How to Prevent Microleakage in Implants?

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Every colleague working in implantology is familiar with the unpleasant odor when opening the implant body (Fig. 1). The involved bacterial colonization is immanent in all multipart implants, however, it can be prevented by adequate treatment methods. In my practice I would notice a putrid smell when making the implant prosthetics. Usually, this smell occurs upon removal of the gingiva former after a few days and naturally when opening the implant bodies.

This is unpleasant for dentist and patient alike. Moreover, it is no great pleasure for the dentist to explain to the patient that implants are colonized with bacteria and consequently do stink. Prevention of bacterial colonization is absolutely desirable for the sake of personal comfort, not to mention medical considerations. When looking for reason and solution, I first contacted the implant makers to get information why implants simply seem to be untight. However, from their side, there is a great silence regarding microleakage and the involved odor development. On the Internet, you see impressive high gloss photos promising an optimal implant fitting, on the other hand, you will not find any information on gap formation between abutment and implant body.

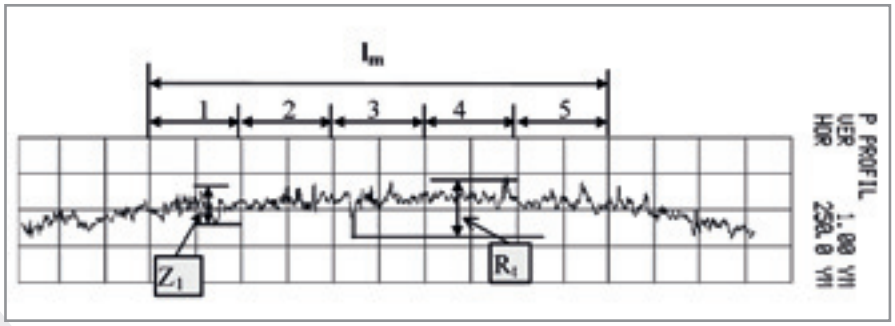

Fig. 2: A surface roughness of more than 1 µm remains in titanium even in case of optimal treatment [2]

Fig. 1: Putrid odor development due to bacterial colonization

Reality, however, shows that multipart implants always feature gaps with an active liquid and germ exchange from the implant body to the in- and outside, which has been proved as microleakage in many current studies. This is most plausible when looking at an implant construction in more detail. [1] Nearly any modern two-piece implant system is made from titanium and zircon (zirconium). Even with the cleanest polish and most modern production techniques, the surfaces still show deviations of at least 1 micrometer (Fig. 2). This seems to be insignificant. For germs, however, they are large inlets. Manufacture tolerances may also affect these optimal values considerably. Even in case of optimal manufacture, dimensions "equal upon equal" might not fit as the parts have to be sticked into one another. Also conical implants cannot be shut hermetically. In case the abutment is additionally screwed, new gaps will develop in the thread. Capillary forces contribute by providing an active exchange between implant interior and the germ-loaded oral cavity. Mastication once more enlarges the gap considerably, as titanium implants are no rigid bodies reacting elastically under function as shown in Fig. 4 respectively table 1: namely by up to 15 micrometers for Astra or Straumann.

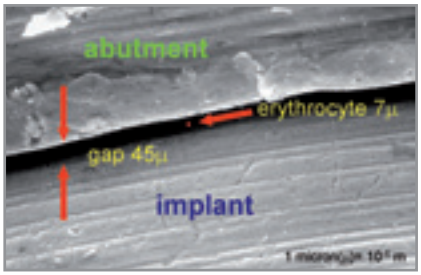

Fig. 3: Size of an erythrocyte and implant-abutment-gap relation (magnification 1:750).

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Evidently, there is still quite some need for communication between dentists, scientists and implant manufacturers. The implant manufacturers are convinced of their implants' quality but daily work reveals that the density of the implants is not as satisfying as claimed by them. Dentists, however, are familiar with the typical unpleasant odor emitted by implants. Researches provide clear evidence of the development of real germ cultures in implants.

