Digital workflows in dental offices: Current state and future possibilities

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The integration of digital technologies into the dental practice leads to fundamental changes in diagnostics, treatment planning and treatment. Today, the impact of advanced hardware and software is perceptible e.g. in restorative and implant dentistry as well as orthodontics. Some of the traditional lines between disciplines like conservative dentistry and prosthodontics are even blurred due to the access to innovative CAD/CAM materials and modern adhesive techniques: Monolithic designs allow for a reduced wall thickness of restorations and high-performance adhesives for non-retentive tooth preparations. An overview of the current possibilities of digital restorative practice workflows is provided in the following.

Optical impressions

Intraoral optical impression systems are not only suitable for impression taking and bite registration, but also for 3D monitoring of changes in clinical situations. Thus, the devices can be used for wear diagnosis, visualization of periodontal changes after treatment and also for supervision of an orthodontic treatment progress. In any case, prerequisites for an accurate scan are that all relevant areas (e.g. preparation margins) are visible to the scanner and a dry working field is ensured.

Chairside design

Within the context of computer-aided design in the dental practice, the user benefits from various automated processes and additional tools for analysis. For example, modern design software solutions provide support in tooth modeling. They have learned from tooth libraries and are able to generate realistic tooth morphologies which are adjusted to the adjacent teeth and the opposing dentition.

For an optimized occlusal design, static and dynamic occlusal contacts may be taken into account. Some software versions feature a virtual articulator. Especially for chairside applications, dynamic articulation can be automated with software and virtual functional generated paths can be calculated. These concepts and software developed in Zurich can cover a broad range of indications in the chairside workflow. The combination of intraoral scanning and modern reconstruction processes leads to a just-in-time design of a functional and morphologically adapted tooth surface (Zurich Concept).

More recently, procedures have been developed that allow an integration of electronic registration devices for the measurement of real jaw movements into the CAD/CAM workflow. They improve the possibilities of TMJ-diagnosis compared to existing conventional techniques.

Chairside manufacturing

For chairside fabrication of restorations, a huge range of ceramics, polymers and composites is available. However, it is not possible and advisable to manufacture all kinds of restorations in the dental practice. Therefore, a possible scenario for a dental office may come with the following concept, as already adopted in the Department of Computerized Dentistry in Zurich: Intraoral scanning becomes a standard procedure used as a basis for (TMJ) diagnosis, archiving, treatment planning and for CAD/CAM procedures. The decision of where these procedures are carried out depends on the complexity of the planned restoration or object.

Conclusion

The digital technologies available today allow for predictable restorative procedures in the dental practice. Further developments such as intraoral scanners with simplified handling, improved software and more productive and accurate chairside mills will pave the way for even more efficient workflows.

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