

Classic vs. digital impressions – Many roads lead to Rome, but not all of them are recommendable

"Obviously digital impressions are an interesting topic, but the classic impression method is not likely to become obsolete for many years. At the moment, many people are acting as if digital impressions have just been invented. This isn't the case, as Cerec has been in existence for 25 years, and the international sales figures are not as high as one might think. Digital impressions also only cater for some indications. The difficulty with all these systems is that it is only possible to see optically what we too can see. And because we can see it, we can also easily make a conventional impression of it. And the whole thing becomes really problematic if the preparation margin can't be viewed. Here all digital systems experience difficulties".

This statement, made by Prof. Dr. Bernd Wöstmann [1] marks the current situation in a both complex and problematic area of reconstructive dentistry, as the quality of the impression results plays a major role in the success or failure of a treatment [Rehmann et al. 2]. They may only be one link in the chain of different clinical and dental working steps, but they are a high-priority link, as any errors made at this stage can generally not be corrected, or can only be corrected by repeating the entire process again [1].

Crown and bridge prosthetics:

Aims and requirements

For the production of correctly-fitting crowns, dimensionally-accurate models of the abutment teeth and the neighbouring teeth as well as a model of the opposing jaw in the correct maxillomandibular relationship is required. This is only possible with a precision impression including a detailed negative display of the clinical situation. Depending on the particular case, ready-made or individually-manufactured impression trays can be used. The optimum layer thickness of the elastomeric impression material lies between two and four millimetres [Rammelsberg et al. 3]

"Perfect in a damp environment"

In contrast to the problems which arise when making impressions with hydrophobic materials (for example addition-curing silicones), polyether elastomers are hydrophilic and therefore less prone to faults. They have been optimised through the development of hybrid polyethersiloxanes (for example EXA'lence Medium Body and Heavy/Light/GC), with which the preparation margin can also be reproduced in a damp environment. In general, automatic mixing is most certainly better than the classic hand-mixing method [1, Wöstmann et al. 4].

Full prosthetics: Functional impressions only using individual trays

Because the functional impressions have to comprise not only of the jaw and mucosa, but also of the cheek, lip and tongue musculature, individual impression trays are required which - depending on the anatomical situation - are produced on a model. Sturdy materials are required for muscular impressions of the functional ridge, which however must be sufficiently deformable to allow impressions to be made through pressure from the cheek, lip and tongue musculature. Even if plastic materials and sturdy silicones are offered by the dental industry for functional ridge work, thermoplastic materials are in fact more suitable for creating an optimum functional ridge to the prosthetics [Setz et al. 5].

Impression accuracy depending on the impression material and technique.

In the Abform-Leitfaden (Impression Manual) by the Poliklinik für Zahnärztliche Prothetik des ZMK-Zentrums der Universität Köln [7] (Polyclinic for Dental Prosthetics at the ZMK Centre of the University of Cologne), which is largely based on a trial conducted by Luthardt [6], facts determined in vitro and in vivo with relation to impressions of prepared abutment teeth are described.

In vitro:

- Single-step procedure using polyether or A-silicones enlarge reproductions of prepared abutment teeth.
- Double mix and corrective impressions lead to diminished reproductions.
- All impression procedures are subject to concave or convex distortion in the area of the occlusal surfaces.
- The use of ready-made plastic trays mainly generates negative effects, whereas individual trays result in significantly improved precision.
- Correctly-executed impression disinfection has no negative effects on the fidelity of elastomeric materials.

In vivo:

- 30 to 50 percent of the impressions for fixed dentures are to be graded as clinically unacceptable.
- It is necessary, in particular with hydrophobic impression materials, to drain them as much as possible, whereby retraction cords in combination with astringents are recommended. Electrosurgical procedures lead to a larger loss in gingival height than when using the retraction cord technique.
- Two-stage procedures optimise the sub-gingival representation of the preparation margin, but result in increased three-dimensional distortions.
- Clinical and histological trials indicated deviations between the preparation margin and crown margin of 5 to 5340 (!) micrometres, whereby the mean values of the marginal gaps mainly lay within a range of 382 to 647 micrometres.
- If the crown margin is in a sub-gingival position, one must expect a far larger spread for the marginal gap.

These findings result in the following insights: The periodontal-gingival situation has a positive or negative effect on the impression accuracy. The same applies for the position of the preparation margin.

