

Seven Steps for Gypsum Success

By Craig A. Pickett, CDT

Even with the latest developments in scanning and milling restorations, the use of gypsum-based materials is essential to your laboratory processes. An in-depth understanding of these materials and their behavior is part of the foundation of success in your business, but you would be surprised at how many laboratory owners and technicians I speak with who have gypsum questions.

It may seem like everyone should be familiar with gypsum usage, but a good review is still beneficial to everyone. First, let's cover the chemistry.

| $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ | - $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ | + 1 1/2 H_2O |
|---|---|------------------------------|
| Raw Gypsum | Plaster or Stone | Excess Water |
| Calcium Sulfate | Calcium Sulfate | |
| Di-Hydrate | Hemi- Hydrate | |

The raw product, either taken from the ground or produced as a by-product of the energy industry by adding water, calcium and oxygen to the sulfur cast off, is heated and ground to a powder. In this

process, excess water is driven out of the material to create dental plaster or stone and the powder product's overwhelming need to get its water back. The gypsum will take back the water from wherever it is able. For example it will take water from the atmosphere on a humid day in the laboratory while it sits in an open box or from the humidity over the sink where it sits perched in a three cubby bin for two or three weeks at a time. As it draws the water back, it does its best to recreate the $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ molecule with which it started life. The result is hardened material at worst and, at best, material that sets too fast. Keeping the water away until you decide to put it back, and in what amount, is how as a laboratory technician you control its physical properties.

Remember the American Dental Association breaks gypsum into five types based on Vicat tests and expansion. If you change to a new gypsum product make sure to match the physical properties of the material you have been using or you will notice changes. For example, you may change to an increased compressive strength, but also from a type 4 to a type 5. Your expansion is now altered and your doctors notice that your crowns are fitting more loosely than normal. It is not the water powder ratio or a problem with the stone. You changed to a material that behaves differently.

Your knowledge base shouldn't stop with the chemistry. These seven keys to success with gypsum may sound like common sense, but they are often some of the most ignored. Ignore them at your peril.



Bulk boxes left open to the atmosphere can change physical properties between the top and the bottom of the box.

1. Store Wisely

Remember that all gypsum products should be stored in low-humidity cabinets or areas and preferably in sealed containers. An open 50-pound box left on the floor with the liner pulled back is an open invitation for material ruin. Occasionally, we'll hear dental laboratory owners or technicians say, "The first half of this box worked great, but now it has problems. I think I got a bad batch." Chances are that you have a bad storage system in a humid environment. Wall bins or drawers are great for access but should not be filled so full that the material sits prior to use for days on end exposed to the atmosphere. Break the large box into smaller snap lid containers that reduce exposure to atmospheric conditions.



Store your materials wisely. Open bins attract moisture.

Mixing at the correct speed and time improves product performance.

2. Measure Twice, Mix Once

Measuring accurately and mixing properly are just as critical as storage. One hundred grams of plaster is not the same in volume as 100 grams of die stone. Manufacturers create defined physical properties for each gypsum product. When you change the parameters of the water to powder ratio and mix time, you change the other physical properties as well. If a particular product is not behaving as you would like, it may be the wrong product for your application or you may not be following the instructions correctly, even if you've been doing it this way for years. Review the procedures on a regular basis to make sure that you have not drifted from the intended use or handling instructions. Also, seek your manufacturer's technical advice for your particular application.

Eyeballing leads to error. Different types of Gypsum have different volumes at the same gram weight.



Machinery that helps weigh, measure and mix is well worth the investment. Even if you have been doing with out it for years, the increase in accuracy and consistency will produce an even better product than you have currently.

The condition of your lab will control your quality, and your chemistry.

3. Clean is Best

If your clients walked in right now would you be embarrassed to have them in the laboratory? How would you react if your physician's medical laboratory looked like your dental laboratory? Make sure that your work areas and your



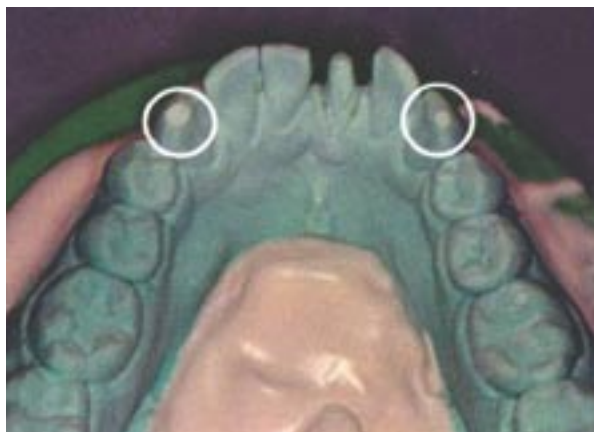
equipment are clean and in proper operating order. Never let partially set gypsum from grindings or scrapings or messiness find its way to the new material. Work pans, mixing bowls, spatulas and knives should all be kept clean from buildup.

4. Beware of Interactions

Gypsum that has already set, called slurry water in its liquid form or bench dust in its solid, acts as a catalyst when in contact with unset gypsum and causes changes in the set and working times. Don't mix gypsum stones and plasters in the same bowls used for phosphate investments. The phosphate can keep the gypsum from setting properly.



