Kids Digital Crown Technique: an innovative approach to restore primary teeth

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Abstract

Aim The purpose of this clinical case is to present the Kids Digital Crown Technique (KDCT), an innovative technique to restore primary teeth with customised prosthetic crowns.

Methods A six-year-old patient presented to our clinic with an extensive carious process affecting tooth 8.4. After assessing the patient's conditions, a digital intraoral impression was taken and digitally sent to the dental lab to realise a customised prosthetic crown of the tooth. After the endodontic treatment and a minimal tooth preparation the crown was cemented using a dual resin-based cement.

Results The procedure permitted to realise a customised prosthetic crown ready to be applied immediately after the endodontic therapy. The crown was the correct size, easy to adapt and of the correct colour. The protocol follows an easy, kid-friendly workflow, reducing the operative time and maintaining the advantages of other procedures.

Conclusion Kids Digital Crown Technique is a valid procedure to restore primary teeth with prosthetic crowns. Future prospective studies will be necessary to confirm the efficacy of this technique.

KEYWORDS CAD/CAM; Prosthetic crowns, Early childhood caries (ECC)

Introduction

A critical aspect of primary teeth restoration is the high percentage of failure of the direct composite restorations [Gao, 2018]. Highly decayed, or extremely demineralised deciduous teeth may oftentimes be difficult to restore due to macro and micro-structural deformities [Paglia, 2018; Chisini et al., 2018; Pasini et al., 2018]. In fact, deciduous teeth not only have a narrower masticatory surface, and a wider/bigger pulp chamber compared to the permanent ones but they also have smaller enamel prisms, which alongside their lower mineralisation make them more prone to a potential damage. Subsequently, caries affecting deciduous teeth have a more aggressive behaviour rapidly involving the pulpal chamber and with a complete deterioration of the crown in few months [Contaldo et al., 2020; Caruso et al., 2019].

Such features may also interfere with the adhesion mechanism of the materials used for the direct conservative restorations, with a relative higher percentage of failure [Chisini et al., 2018].

The use of paediatric crowns is ultimately gaining more and more attention as an efficient and alternative method to preserve decayed and demineralised teeth, and it is widely suggested by different studies and guidelines in paediatric dentistry [Leal and Takeshita, 2018; Sonbol, 2018; Wada, 2015]. This novelty suggest a thorough and efficient restoration of conditions in cases where other standard techniques could not be achieved, with maintenance of a valid occlusion, interdental and anatomic spaces. Nowadays, the most used techniques are mainly limited to preformed crowns (with a core of steel, or zirconia) which are systematically adapted to each tooth directly in the patient's mouth [Innes NPT and Santamaria, 2015]. These types of crowns are produced in different sizes and measures and have to be adjusted following a minimal prosthetic preparation of the tooth [Seale and Randall, 2015; Walia et al., 2014]. Unfortunately, as on one hand preformed crowns represent a valid alternative to composite restorations, they have some limitations [Attari and Roberts, 2006; Mathew et al., 2020]. To start, zirconia crowns despite their state-of-the-art aesthetics, have a Vickers hardness about 3-times greater to the deciduous teeth enamel (900mpa vs 350 mpa), making their occlusal adaptation more difficult and making this an important obstacle to the prosthetic workflow [Tote et al., 2015]. Interestingly, a valid alternative to preformed crowns, may come from the long-time used CAD/CAM technology, which through a "kid-friendly" digital workflow provides a highly precise and easy-to-use manufacturing process [Dursun, Monnier-Da Costa and Moussally, 2018; Zimmerman et al., 2009]. Moreover, we believe that this digital workflow would also reduce in-office visits and procedures and – last but not least – would reduce the cost of the procedures. In fact, differently from what performed by Mourouzis et al. [2019] in case of important caries removal, all procedures – including local anaesthesia – would be performed one time in a single setting, with the caries being removed, the tooth being then restored,

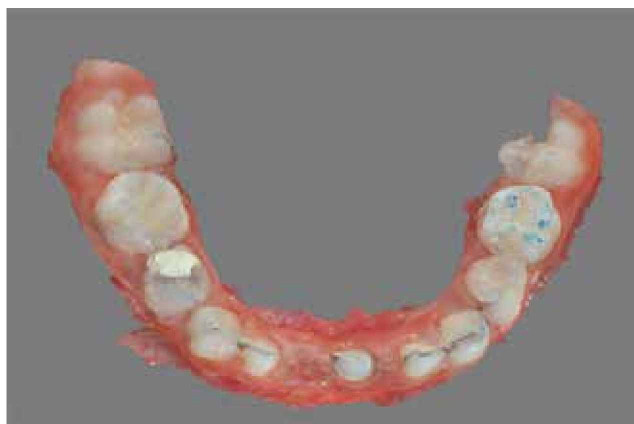

FIG. 1 Intraoral scan.

