



Figure 1. DSD photographic protocol.

## The use of digitally fabricated control guides in veneer preparation. A case study using Natural algorithms, Digital Smile Design (DSD) with CAD milled ceramics

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**D**igital Smile Design (DSD) is now a sophisticated tool that allows us to produce highly predictable and aesthetic results for our patients. With the advent of DSD and the use of natural tooth libraries being incorporated into a streamlined workflow, facially driven design is now becoming the norm. Adding to the advantages of digital dentistry is the ability to control the preparation of teeth. The use of digital guide preps allows for perfect control and avoids

unnecessary tooth reduction. What was previously fabricated via silicone keys is now completed using an accurate, perfect fit 3D printed guide that is used in situ. These guides are designed by the DSD planning centre, which is where the digital lab finalises the prescriptions for each case. Then the virtual wax-up is used as the basis for the guides fabrication.

This case not only demonstrates the effectiveness of DSD and the digital natural smile library but also the precise adherence to the original design.



Figure 2. Images captured from DSD video protocol help identify function and lip dynamics.



Figure 3. Patient's presenting dentition - note old composite, staining and unaesthetic anterior segment.

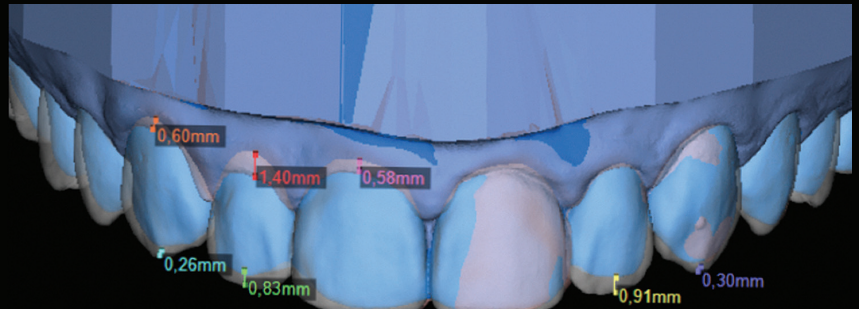


Figure 4. Natural teeth library of the DSD laid over original dentition producing the "digital" wax-up.

A 25-year-old patient presented with aesthetic concerns regarding her dentition. Examination revealed a history of orthodontics and previous failing composite veneers that had been replaced on a regular basis. This, together with the irregular anterior teeth and moderate smile line indicated indirect restorations as the ideal treatment modality. The patient also wanted the final restorations to look as natural as possible, making this case ideal for "DSD Natural Restoration".

Initially, a complete set of photographic and video records were captured (Figures 1-3) along with an intraoral scan as part of the DSD protocol for facially driven aesthetic mock-ups. This aids in accurately assessing smile parameters to identify any specific cant or midline issues that may affect positioning of restorations, all in relation to function and lip dynamics.

An initial 2D DSD was first completed using the DSD App software (Figure 5). This allows us to orientate and determine the smile parameters for this patient prior to the 3D modelling.

The smile design is then imported into Nemostudio software and using the designated matching natural libraries in both applications, a digital wax-up is generated (Figure 4).

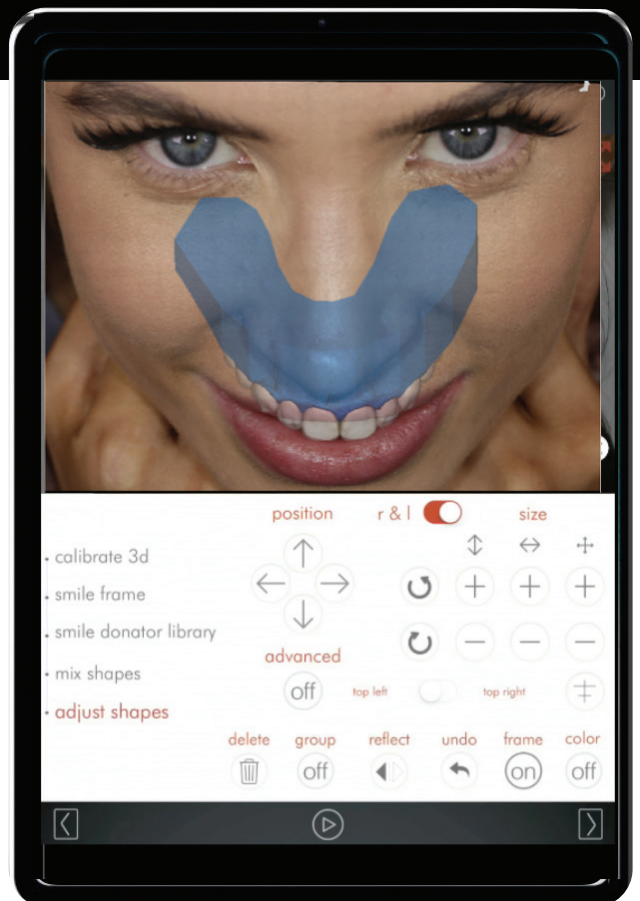


Figure 5. Initial 2D smile design using DSD App.





Figure 6. The mock-up in situ.



Figure 7. Gingival recontouring using the bis acryl mock-up as a guide.

