By eliminating the necessity of a custom or stock tray, the dental



Figure 1. Evolution from the metal sidewall tray, to the plastic sidewall tray, to the posterior ergonomically designed Triple Tray.



S. Rand Werrin, DDS

that time, there were no fax machines and no e-mails; lots of ungloved, wet-fingered dentists. There was also a sense of prevailing hostility towards the idea of taking an impression of a prepared tooth, the opposing teeth, and the habitual centric occlusion...*all in one neat little package!* When you are ahead of the consensus, you tend get a lot of ridicule and criticism. In the 1970s, many dentists had problems taking a comfortable, easy impression for single restoration such as inlays, onlays, three-quarters, and full crowns. It seemed to me that they were killing a flea with a sledgehammer. Too much time was spent, patients were choking, and, in my opinion the alternative of fabricating custom trays in a busy practice was a problem for many dentists.

The metal bite relator impression tray available at the time was intriguing to me but, in my opinion, it had some flaws. I had noticed that the sharp edges of these trays were cutting into my

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operator saves much time and many materials, making the impression experience much more pleasant for both the patient and the doctor.

Jerry Frezel, vice president of Premier Dental, at the Greater New York Dental Meeting, initially supported my idea even though some other large dental corporations had rejected the concept as being too radical. His brother, Bill Frezel, Premier's research and development engineer, was able to develop the prototypes and equipment to manufacture this innovative, new product. Gary Charlestein, president of Premier, and his father, Morton Charlestein, chairman of Premier Dental, were most supportive but more surprised than anyone when each year these new dental trays continued to grow in acceptance and popularity around the world.

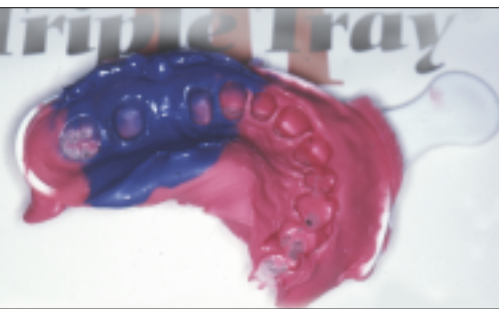


Figure 2 Extended quadrant triple tray includes more teeth for fabricating 2 crowns.

Dr. Adams: How did the different designs evolve?

Dr. Werrin: Gary Dunn, a 290-pound, 6-foot 6-inch Pittsburgh Steelers football player with very large teeth, needed a new crown. When I tried to use a normal posterior Triple Tray, it was way too small. So it was a logical progression for me to create a wider, longer Triple Tray.

The anterior Triple Tray was an example of "necessity is the mother of invention," since many dentists enjoyed using the posterior tray and asked me, "Couldn't you invent something for use in the anterior segment?" Eventually we came up with the present-day design with a foam posterior stop. After a few years, this stop was replaced with a more comfortable and more easily manufactured plastic segment.

The Extended Quadrant Triple Tray (Figure 2) evolved when many dentists and lab technicians asked for more teeth to be included in the final impression so that both canine teeth would be replicated. This type of tray is especially valuable when taking an impression of more than one tooth.

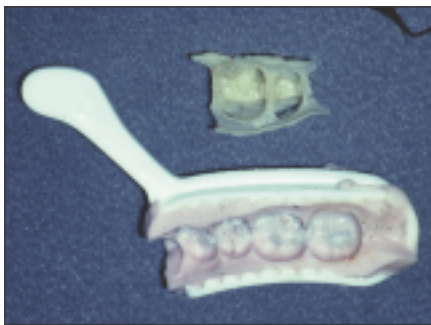


Figure 3. Alginate preliminary impression used as matrix for resin temporary.

Dr. Adams: For which procedures are Triple Trays best suited?

Dr. Werrin: Today's dentists are fabricating more and more restorations, and they are taking more impressions; most of which are one or 2 units.