FIG. 2 CAD design.

prepared, and the crown being delivered the same day [Padminee et al., 2020]. As such, the aim of our study was to highlight the phases of our "Kids Digital Crown Technique (KDCT)".

Kids Digital Crown Technique (KDCT)

In the last few years digitalisation in dentistry has become a true revolution, not only for great improvements in the prosthetic workflow, but also for developing procedures with new materials which are more comfortable for the patients. As a matter of fact, we believe that the use of Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) and the use of the intraoral scanners (IOS) for the restoration of deciduous teeth in paediatric dentistry, are clinically and logistically the best methods for the little patient in terms of compliance.

The KDCT is a new technique used for paediatric aesthetic crowns using a digital impression of the tooth before its preparation. Taking of the impression before the crown prep, will in fact facilitate the fabrication of the crown, which will likely be more similar to the patient's dental anatomy, and easier to adapt after tooth preparation. Crowns are customisedly manufactured by the dental technician in different materials (composite, PMMA, zirconia) depending on the clinician's instruction, from a single block of material and shaped following the CAD/CAM workflow. Once the crown is ready it will be easily applied to the patient's tooth after a minimal preparation and sealed with an aesthetic adhesive cementation. Importantly, the dual resin-based, self-curing cement used has multiple functions, such as relining of the crown, sealing the residual cavities following the removal of the carious tissue, sealing the preparation margins and ultimately cementing the crown as well.

Methods

During the first visit it is fundamental to take an intraoral scan as first approach to the little patient who subsequently would likely experience the visit as a moment of fun and play with the dentist. Moreover, other than breaking the ice between the patient and provider, the IOS will better serve to highlight the intraoral status of the kid. During the procedure, two impressions are taken scanning the upper and lower arches, and making sure every point is well detailed (Fig. 1).

A third scan of the occlusal bite of each side (left and right) is then required in order to establish the patient's occlusion. No precision impression is needed because the final/definitive crown is directly made without the temporary one. The impression is then sent to the dental lab with a prescription and indications on the teeth to treat and the material to be used for the crown.

As far as the material, we prefer the 550 Mpa zirconia,

FIG. 3 Tooth preparation.

FIG. 4 Customised zirconia crown.

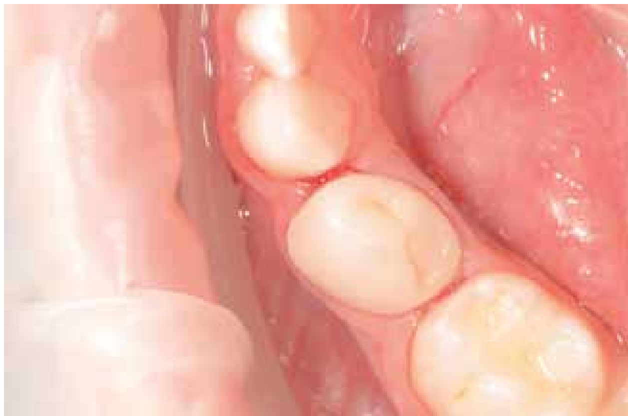

FIG. 5 Crown applied after resin-based cementation.

which hardness is very similar to that of the enamel of the deciduous teeth (350Mpa). The thickness of the crowns has to be 1 mm on the occlusal surface, and 0.7 mm on the lateral walls in order to warrant enough strength with minimal dental preparation.

In case the dental technician does not have CAD/CAM software programmes (Fig. 2), the shape and dimension of the contralateral tooth could be useful for the preparation of the crown. Shaping of the crown should be realised following the pre-filing provisional crown technique used in traditional prosthetic dentistry, where the prosthetic structure is minimally wider than the original tooth (0.2 mm), and the crown margins a bit deeper than the gingival margin (0.5 mm), in order to ease the adaptation and guarantee a complete sealing of the prepared tooth.

The zirconia crowns are prepared with a minimal and basic aesthetic structure, both because there is no clinical need to do so and to reduce the production cost. This way, the patient may benefit of a high-quality product at reduced costs.

The teeth are prepared (Fig. 3) using dedicated cylindrical burs of 14 mm thickness for the occlusal aspect and burs of 0.7 mm thickness for the interproximal, buccal and lingual aspects.

After the dental preparation, the crown is fitted and once it completely adapts to the tooth structure (Fig. 4), it is cemented using a dual resin-based and self-curing cement (Fig. 5) (Ivoclar Speedcem®) which requires about two minutes to completely harden [Yalmaz, 2011].

The occlusal check is then performed, and the patient is discharged with proper indications so as to avoid post-op complications.

Conclusions

The Kids Digital Crown Technique is a simple yet very efficient rehabilitation technique for paediatric patients with decayed teeth or important enamel structure defects. KDCT entails the use of paediatric aesthetic, customised crowns for each deciduous tooth, which makes the prognosis much more predictable.

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