Going (unintentionally) green

The unexpected bonus of switching to CAD/CAM and same-day dentistry

By Dr Joel Strom, USA

With dentistry as innovative and dynamic as it is, the progress made and the exciting new trends that result are often judged by the technology of either the technical or financial. We can update our equipment to have a purely digital office, or we can adopt new practices and offer new procedures to our patients that bring in extra revenue.

While these accomplishments are certainly laudable, it is time for dentistry to measure its progress by different standards, ones that affect the profession and the world as a whole. In short, we can examine how our practices and procedures influence the environment and what dentistry as a profession can do to ensure this influence remains positive.

Fortunately, dental professionals no longer have to choose between advances in technology and what is considered “eco-friendly.” In fact, practice owners can assume themselves of the best of both worlds by adopting digital technology, such as in-office CAD/CAM systems such as the Planmeca PlanScan System (E4D Technologies).

While the practical and financial benefits of CAD/CAM technology are well established, the environmental benefits—though discussed less often and perhaps not as well understood—abound.

**CAD/CAM: Why dive into digital?**

Though not ubiquitous, digital technologies, particularly in-office CAD/CAM systems, are making their presence known. Dental professionals who integrate these advanced technologies can offer same-day dentistry 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 can be milled and seated immediately. Essentially, in-office CAD/CAM systems are revolutionizing how restorative dentistry is practiced.

This CAD/CAM revolution provides almost innumerable benefits to patients. Multiple appointments for one restoration become nonexistent, so patients no longer need to make multiple trips to the dental office. Digital scans eliminate the need for messy, uncomfortable impressions that make patients gag and are prone to errors. Temporary restorations no longer are needed, removing that extra step from the restorative process and ensuring that patients are not at risk for increased sensitivity or leakage while wearing sometimes uncomfortable provisional restorations. In addition, digital scans reduce the amount of water used when mixing materials, such as disposable impression materials or to have a backup on hand in case there are problems down the road. Over time, material waste created using traditional impression technology find that streamlined procedures and happier patients lead to 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**

In addition to the above in-office CAD/CAM benefits, the majority of the materials for same-day CAD/CAM dental procedures are generally composite or all-ceramic blocks, so there is no metal involved. These metal-free restorations can be used without reservation for various indications, including single-unit restorations, inlays and onlays. While the benefits of these materials have been well-documented (e.g., aesthetics, ease of use, wear 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 high 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 dental practices no longer have to worry about amalgam disposal and its accompanying mercury toxicity.

The Environmental Protection Agency (EPA) estimates that nearly 50 per cent of all mercury entering local wastewater treatment facilities originates in dental offices.

**Greener materials:**

**Using all ceramics instead of amalgam**

Amalgam restorations had been the standard of care in restorative dentistry for decades. With material science advancements, however, there are new contenders for this title. In particular, the use of all-ceramic materials has significantly increased in recent years, and when coupled with in-office CAD/CAM systems, their advantages are economical and ecological, in addition to aesthetic, biocompatible and functional.

An average dental practice uses 364 gallons of water per day. Think how much you can save by getting rid of extra washing cycles.

**Switching to digital is beneficial not only to clinicians and patients but to the environment as well.**

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**CAD/CAM supports this effort.**

This totals 52,000 gallons of water 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 uses, along with laboratories and their respective procedures that will always require water, these staggering statistics spell out the clear need for water conservation whenever possible, and in-office CAD/CAM supports this effort.

**TRENDS & APPLICATIONS**

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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 byproducts 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 the practice. This would result in a 50 per cent reduction in gasoline and oil product use.

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 (2,421) 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 adopt 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 reductions 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.

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References

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