The Diode Laser - Tip Selection and Initiation. - *By Dr. Glenn A. van As*

Introduction

In this article I will focus on a simple, but "*for many new users*" a confusing procedure that must be completed prior to starting many diode laser procedures: The process of the **selection** of the ideal disposable tip and when and how to best **initiate** that tip. Picasso laser technology comes standard with a multi-tip handpiece which is a fiber optic bundle that carries the laser energy from the back of the laser to the surgical site. Many diodes have a strippable fiber that each time after you use it, you must remove off the insulation (strip the fiber), as well as cut it clean and sharp (cleave the fiber). This strippable fiber is very economical, and available in 400 micron (surgical diode dentistry) for all Picasso lasers. However, many clinicians prefer the simplicity and ease of single use tips, where the tip is simply removed from the package having already been stripped and cleaved and is ready to go.

Selection of the Disposable Tip.

The Picasso Lite laser has many tips available for it (table 1, Fig. 1) and they all can fit on the multi-tip handpiece. These tips come in boxes of 25 (20 for 200 micron), in either, one shape and length or as an assortment of the shapes and lengths. These tips come in 3 diameters **(200 micron, 300 micron and 400 microns)** and two lengths **(5 and 10 mm)**. The 200 micron tips come in a standard length of 20 mm. These tips are easy to now distinguish by their colors. The green plastic sleeves are 200 micron, the purple sleeves are 300 micron and the orange sleeves are all 400 micron diameters. Choice of which tip to use is somewhat of a personal preference, but I have provided for readers an overall guide to when I use certain tips. Of course, individually the user may find that one tip or another works better in their hands. My primary tip of choice for surgical procedures such as crown troughing, gingivectomies and laser bacterial reduction is a 400 micron orange tip that is 5mm in length. The reason for this is that this tip is sturdy, doesn't break readily, and allows for ease of use in most situations where soft tissue ablation is required. In some situations which require a longer tip (i.e. crown troughing on posterior teeth that have long clinical crowns), I will instead use the longer 10mm orange tip. These tips are more flexible though so care must be taken to not break them. One additional consideration on tip selection is that should the tip become chipped, or fractured during use, and it is 10 mm long, it can often be re-cleaved shorter and reused on the same patient without the clinician having to use a second tip for the same procedure. I am often able to use a single tip for crown troughing on up to 12 teeth in one arch during a rehabilitation case, so with care and a gentle movement, these tips are very durable.

Another benefit of these single use tips is they come pre-bent at an angle of around 60 degrees but because of the metal cannula that extends from the plastic sleeve, one is able to bend the tip over your thumb to an angle of 90 degrees. Often for certain procedures this is of benefit when working in certain areas where access is difficult (posterior teeth where crown troughing is required with limited inter-occlusal opening). If the clinician prefers a straight tip, they can also straighten the metal cannula which is advantageous for working in anterior areas of the mouth.

It is very important to make sure that a gap does not exist in the connection of the disposable tip to the Multi tip handpiece. The connection between the plastic sleeve and the metal portion of the handpiece must be firm (no gap). There is an audible “click” when the tip is inserted on the hand-piece all the way. If this connection is not tight then energy can be lost at this point and then the clinician will require greater energy to complete the given task.

Table 1 and Fig. 1 - Tip Selection for Picasso Lasers

Tip Diameter	Color	Use	Tip Length
200 micron	Green	Procedures requiring more access	20mm
300 micron	Purple	Hygiene	5 and 10 mm
400 micron	Orange	Surgery	5 and 10 mm
Quadra (Bleaching) tip	Blue	Laser Assisted Bleaching	

There is one additional tip that can be connected to the multi-tip handpiece and that is the Bleaching handpiece which is not single use. (Fig. 2) The Bleaching Handpiece should only be used with the 7 watt Picasso when providing laser bleaching to patients. The Picasso Lite (2.5w) laser cannot provide enough energy to the tip to be effective for laser bleaching.

Fig. 2 Laser Bleaching Handpiece.