After identification of the reason I looked for a solution. My first attempts headed for CHX. Unfortunately, CHX does not fight fungi and viruses but only bacteria. Furthermore it only features a short-term effect. Finally, I discovered a suitable material called GapSeal (Hager & Werken, Duisburg, Germany, Fig. 5) on the IDS, which stood the test in my daily practice work and which has proven clinically for more than 18 years. GapSeal is a highly viscous material (hermetical seal) featuring hydrophobic characteristics (no washing-off), which keeps its consistency and does not harden (no new gap development). In my daily practice work, I do not only use GapSeal during prosthesis making and the respective implant build-up but as gap sealer for every fixed two-piece implant system (Fig. 6).

Size of Microgap Under Different Mechanical Loading Conditions

	Implant system											
	Ankylos c/x				Ankylos Plus				Bone level			
Load type	A	B	AF	BF	A	B	AF	BF	A	B	AF	BF
0 N												
Virgin	11	0.3	0.6	0.1	0.3	0.2	0.2	0.3	0.2	0.4	0.2	0.3
Fatigue loaded	4	0.2	0.7	0.1	31	1	5	3	0.8	0.2	0.7	0.7
30 N, 90 degree												
Virgin	0.2	0.9	12	0.1	0.6	1.2	3	0.2			1.8	1.7
Fatigue loaded	0.5	0.7	12	0.2	1	12	32	0.3				
100 N, 90 degree												
Virgin	0.5	4.6	28	0.1	3	10	18.5	0.1			18	13
Fatigue loaded	1.2	2.5	24	0.2	0	30	36	0				
200 N, 30 degree												
Virgin	0.1	0.7	24	0.1	0.1	4	9	0.1	0.2	0.3	0.3	0.6
Fatigue loaded	0.1	3	22	0.1	–	–	25	0.1	0.3	0.1	1	1

Values for the virgin IAC assemblies are reported in Rack et al.

Table 1: Size of micro gap under different mechanical pressures and mastication [3]

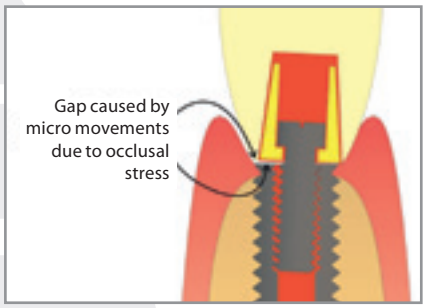

Fig. 4: Schematic representation of micro-movement under mastication [4]

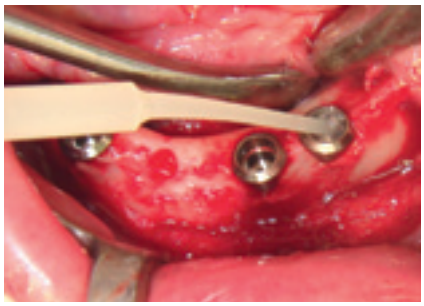

Fig. 5: Ready-for-use GapSeal in situ. Easy and fast handling

Source:
[1]: Fritzemeier,CU Peri-implantitis prophylaxis by sealing implant gaps and hollow spaces. implants 2013, 3 (41-43)
[2]: Oberflächenrauheitsprofil eines feingeschliffenen Metallprobekörpers (Titan), Werkstoffkunde ZZM Charité HUB, 2009
[3]: Rack T, Zaler S, Rack A, Riesemeier H, Nelson K. An in vitro pilot study of abutment stability during loading in new and fatigue-loaded conical dental implants using synchrotron-based radiography. Quintessence 2013, Vol. 28, No. 1
[4]: Zipprich, H. et al. Erfassung, Ursachen und Folgen von Mikrobewegungen am Implantat-Abutment-Interface. Implantologie 2007,15 (31-46)

Fig. 6: GapSeal applicator allows on-the-spot application for 2 – 3 implants per cartridge

GapSeal set (Applicator + 10 tips)	REF 152 041
GapSeal refill (10 tipsa 0.06 ml each)	REF 152 040
Applicator	REF 152 042

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