1 TITANIUM — THE ALLOY
   - Rutile Ore — one of the world's most abundant alloys — offers price stability.
   - Molecular Structure — Hexagonal, close-packed crystal lattice Alpha (a phase), which transforms into a body centered cubic form (b phase) at 883 degrees Celsius.
   - Important that all firings remain under the 883 celsius temperature. Why? What are the warning signs when processing Titanium? How can we increase the buffer zone between the lowest firing and high temperature parameters?

2 PORCELAIN CALIBRATION — CRUCIAL STEP TO DETERMINE PROPER PORCELAIN MATURATION AND TO SET MAXIMUM FIRING PARAMETERS
   - Create shade tab using GC Titanium CL-W. I suggest firing at +40 degrees C., higher than manufacturers recommended starting point. Adjust firing parameters accordingly.
   - Achieve proper porcelain maturation, and increase buffer zone between lower firing temperatures and the Beta case high temperature of 883 C. How? Slower rates of climb and longer hold times.

3 CASE SIZE LIMITATIONS — NONE
   - Precision model system is needed for large cases.

4 METAL PREPARATION
   - Standard SHP burs for Titanium at speeds of 15,000 rpm max.
   - My technique and materials used: Shofu mounted points are No. 5, No. 6, and No. 1. The Komet disc is 7/8ths inch diameter. We also use the 556 FG. Carbide burs in an air turbine at reduced pressure careful not to stall the handpiece. The 699 or 701 FG carbide can be used to further reduce the margin or use the Komet disc. Burnish the margins if needed by using the Shofu mounted points at speeds not to exceed 10,000 rpm.

5 SANDBLASTING — CAUTION: NEVER USE AN ALUMINUM OXIDE PARTICLE OR GRIT SIZE SMALLER THAN 125 MICRONS. GRIT SIZES OF 125 TO 150 MICRONS ARE INDUSTRY STANDARDS. SMALLER GRIT SIZES WILL CREATE A WEAKER BOND AND ULTIMATELY LEAD TO FAILURE.
   - Never exceed 2.5 bars or 30 psi of pressure, and always blast at a 45 degree angle.
   - Passivation Process: Do Not Omit! Steam clean substructures after sandblasting and let dry on a tissue for 5 minutes to naturally oxidize. Never exceed 30 minutes, and if you do you must start Step 5 over.
GC TITANIUM BONDER: CRUCIAL STEP! DO NOT OMIT!

› Apply thin coating and avoid puddling. Properly fired bonder will have very slight sheen under lighting. White or grey thick areas are indications of excess bonder and you must go back to Step 5 and start the process over.

OPAQUE LAYER — CG TITANIUM OPAQUE

› I recommend the Trydynamic glass opaque rod. Apply and fire according to established firing parameters.
› Spray opaque is another option. We have used this technique successfully, but I prefer the glass rod for applying thin layers of opaque.

PORCELAIN APPLICATION

› Apply as you normally would with any pfm.

POLISH TECHNIQUES: RUBBER WHEELS AND DIAMOND PASTE

› Polish any Titanium surface to a high luster. There is one last important step: You need to wait 10 minutes after high-shine procedure before steam cleaning. This allows the Titanium oxide to seal the surface of the polished area. Failure to do so may cause the polished surface to discolor in the patient’s mouth.

CAUTION!!

› Never use stripping agents to remove porcelain. These can distort or dissolve Titanium frames.

The above procedures and recommendations are courtesy of Tim Tyndall, CDT, Owner of Creative Expressions in Winterville, North Carolina. Tim was recognized with the 2011 John Ness Award as the Lean Laboratory #1 Mentor of the Year, and the previous year with the 2010 Operational Excellence Award.

These recommended procedures are based on years of R&D in his laboratory using the GC Initial Ti Porcelain system.

CREATIVE EXPRESSIONS — RECOMMENDED FIRING PARAMETERS FOR INITIAL Ti

These temps and rates are different than manufacturer guidelines, but have been found to be very successful in his laboratory.

FULL VAC throughout cycles, start at close and drop when open muffle.
Bonder: 6 min dry 450C entry temp 45C rate of climb 825C final temp hold 2:25
Opaque: 6 min dry 450C entry temp 40C rate of climb 825C final temp hold 3:30.
(should be shiny but not glazed)
Dentin: 6 min dry 400C entry temp 35C rate of climb 810C final temp Hold 2:10
(again shiny but not glazed)