Approximately 80% of all crown and bridge restorations are single crowns. Newer materials and techniques allow the modern practitioner to be more conservative and less invasive. The full-mouth reconstruction treatment option is seen less often these days because the thinking of modern dental practitioners is geared towards more conservation of tooth structure. Therefore, the quadrant closed-mouth impression technique is ideally suited for one or 2 units, preferably with natural teeth as stops on either side of the prepared teeth.

Dr. Adams: With the increasing introduction and use of digital technology to capture digital impressions, will this technique employing physical impression materials survive very much longer as we move into the future?

Dr. Werrin: Interest in the use of digital impressions and the CAD/CAM fabrication of restorations is quite high, and the popularity of these technologies will likely continue to increase in the future. However, the very high cost of ownership of this technology will prohibit the purchase and utilization in most dental practices around the world. In my practice, I have found 4 areas that are problematic using CAD/CAM technology:

First, the pitch and yaw problems created by the axis of the camera can cause distortion.

Secondly, the software art tools that design the restorations can sometimes give you a poor final contour. Calibration needs to be monitored and sometimes can go on the "blink."

Next, we need to remember that the preparation design for CAD/CAM is more diverse and rounded with a one-mm minimum width for proper milling. Contours smaller than one mm cannot be handled by this technology. This is particularly a problem

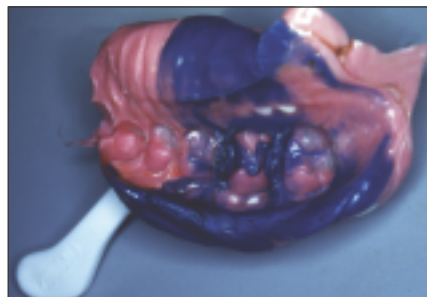


Figure 4. The white plastic sidewall showing in a final impression indicates an area of pressure/flexure causing impression distortion.

make a plastic temporary splint are able to utilize the dual-arch technique, which can be quite a time saver. An impression is taken before the teeth are prepared and set aside for utilization as a matrix for temporary fabrication (Figure 3).

Dr. Adams: What are some of the most common mistakes made by dentists when using Triple Trays?

Dr. Werrin: It is very important to make sure that the sidewalls of the

It is very important to make sure that the sidewalls of the Triple Trays are not impinging; they should fit passively in the patient's mouth. A sideless tray is a possible solution for a difficult anatomical situation

with inlays and onlays, which can be small in size.

Another consideration is that the amount of time and energy necessary to be proficient at handling this very sophisticated high-tech piece of equipment can be daunting for many dentists. Furthermore, I have found that the total amount of chair time that is necessary for the dentist with CAD/CAM technology in one appointment is significantly greater than taking a closed-mouth impression, even though the closed-mouth impression technique involves 2 separate appointments.

The dual-arch impression technique can be used to fabricate restorations utilizing CAD/CAM technology since a model can be constructed from an impression and scanned to create a final restoration.

Dr. Adams: What do dentists feel is the biggest benefit of using the closed-mouth impression technique?

Dr. Werrin: The biggest benefits are the amount of time saved by taking one impression instead of an upper and lower impression, and a bite registration. Additionally, dentists save a significant amount of money on impression material since only about one third of the amount of material is necessary. The patient benefits by being much more comfortable taking an impression with the teeth in a closed position, therefore avoiding material running down the back of the throat, causing gagging.