Initiating the tip

Now after selecting the tip that you wish to use, one must consider whether to **INITIATE** the tip or not. ***The simple rule is that any time that you wish to be in contact with tissue and ablate it, the tip must be initiated.*** The process of initiating the tip will concentrate the laser energy in the tip essentially making it a "hot tip". The monochromatic laser light is turned into heat and hence this process is called a **photo-thermal** reaction. The heat that is generated causes a localized zone of vaporization, surrounded by zones of carbonization (try to keep this char zone as small as possible), coagulation and hyperthermia. (Fig. 4-5) The higher the settings, typically the faster the vaporization, but the greater these other zones of unwanted lateral thermal damage may be. In keeping with the Academy of Laser Dentistry's most current guidelines, which "advise the use of the lowest average fluence to avoid risks of excessive heat complications whenever possible," (1) Of course total treatment time must also be kept in mind in trying to minimize the collateral thermal damage that can be created by prolonged exposure to laser energy through settings that are not above the ablation threshold required for vaporization.

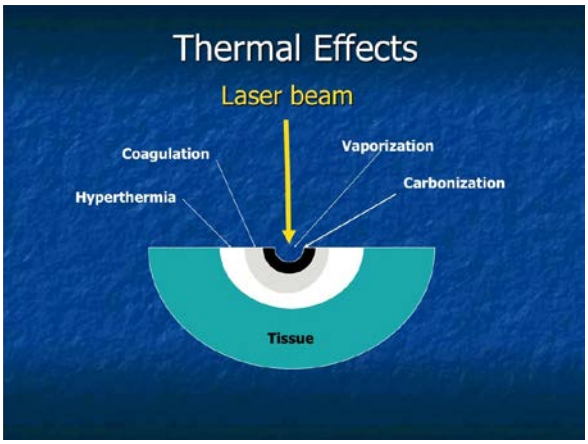

Figure 3 - Thermal Effects of Diode Laser Ablation.

The process of ablation or vaporization requires the tip of the diode laser to be initiated. There have been several methods proposed over time from initiating the tip on the tissue itself, initiating with a sterile black sharpie marker, using a cork to initiate the tip, using black ebony art paint on the tip and finally the most common methodology of using a piece of articulating ribbon to initiate the tip.

In research (2) from Dr. Wayne Selting, who was the ALD 2011 recipient of the TH Maiman Award presented annually for excellence in dental laser research, provided some excellent new information on the process of initiation. Dr. Selting showed that using cork for initiation as i have repeatedly suggested was in fact perhaps not the best idea. The initiation of the tip in cork is not as effective as using blue articulating ribbon. The tip is only partially covered with loose ash and it can wipe off immediately. If you must reinitiate the tip, after ablation attempts are unsuccessful on tissue in the mouth, then the cork is no longer sterile when you reinitiate the tip. Approximately 11% of the tip is initiated using the cork whereas with ideal initiation of the tip with articulating ribbon almost 60-80% of the tip can be initiated. The process of initiation traps almost all of the energy in a very small zone (likely 20-40 micron layer) and the tip can heat up to 1500 Celsius in just a couple of seconds. Care must be taken with these temperatures to not "melt" the tip, so lower energies will yield better ablation of the tissue if proper initiation of tip is accomplished. A key visual clue that the tip is properly initiated is that when you step on the foot pedal, you see that the single use tip "glows" like a candle with an orange incandescent color. Starting with a setting of 0.8-1.0 continuous wave after initiation of the tip is a nice starting point for many procedures to minimize the collateral thermal damage that can occur. (Figure 3). Below in Table 2 is the ideal initiation sequence according to Dr. Selting for the Picasso Lite lasers.

Table 2 - Dr Wayne Selting Initiation Technique.

Step	Procedures
1	Select appropriate single use disposable tip (orange or purple)
2	Select single piece of blue articulating ribbon (Bausch is a good brand- See Figure 2). Some brands of paper will ignite with contact with the laser tip due to higher alcohol contents in the paper.
3	Set the laser at a low setting of 0.5 watts.
4	Touch the tip to the articulating paper first then step on foot pedal for ONE second.
5	Repeat 8 times or more. The **tip should glow an incandescent orange when stepping on the foot pedal (like a candle flame)**
6	Touch initiated tip to tissue holding tip stationary and look for signs of ablation (laser plume, and vaporization of tissue).
7	Begin procedure or reinitiate tip if needed on the articulating paper.

FIg. 4 Bausch Articulating Ribbon.


FIg. 5 . Properly Initiated tip.

With careful selection of the desired tip, and initiation of the tip when using the diode laser in contact to ablate tissue, the ablation of tissue can become much more predictable and completed with lower settings, providing for less post-operative discomfort for the patient, and lower risks of developing iatrogenic sequelae as well.

References

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2. Selting W. Personal communication regarding diode laser initiation. Email on April 17, 2011.