The temporal interval between preparation and impression plays a role with relation to the periodontal-gingival situation. The achievable drainage condition is of particular importance. The individual knowledge and skill of the person carrying out the work and the clinical handling properties of the materials and technical equipment are what decide the quality of the impression result.

Dentist or patient-influenced prosthetic margin production?

In one of the numerous impression trials conducted by the Poliklinik für Zahnärztliche Prothetik des ZMK-Zentrums der Universität Gießen (Polyclinic for Dental Prosthetics at the ZMK Centre of the University of Gießen) [for example 1,2,4,5], patient satisfaction after a dental or patient-influenced optimisation of the margin of full upper jaw prosthetics using impressions with an elastomeric impression material (Xantopren function, Xantopren function light, Heraeus Kulzer) was determined [Wagner et al. 8]. Whereas some patients (20) were able to influence the impression process through pursing of the lips, movement of the cheeks, speaking and swallowing, 16 patients had to leave all manipulations to the dentist. In the end, no significant differences could be determined once the impression had been relined with Palapress (Heraeus Kulzer), so that - with an overall successfully-

improved prosthetic margin design and resulting patient satisfaction - the procedural method does not appear to play a significant role.

"Poor hygiene - impression disinfection"

In an article by I. Denzer and J. Schubert entitled "Poor hygiene - impression disinfection [9], it has been determined that disinfection was already being carried out since the end of the twentieth century, but that the appropriate hygiene recommendations by the RKI [10] and the DGZMK [11] were obviously not always being maintained. However, attention was already being drawn to the necessity of impression disinfection in the 1960's [12].

The authors are correct to maintain their recommendation to include impression disinfection in own hygiene chains in terms of Quality Management, in order to avoid risks both in the practice and in the dental laboratory.

Is it possible to transport alginate impressions safely?

Whereas elastomeric impression materials can easily be treated with suitable disinfectant and then transported within the dental area (practice or external laboratory), alginate impressions cannot. They can be disinfected with suitable preparations, but their dimensional stability is at risk if they are not cast immediately after the impression has been made, rinsed and disinfected. M. Göllner recommends transport in a damp chamber (Algiport II, Elben-Dental) [13], whereby using this transport box could at least minimise the risk of quality losses. However, it is without doubt safer to cast alginate impressions within the practice.

Intraoral scanner considered positive by patients

In particular for patients with a strong gagging reflex or respiratory problems, digital impressions may contribute towards an improved relationship between patient and dentist. In addition, patients lose their fear of impressions, as it is possible to interrupt the process of data recording at any time.

At the IDS 2011, nine different systems for the digital recording of intraoral data were presented. They were based on the triangulation principle. In these systems, measurement takes place through a laser beam projected by a sensor, the backscattering of which is guided by the surface of the object being measured via a lens in an oblique viewing angle onto an optoelectronic receiver unit. The distance from the sensor to the object being measured is calculated via the position of the received laser beam on the chip [B. Maier 14].

Even if the hybrid polyethersiloxanes previously mentioned are not yet listed in the Dental Vademekum, the BZÄK/KZBV/IDZ (Federal Association of Dentists/Federal Medical Association/Institute of German Dentists) product guide [Pfeiffer 15], this publication does provide a complete overview with comprehensive data material. The same applies for the Dental-kompakt-Jahrbuch 2011 (Condensed Dental Yearbook) [16], in which the introductory article by Rehmann et al. [2] and a table listing the digital scanners are also contained.

Again a quote from the scientist from Gießen, who has concerned himself for many years with the subject of impressions. He wishes that this topic would generate more interest: "Here we are not thinking sufficiently in terms of economics; many dentists see only the time expenditure. However, from an economic point of view it is far better to invest five more minutes in the impression in order to save a quarter of an hour of grinding. The necessity for repetition is a problem of which many laboratories, no matter how high their quality, are aware. There is high potential for optimisation here", says Wöstmann [1].

It isn't only about the dentist, but also about the team member participating in this working process being aware of and fulfilling the requirements for an optimum procedural method with the respective impression method [Kimmel 17].

There are at present numerous reasons why the classic impression will continue to remain the standard method, whereby the cost-benefit ratio will of course continue to play a role. Substantial research is required before digital impressions can expand into other indications. Seen overall, patients and dentists, but also dental technicians, are thankful for any progress made. The main aim remains to execute an impression with as few faults as possible, with the least possible stress for the patient and with the lowest possible amount of effort.

Kimmel

The Bibliography can be requested via email from leserservice@dzw.de at the DZW Editorial Office