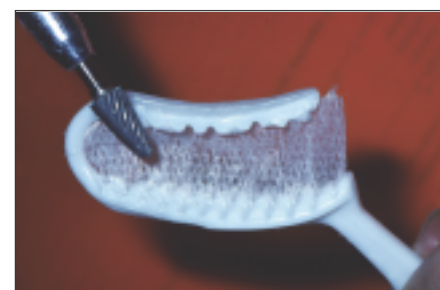
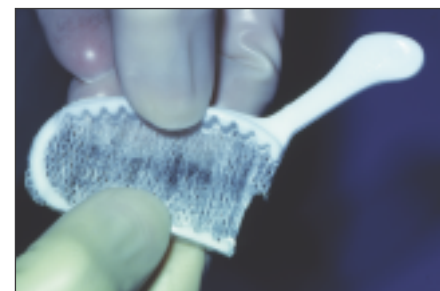
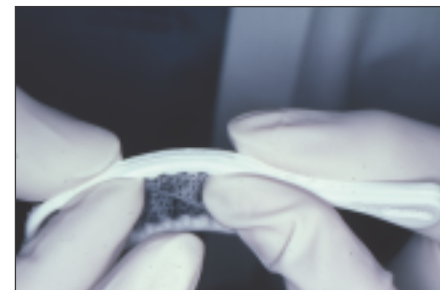
With some of the very rigid, stiff polyvinylsiloxane (PVS) materials, a final impression that is very stable and accurate can be taken in just one minute.

The majority of dentists who do not have an in-house laboratory to

Triple Trays are not impinging; they should fit passively in the patient's mouth. A sideless tray is a possible solution for a difficult anatomical situation. The very thin, pliable mesh and bendable plastic are both advantageous qualities that ensure that the trays are fitting passively in the patient's mouth.

Another key to accuracy and good-fitting restorations is the use of a very rigid, stiff PVS or polyether impression material. The tray must have a passive

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Figures 5 to 7. Bending, stretching, and cutting plastic trays are encouraged to create a totally passive fit.

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fit with no side- or backwall interference. After an impression is taken, the dentist should inspect the final impression unit to ensure that there is no white plastic showing through the impression material, indicating a possibility of spring back and distortion of the impression (Figure 4). The advantage of the sideless tray is that there are no walls that may cause interference. However, the sidewalls do have an important function of compressing the unset impression material around the prepared teeth. Professional judgment comes into play in determining



Figure 8. A poorly oriented (as placed by the operator) dual-arch impression.

which tray is suitable for each unique impression situation.

Ideally, when using the dual-arch impression technique to get the best results, the single abutment should be bound by intact teeth and opposed by intact teeth. In addition, the canine should be registered. Problems can arise when a dual-arch tray does not have enough teeth captured in the impression to allow the dental laboratory technician to articulate a model with confidence. Multiple restorations should be planned with caution, especially if anterior guidance is absent. Long-span restorations are not recommended because of the possible occlusion instability and the potential for incorporation of noncentric contacts.

A Triple Tray that is not filled with enough impression material will result in a model of poor quality that may be unusable to the laboratory technician. When required, proper adjustment of the tray (Figures 5 to 7), and then proper orientation and placement of the tray into the mouth is important (Figure 8). The placement of the tray posterior to the last tooth also allows the patient to properly close into habitual centric relationship. If the patient bites on the posterior crossbar, an uncertain bite relationship will be recorded (Figure 9). I do not feel that the tray adhesives are necessary since the impression materials seem to lock themselves

into the tray. If tray adhesive is preferred by the operator, it should never be painted onto the mesh. This error prevents the dynamic flow of the impression materials through the tray, thereby creating an open bite relationship when the impression is poured in stone and articulated. The very thin mesh was created to allow the closest possible interdigitation of the teeth without quite touching; the thinner the mesh, the better. Plastic or nylon mesh, as found in some trays, is inherently thicker which could prevent an occlusal relationship problem during the model fabrication.

Dr. Adams: *What has the research*



Figure 9. Biting on the posterior cross bar can create an inaccurate bite record.

shown when comparing the dual-arch impression technique to previous methods?

Dr. Werrin: I will read to you the following from the 2009 *Journal of Prosthodontics* (October, Volume 18, pages 582 to 588), the article entitled, "A Preliminary Survey of Impression Trays Used in the Fabrication of Fixed Indirect Restorations" by Sonya T. Mitchell, DMD, MSHA, et al:

"A clinical trial comparing single crowns made using either a metal stock tray or a plastic dual-arch tray found no differences in fit or occlusion of the restorations. They showed that the dual-arch technique was significantly faster and used one-half as much impression material. The dual-arch technique was easier for the operator and more comfortable for 80% of the patients, and they reported making their dual-arch impressions with a material specifically designed for use with the dual-arch tray. ...[Researchers] observed 12 times greater accuracy in the maximal intercuspal position with the dual-arch cast. Full single-arch trays are useful when fabricating multiple restorations when sufficient teeth would not be present in the dual-arch cast to provide guidance, when increasing vertical dimension, and for extensive restorations.

