

Direct restorations: the last 10 years

Andrew Chandrapal¹

The notion of recreating the natural form of teeth was once a technique and art form left to those at the very top of the 'direct restorative food chain'. Some of these individuals remain at the forefront of inspirational dentistry and display their work around the globe.

For those of us mere mortals who practise everyday general dentistry and in particular direct restorations, the main focus has remained to take the patient through a comfortable and clinically suitable journey to improving their dental health, using one or several materials available on the professional commercial market.

If the last 10 years has taught us anything, it is that the general practitioner is able to practise excellence in direct restorative dentistry, enabling natural yet functional outcomes that are not only representative of the natural tooth form but also attempting to conserve as much tooth tissue as possible.

In other words, the last 10 years has given the general dentist the opportunity to recreate the natural dentition and not just a 'filling'.

Composite resin – material changes over the last 10 years

Composites, by definition, are simply 'the combination of several parts or elements'.

The adaptation of filler particles, monomers, photoinitiators, and coupling agents has changed hugely over the past 10 years. Filler particle size has changed from hybrid to nano and even micro particles. In real terms, 1µm particles have reduced to 0.04µm, as a direct comparison. This, as well as filler volume variation, has created improved hand fling, better aesthetics, greater fracture resistance and improved polish retention within the oral environment.

The direct result of this is the fact we now apply composite resin to more clinical applications than we ever thought possible. Figure 1 illustrates the natural and harmonious results obtained using composite for direct veneers. Although the recall is only at one year, it shows how well the material is able to support and mimic the surrounding dentition using no preparation techniques.

It is now possible to conduct full mouth rehabilitations using direct composite resin to very good levels of predictability. Following on from this, it has enabled our dentistry to become far less invasive to the tooth substance than previous versions of the material. In the right circumstances, prep-less dentistry is possible using modern composites that have improved wear properties and aesthetic qualities.

Obtaining suitable combinations of varying nano filler size with filler weight has enabled the industry to create strong yet highly polishable materials that are suitable for both anterior and posterior dentition.

Now that such materials are available, the key is learning how to use them in such a way to obtain optimal results. This means learning how to handle, manipulate, layer, finish, and polish the material.

¹ Andrew Chandrapal BDS
MFGDP(UK) DPDS(Bris)
MCLinDent (Pros)
Private Practice, London, UK



Figure 1: 12-month recall on upper central composite veneers.



Figure 2: LM Arte Misura, courtesy of Styleitaliano.

Most composite systems on the modern-day market will allow decent restorations when handled correctly. The most experienced clinicians will know the materials so well they will be able to combine various systems together to obtain a true representation of the surrounding natural anatomy.

Hand instruments

In 1994, Dr Nitzan Bichacho suggested the idea that the various hand instruments used to manipulate direct restorations were unnecessary (Bichacho, 1994). With regards to composite materials, the industry has almost gone full circle in the last 10 years. Elaborate instrument sets were – and still are – available to enable the clinician to handle the material and apply it in an anatomical fashion.

We have learned over the last 10 years that this in fact is not needed and thus refer back to the work of Dr Bichacho of more 20 years ago, which suggested the mode of application of composite increments using a probe and manipulating this increment to its desired position using high quality micro brushes. This not only reduces the complexity of instruments being used, it also enables complete control of polymerisation contractile forces causing unwanted flexure upon curing.

In more recent years, certain instruments have emerged that aim to assist in the layering process of enamel and dentinal composites. Given the fact the refractive index of enamel composites is generally greater than that of natural enamel, the final enamel layer tends to be thinner than the natural tissue would otherwise be.

LM Arte has created the Misura instrument, shown in Figure 2, which highlights 0.5mm thickness of material so as to ensure over-contouring does not take place, as well as obtaining an even thickness over the horizontal profile of the

restoration. In short, the process for instrument application over the last 10 years has reduced in need, although new instruments that have emerged in response to a greater understanding of composite resin.

Photography – our opportunity to scrutinise to the next level

Clinical photography has improved in leaps and bounds over the last 10 years. Cameras are now more sensitive, and lighting systems are now more readily available. The ability to use twin versus ring flash systems enable us to evaluate the natural form and end restoration with confidence. It remains essential to utilise clinical photography to document and plan the direct restoration to maximal extent.

Use of photographic aids, such as contrasters, have also aided the clinician in terms of incisal edge anatomy, translucency, dentinal mammelon structure and distribution, and primary, secondary and tertiary anatomical features. Figure 3 shows a range of natural features that can be used when direct composite can not only include such high features, but be applied in a conservative manner, and thereby not adding to the tooth tissue loss that has already occurred. Such skills can also highlight the nature and extent of developmental white and brown spots on teeth so that they can either be removed or incorporated within the restoration.

The explosion of dental clinical photography has aided the clinician greatly. In reference to direct resin dentistry, it has enabled us to plan our restorations by taking a series of clinical shots using a few aids such as retractors and contrasters to highlight the detail in the natural form, as well as anatomical feature and morphology.



Figure 3: Preoperative records to illustrate tooth surface loss.

Once again, the last 10 years have given the clinician a gentle push to be educated within the field of photography, given the availability and importance of clinical documentation.

Curing lights

Curing lights have moved away from halogen and towards LED, which is now the mainstay of direct and indirect adhesive dentistry. This means a more constant wavelength with no variability of curing ability and loss of power that can happen with an expiring halogen bulb. This has meant light curing units are smaller, which equates to easier placement towards the posterior teeth as well as fewer components, such as fans for cooling.

