22 Trends & Applications

Going (unintentionally) green: The unexpected bonus of switching to CAD/CAM and same-day dentistry

De Joel Stimson
USA

With dentistry as innovative and dynamic as it is, the progress made and the exciting new trends that result are often judged in terms of the technological or financial. We can update our equipment to have a listory to their patients; that is, they condense the restorative process of multiple appointments over several weeks down to one appointment lasting a few short hours. Clinicians can digitally scan the patient’s teeth and design the restoration(s) right then and there. Once approved, the restoration(s) can be milled and while remaining chairside, providing patients with that “wow” factor as they see what digital technology is allowing dentists to do. Once designed, the restorations can be immediately milled in the office and tried in the patient’s mouth, so a perfect fit and high-quality aesthetics are affirmed at the same appointment.

Digital practice equal green practices

Since CAD/CAM technology was first introduced decades ago, early adopters and technology enthusiasts have encouraged integration of these systems for various practical and financial reasons. Though generally a substantial initial investment, practices that upgrade to digital technology find that streamlined procedures and happier patients lead to a significant return on investment.

But switching to a CAD/CAM system provides an unanticipated bonus, one with a far broader impact. Using an in-office CAD/CAM system is one of the most environmentally conscious upgrades a practice can make, offering both concrete and intangible benefits for dental practices, their patients, and the greater community.

CAD/CAM systems add to a practice’s green image with the many small changes they allow the office to implement. For example, now that impressions are taken with a digital scanner (PlanScan), traditional impression methods add up. Using digital technology not only streamlines the process but ensures that materials, time, and money aren’t wasted.

Moreover, because traditional impressions aren’t needed with a digital workflow, equipment previously used to perform these procedures, such as a mixing gun for impression material, are also no longer necessary. While clinicians may think they are only saving themselves hassle or time by purchasing an easier-to-use piece of equipment, they’re also saving energy—literally. With digital technology, impression-taking instruments no longer need to be run through a wash cycle and sterilized. This saves time, energy and water.

While it seems like saving resources, particularly water, isn’t possible in digital practices, small steps such as these really add up. The Eco-Dentistry Association (EDA) (www.ecodentistry.org) estimates that dental practices use 560 gallons of water per day. This totals 57,000 gallons of water per year, per practice. In the United States alone, dental practice water usage totals approximately $50 million dollars per year. This does not even include dental laboratories, which must use substantial amounts of water when mixing and pouring models in stone and cleaning their equipment.

In addition to the above in-office water issues, dental laboratories and their respective procedures that will always require water, these staggering statistics spell out the need for water conservation whenever possible. Because CAD/CAM supports this effort.

Greener materials: Using all ceramics instead of amalgam

Amalgam restorations had been the standard of care in restorative dentistry for decades. With material science advances, however, there are new materials for that same amalgam, the use of all-ceramic materials has significantly increased in recent years. When paired with in-office CAD/CAM systems, their advantages are economical and ecological, in addition to aesthetic, biocompatible and functional.

The majority of the materials for same-day CAD/CAM dental procedures are either composites or all-ceramic blocks, so there is no metal involved. These metal-free restorations can even be used without reservation for various indications, including single-unit restorations, inlays and onlays. While the benefits of these materials have been explored (e.g., aesthetics, ease of use, optical properties), they provide tangible environmental benefits as well.

For example, the longevity of all-ceramic restorations such as in-office CAD/CAM designed inlays is well documented. In addition to a highly aesthetic restoration, patients receive restorations that will last for many years, without the concerns associated with amalgam, such as cracks, failures or potential mercury toxicity. This potentially saves patients and clinicians time, money and wasted resources that would be spent traveling to and from the dental practice, taking more impressions and fabricating new restorations.

Perhaps of greater consequence is removing toxic metal from this equation. All-ceramic and metal-free restorations mean that dentist’s no longer have to worry about amalgam disposal and its accompanying mercury toxicity.

An average dental practice uses 1,500-2,000 gallons of water per day. Think how much you can save by getting rid of extra washing cycles.
The Environmental Protection Agency (EPA) estimates that nearly 50 per cent of all mercury entering local wastewater treatment facilities originates in dental offices.

Using CAD/CAM compatible materials such as all-ceramics lessens or eliminates the contribution of your dental office to environmental mercury. It also means that dental practices needn’t worry about using an amalgam separator.

Currently, the American Dental Association (ADA) does not have national regulations in place for amalgam separators, so many dental practices and laboratories aren’t compelled to use them. Although designing and milling all-ceramic materials still requires energy and results in some waste materials, can they really compare with the toxic by products of metal-based restorations?

Crunching the numbers: CAD/CAM math

In-office CAD/CAM systems provide more than just a clear conscience about saving the environment. There are real, tangible benefits and savings that can easily be estimated to demonstrate the immense value of this digital technology.

Because same-day in-office CAD/CAM dentistry reduces the number of appointments from two (or possibly more, if the restoration does not fit) to one, it stands to reason that every dentist who incorporates these procedures would positively impact the environment by reducing the number of automobile trips patients make to practice. This would result in a 50 per cent reduction in gasoline and oil production.

With a carbon content of 2,421 grams, one gallon of gasoline produces approximately 19.4 pounds per gallon of carbon dioxide emissions. This is calculated by multiplying the carbon content (2.241) by the amount of carbon that remains unoxidized (0.99) by the ratio of the molecular weight of CO₂ (44) to the molecular weight of carbon (12).

Using the state of California as an example, where approximately 10 per cent of the 100 million laboratory dental restorations are completed in the United States every year, we can calculate an approximate savings. If four gallons of gasoline are used for a round trip to the dentist, a restoration needing two appointments to complete would require eight gallons of gasoline. But if these dental practices adopted same-day in-office CAD/CAM dentistry, that number could be cut in half, saving four gallons of gasoline per restoration. Four gallons of gasoline multiplied by 10 million restorations would equal a savings of 40 million gallons of gasoline for restorative procedures in the state of California alone. This, in turn, would equal a reduction of carbon dioxide emissions by 776 million pounds per gallon each year (assuming the previously calculated 19.4 pounds per gallon measurement).

If we extrapolate to the United States as a whole, we can calculate that this would equal 400 million gallons of gasoline saved and 7,760 million pounds of carbon dioxide emissions eliminated, per year. This would all be due solely to a reduction in patient automobile trips to and from the dentist for restorative procedures. While same-day dental procedures may not save the world, their potential impact, even estimated, is undeniable.

Conclusion

In-office CAD/CAM systems’ advantages are limitless. In addition to the clear financial and practical benefits they bring, their positive impact on the environment makes the decision to upgrade even better. They remove toxic, wasteful and disposable materials and practices from the equation, replacing them with greener practices that have a tangible influence. While the clinical advantages of CAD/CAM systems and same-day dentistry continue to be rightfully celebrated, their ecological advantages should not be overlooked.

References