

Abstract

Treating facial anomalies with a 3D printer - establishing a fully digital workflow for cleft palate children

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One out of 500 children is born with the condition of a cleft lip and palate. If the palate is affected there is a uni- or bilateral cleft, running from the lips to the pharynx. The cleft can lead to an unnatural swallowing pattern and severe difficulties in feeding the newborn. Also, the cleft can be enlarged due to mispositioning of the tip of the tongue. The gold standard is manufacturing a palate plate in the first few days of life to separate the main nasal and the oral cavity. This is done conventionally with the help of a plastic impression with an alginate compound. The material, which has a liquid to viscous consistency when introduced into the baby mouth, is associated with severe stress for the child. An even greater risk concerning the life of the child is the aspiration of the impression material. In Kiel we modified the workflow of our colleagues from Tübingen [1,2]. We describe the establishment of the digital workflow at our department and encountered pitfalls. When our department for facial anomalies in children gets noticed of the birth of a child with a cleft (lip and) palate, we visit parents and child and take a digital impression using an intraoral 3D scanner (TRIOS 3 from 3Shape). In Kiel we use only one program to process the scan (ONYXCEPH³™ (Image Instruments GmbH)). At first a model is digitally socketed, then the cleft is isolated using edit mode and covered by prosthetic bridge operations. A palatal plate can now be constructed using the Bite Splint 3D module. The printing workflow is done with a Formlabs 3B+. The material used, Dental LT Clear, is a splint plastic with high biocompatibility. The integration usually takes place the following day in our outpatient department. As the newborn and jaws grow, a digital impression retake, platemaking and reinsertion is performed after a few weeks. Normally two to three plates are needed until the operative closure of the cleft palate at the age of about 10-12 months. With the new implemented workflow, we are able to do the scan chairside. Since Schleswig-Holstein is a relatively sparsely populated area, the clinics where the children are born are widely distributed. It is difficult for parents and children to travel to Kiel immediately after the birth, especially if the child has comorbidities. The digital workflow now enables us to take a digital impression in the external clinic and transfer it to the laboratory in Kiel without errors like shrinkage artifacts. After the plate has been produced, it can if necessary, be adjusted in cooperation with resident colleagues who are trained in the procedure. It was not easy to establish this workflow, but it is a significant advantage for everyone involved compared to conventional method. It is easy to implement our system in an existing digital workflow but for the construction of the plates you need a high skilled employee with an affinity for 3D modelling. There is no clinical evidence that the new plates are inferior to the previous ones, although studies have to be conducted.

AUTHOR'S STATEMENT

Authors state no conflict of interest. Informed consent has been obtained from all individuals included in this study. Ethical approval: The research related to human use complies with all the relevant national regulations, institutional policies and was performed in accordance with the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

REFERENCES

- [1] Xepapadeas AB, Weise C, Frank K, Spintzyk S, Poets CF, Wiechers C, Arand J, Koos B. Technical note on introducing a digital workflow for newborns with craniofacial anomalies based on intraoral scans - part I: 3D printed and milled palatal stimulation plate for trisomy 21. *BMC Oral Health*. 2020 Jan 23;20(1):20. doi: 10.1186/s12903-020-1001-4. PMID: 31973720; PMCID: PMC6979345.
- [2] Xepapadeas AB, Weise C, Frank K, Spintzyk S, Poets CF, Wiechers C, Arand J, Koos B. Technical note on introducing a digital workflow for newborns with craniofacial anomalies based on intraoral scans - part II: 3D printed Tübingen palatal plate prototype for newborns with Robin sequence. *BMC Oral Health*. 2020 Jun 16;20(1):171. doi: 10.1186/s12903-020-01159-7. PMID: 32546229; PMCID: PMC7298740.