Within the last 10 years we have seen a reduction in the use of plasma curing lights that made the claim to being able to polymerise composite resin within a matter of a few seconds. We now know that depth of cure varies dependant on the opacity and bulk of increment being placed, as well as reflection of the increment also having a bearing.

Angle, rate and intensity of cure have been shown to matter (Price et al, 2015). In short, whilst LED lights now offer this, plasma lights are now all but redundant as it has been shown that polymerisation rates cannot be guaranteed using such short curing cycles. The principles of light curing have thus remained to be the same, as the industry appears to have gone full circle in an effort to bring the clinician more efficient methods of curing.

Shade taking

Matching the natural dentition remains at times to be a demanding and time consuming process, which can be fraught with error and mis-judgement. The notion that single layer (monochromatic) composites can be used to mimic the natural dentition simply cannot be achieved with predictability.

Consequently, we now have greater understanding of shade and some aids that have been designed within the last 10 years. Certain photographic filters, such as cross-polarisation, have enabled the clinician to eliminate spectral reflection, thus effectively highlighting the internal anatomy of teeth.

This has been influential in terms of dentinal mammelon distribution and inclusion of intensive features such as white spots. Such filters are now widely available and can even be homemade, but allow greater depth of observation to enable more features to be included within direct restorations.

Historically the industry has relied upon Vita shade guides to determine the overall shade of teeth. Vita 3D guides have moved us one step further on in terms of value and chroma determination. However, the notion that acrylic can mimic the restorative material used at that time has remained to be incorrect.

As such, the last 10 years have given us the ability to use prefabricated or custom shade guides that are made from the direct restorative material being used at that time. This gives us the closest reference possible in terms of the materials being used.



Figure 4 and 5: Composite shade tabs illustrating enamel and dentine alongside the combination of the two for true comparison (Inspiro – Optident).

It is essential that the clinician ensures the composite system being used has its own shade guide constructed of the resin material and not acrylic. Such guides are now also available in an outer shell of enamel and internal dentine to give combination effects to mimic the effect of layering two specific shades together.

The last 10 years have empowered the clinician to think more laterally about the tissues he/she is attempting to reproduce. As such, the industry has responded by constructing shade guides that are now designed to mimic the layers, rather than a Vita acrylic block that can at times lead us to incorrect results.

Figures 4 and 5 illustrate such an example of composite resin shade tabs arranged in enamel and dentine, but also allowing the combination of the two. Such resources have really changed the way the clinician is able to perceive the desired shade.

Empirical longevity studies

As with most forms of clinical and academic dentistry, we now have more clinical research to be suggestive of greater success rates using direct materials. This is in part due to an improvement in the materials, but also techniques of isolation, bonding protocols and being more aware of the limitations.

Academics such as Jürgen Manhart and Didier Dietschi have been pivotal in providing the clinician with valuable data to suggest our methods of direct resin restorations are showing promise, not only in the short term, but anything up to 25 years of data have now been produced to support such techniques (Hickel et al, 2000).

It is important that clinicians make themselves familiar with such research to support their techniques and update them

accordingly. However, the current stance is that using strict isolation and bonding protocols, direct resin restorations are being shown to have very good longevity – albeit remaining sensitive to clinical technique.

Tooth preservation

The strive to become ever more conservative within the last 10 years has spearheaded the need for direct resin restorations to have a resurgence within the dental market. Organisations such as the British Academy of Cosmetic Dentistry have been widely promoting, where possible, minimally invasive dentistry to create lifelike results with ever-improving longevity.

This results in dentistry that is both appealing, and cost-effective to the patient, as well as generally safer methods of application when compared to aggressive preparations that are related to indirect techniques.

With this said, it remains the clinician's level of experience and expertise that must make the correct judgement as to what will obtain the best result in the interest of the patient for short and long terms time spans.

CAD/CAM hybrid composites

The drive to make clinical dentistry more digital has led to the industry producing hybrid composites that are effectively machined within our own surgical environments using CAD/CAM technology. The last 10 years have vastly improved in terms of scanning technology and thus the use of hybrid composite, often containing ceramic fillers to be used in clinician scenarios where perhaps indirect restorations that were lab based were being utilised.

The discussion as to whether such resins remain to be truly

direct or indirect continues; however, the last 10 years have empowered the clinician to at least offer this service, as well as accuracy of intraoral scanners increasing hugely. This means a shift of thinking for the clinician but for some has changed the way they practice dentistry.

Conclusions

Ten years in science and research can be seen to be a long time. It is clear things have changed; by using modern direct composite materials we are now able to be more predictable and have greater longevity with a wider remit of treatment modalities. It is fair to say that further research is always the key and that the industry will not always produce products and materials that are truly beneficial to the clinician and patient; however, adhering to strict isolation and bonding protocols and lateral thinking on clinical decisions and treatment planning can greatly improve outcomes.

Modern materials and techniques have so far taken us a long way and will continue to do so for at least the next 10 years.

References

- Bichacho N (1994) The centripetal build-up for composite resin posterior restorations. *Pract Periodontics Aesthet Dent* 6(3): 17-24
- Hickel R, Manhart J, Garcia-Godoy F (2000) Clinical results and new developments of direct posterior restorations *Am J Dent* 13(Spec No): 41D-54D
- Price RB, Ferracane JL, Shortall AC (2015) Light-curing units: a review of what we need to know. *J Dent Res* 94(9): 1179-1186

Reprinted with permission by Aesthetic Dentistry Today February 2017