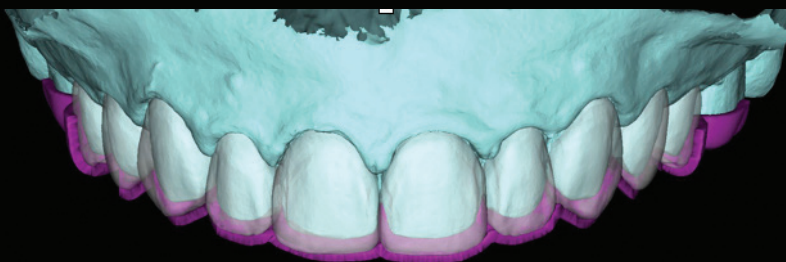


Figure 8a. Digital wax up with prep guides designed for incisal reduction. (Guides designed by Angelo Raphael ,DSD Lab)



Figure 8b. 3D printed prep guides for incisal reduction in situ.

The digital wax-up allows for customisable prep guide fabrication. The guides shown are for conventional reduction planes i.e. labial, vestibular and incisal. However, other reduction guides can be designed for interproximal and specific edges.

The scanned (CAD file) smile library has an array of shapes retaining their natural aesthetics and textures with slight imperfections that can be overlaid between individuals.

This is an imperative step as with the selection of natural textures available from smile donors increasing, the ability for the dentist to accurately achieve a facial aesthetic result that is very predict-

able likewise grows. The key is the use of donors of the same gender and in a similar age bracket for ideal proportions and harmony.

The accuracy and consistency of the proposed design can be seen via the mock-up (Figure 6).

This case required more buccal fill on the posteriors and more length gingivally. This visualisation facilitates minimal tooth preparation through the customised preparation guides.

The mock-up can be used as a guide if gingival recontouring is required as per the DSD prescription (Figure 7). In this case, electrocautery and a fine scalpel was used.

Restoring the gingival harmony is a key factor in creating an ideal aesthetic outcome.

The prepping through the mock-up technique allows for conservative and accurate tooth preparation but this is not enough for perfect assessment of the reduction. The technique of prepping through the bis-acryl mock up and the use of silicone prep guides is the gold standard. However, with the advancement of digital dentistry and versatile design software, we can create guides for all planes of reduction, allowing conservative preps and more importantly the right amount. These are 3D-printed and placed in situ with a stable fit consistent with the design (Figure 8-11).

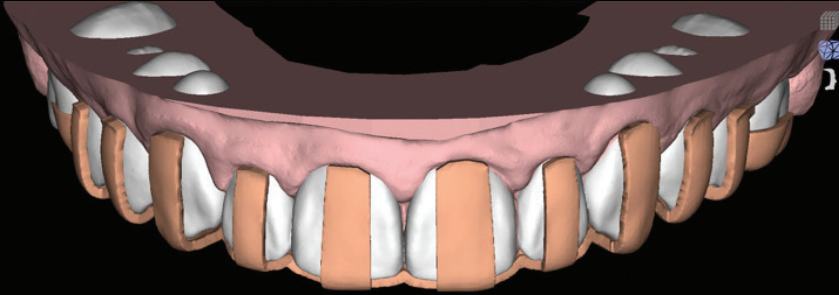


Figure 9. Printed prep guides for for vestibular reduction using the digital wax up.  
(Guides designed by Angelo Raphael ,DSD Lab)



Figure 10. Printed prep guides for for labial reduction using the digital wax up.  
(Guides designed by Angelo Raphael ,DSD Lab)

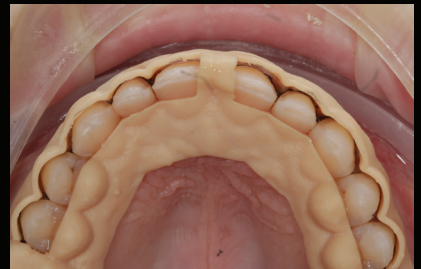


Figure 11. Veneer preparations scanned with an intraoral scanner.





Figure 12. The final design is imported into the milling software.

Figure 13. Note the natural textures on the monolithic CAD milled indirect restorations that have been perfectly reproduced from the digital file.

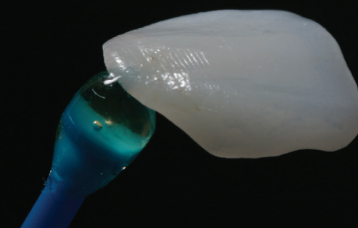


Figure 14. Cementation of veneers under rubber dam.



Figure 15. Final restorations at rest.

"What is more important is making sure that preparations remain conservative and not overly done as is commonly seen clinically. The guides are a perfect tool for this purpose..."

The preps are then scanned digitally and a digital "over the prep" model is created incorporating the teeth selected and planned from the natural library (Figure 12). This is initially done in the Nemostudio software and then prepared for milling with any desired system (Dentsply Sirona inLab, 3Shape, exocad, etc) (Figure 13).

The restorative material chosen was Empress Multi BLT3 (Ivoclar Vivadent). The final restorations are then cemented under rubber dam for ideal bonding and moisture control (Figure 14).

The final photos highlight the beauty of nature (Figures 15-17). The shape and texture of the final veneers are untouched from the original file. This case demonstrates that with a facially driven design and natural tooth libraries using the DSD protocol, we can achieve a perfect natural smile.

What is more important is making sure that preparations remain conservative and not overly done as is commonly seen clinically. The guides are a perfect tool for this purpose.

### About the author

Dr Yassmin first studied DSD with Christian Coachman and not only did he incorporate it into his daily practice workflow but has become a speaker and official instructor for DSD. This training along with his Masters in Aesthetic Dentistry from the Kings College of London has enabled him to further establish his cosmetic and implant practice in Sydney. He is currently running his DSD courses in Australia and Asia.





*Figure 16. Final images of patient.*



*Figure 17. Before and after.*