The use of accurate dispensing equipment increases your consistency and product performance.



Chalky cusp tips and surfaces caused by improper measurement and impression preparation.

5. Less is More

Other chemistry issues can affect you also. Excessive disinfectant solution or water can give you unset or powdery gypsum at the surface. Make sure that your impressions are clean and only slightly damp before you pour. Excessive use of alcohol-based surfactants or de-bubblers will give you surface issues like softness or chalkiness. Using a solution of water and Dawn dishwashing liquid with a soft brush to scrub away the excess chemicals on the impression surface will reduce unwanted gypsum-impression interface reactions.

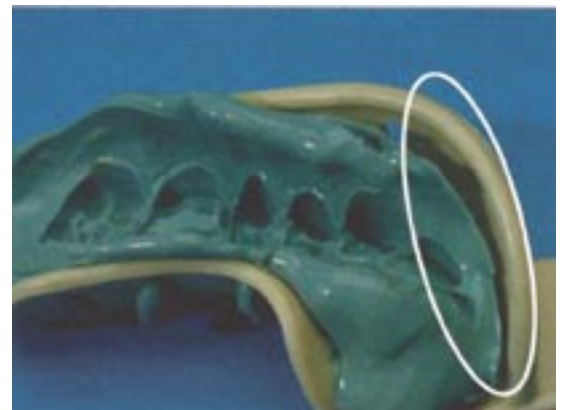
6. Eliminate Impression Headaches

Impression materials and their use can be problematic. Do your best to match the linear expansion of your stone to the linear contraction of the impression materials that you receive. Stones generally range from .05 percent to .3 percent expansion. Impression materials are being reported from .0018 percent to .4 percent



Improperly cured VPS Impression material causes Hydrogen bubbles in the gypsum model.

Lack of adhesive causes shrinking impressions and distorted model work.



contraction. So you can see there is a great possibility of a mismatch. If your doctors are constantly complaining about tight crowns, you may want to check for a mismatch problem before you change the ratios in your investment materials.

Always check impressions for problem areas. Tears, voids, unset material, air traps on marginal areas or impinging on the tray (tray show through), all are sources of case failure and should be pointed out to the doctor and noted on the prescription, along with the doctor's indication to continue or re-take the impression. Pouring and pulling can damage what you first see. Show the doctor the problem in the impression prior to the pour.

7. Presentation Counts

Sloppy gypsum work leaves your practitioner clients with the image that you are a sloppy, non-professional laboratory. See that the model work and articulations are smooth, free from excess gypsum and clean. There should not be articulating ink, fingerprints or other unnecessary markings left on the casts when returned to clients.



Inaccurate Impressions cause distortion and remakes.

Professional model work leaves a professional image of you.



Remember, that what you do with your gypsum work is the foundation that the remainders of the processes are built upon. The architecture won't be remembered if the foundation fails. Beginning with a well done foundation helps to insure that your restorative creativity will be long lived and professionally appreciated. ①

About the Author

Craig Pickett, CDT, is technical support manager at Whip Mix Corp. and is NBC-certified in crown and bridge with a Technologist designation. He attends Brigham Young University as a management student and is a Recognized Graduate of Diablo Valley College in Dental Technology. As a 25-year-CDT, Pickett has been a lab manager for two laboratories, a former technical sales representative with J.F. Jelenko & Co., Whaledent and Dentsply and the owner of Pickett Fabrication in Vacaville, Calif. He has nearly 30 years of crown and bridge and ceramics experience.

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Without a great foundation, the remainder of your artistry wont be worth much.



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“Seven Steps for Gypsum Success”

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1. Raw gypsum is either taken from the ground or produced as a by-product of the energy industry.
 - a. True
 - b. False
2. How can you control the physical properties as gypsum as a laboratory technician?
 - a. Add Calcium Sulfate
 - b. Ground to a powder
 - c. Keeping water away, till you decide to put it back
 - d. Leaving it outside on a humid day
3. How many types does the ADA break gypsum into?
 - a. 1
 - b. 3
 - c. 5
 - d. 7
4. What is step two in the seven steps to gypsum success?
 - a. Clean is Best
 - b. Presentation Counts
 - c. Beware of Interactions
 - d. Measure Twice, Mix Once
5. What perils does storing your gypsum in an open container invite?
 - a. A mess
 - b. Material ruin
 - c. Bugs
6. Slurry water is gypsum that has already set in its liquid form.
 - a. True
 - b. False
7. Bench powder is gypsum that has already set in its solid form.
 - a. True
 - b. False
8. Which of the following chemistry issues will affect how your gypsum sets?
 - a. Excessive water
 - b. Excessive de-bubblers
 - c. Both a & b
 - d. Neither a nor b
9. If you notice a problem with your impression you should not contact your dentist, but work around it as best you can.
 - a. True
 - b. False
10. What should not be included on model work and articulators?
 - a. Finger prints
 - b. Excess gypsum
 - c. Your name and e-mail address
 - d. All of the above

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