"In 1991, Davis and Schwartz published an in vitro investigation concluding that both metal and plastic dual-arch trays produced dies as accurately as custom trays. They reported using an additional silicone material, and reported

pouring the working side cast first. The die dimensions produced with each tray type were within clinically acceptable limits..."

This article concluded that: *"Within the limitations of the study, the dual-arch trays were the most commonly used tray."*

Dr. Adams: *As you know, the dual-arch impression technique has not been routinely taught in most dental schools. Do*

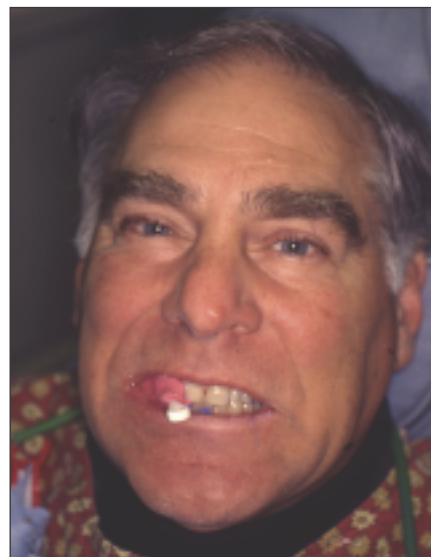


Figure 10. The patient here is Dr. Werrin, practicing what he preaches.

you think this technique should be taught?

Dr. Werrin: When dental students first begin to learn how to take impressions, they should utilize full-mouth impressions for single crowns and simple indirect restorations. However, one of the objectives of dental school is to expose the student to many different methods of accomplishing a goal while being able to be efficient in the real world. Therefore, in my opinion, students should be exposed to the dual-arch impression technique by their senior year. The only way to learn this technique and the various materials associated with it is by doing it. This will demonstrate both the advantages of the technique, along with an understanding of the potential pitfalls that can occur. In this way, young dentists will be prepared and comfortable in utilizing this efficient technique when they graduate and start to practice in the "real world."

Dr. Adams: *I want to thank you for taking the time for this interview. Congratulations on your accomplishments in dentistry, Rand! You are certainly an excellent example of a professional who has made a major impact on the profession. Do you have any closing thoughts to share with our readers?*

Dr. Werrin: Well, Damon, the universe, the dental universe, and our own professional horizons are in constant change. To survive and flourish

in the environment that surrounds us, we must observe, evaluate and evolve to newer, better materials and techniques. I would recall for you what Alexander Pope wrote about 275 years ago: "Be not the first by whom the new is tried, nor yet the last to lay old aside." It has always been my professional quest to find easier, faster, and better techniques. ♦

Dr. Werrin has been in private practice in Oakland, Pa, specializing in restorative and cosmetic dentistry for the last 40 years with Dr. Charles J. Miller and for the last 27 years with Dr. Jack Gruendel. Dr. Werrin has been a faculty member of the University of Pittsburgh School of Dental Medicine and presently lectures on behalf of the Department of Continuing Education. He graduated in 1967 from Temple University School of Dental Medicine and is a Fellow of the American College of Dentists, the International College of Dentists, AGD, and Dentistry International, as well as a lifetime member of the ADA and the Pennsylvania Dental Association. He is active in the Dental Society of Western Pennsylvania and was president of the Pittsburgh Dental Research Club. An international presenter on restorative dentistry, he has also consulted for a number of dental manufacturers and is the inventor of numerous dental products. He can be reached at (412) 621-0200 or werrin@dentalpgh.com.

Disclosure: Dr. Werrin has received royalty income since 1980 from Premier Dental Products for his numerous Triple Tray inventions.

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