Interview Dr. MARC QUIRYNEN

Professor M. Quirynen graduated in 1980 as dentist at the Catholic University of Leuven and finished in 1984 his training in periodontology at the department of Periodontology (Catholic University Leuven). In 1986 he presented his Ph. D. entitled: Anatomical and inflammatory factors influence bacterial plaque growth and retention in man. In 1990 he was appointed professor at the Faculty of Medicine of the Catholic University of Leuven to teach periodontology and head & neck anatomy. His research deals mainly with oral microbiology (with special attention to the influence of surface characteristics on bacterial adhesion and the effect of antiseptics), oral malodour, simplification & optimization of periodontal therapy including implant surgery. He published over 300 full papers in international peer-reviewed journals. He is member of the editorial board of the Journal of Clinical Periodontology (associate editor), Clinical Oral implants Research, Journal of Dental Research, Periodontal Practice Today & Parodontologie.

1. As a senior clinical researcher in periodontology, how has your knowledge of periodontal disease changed from when you started?

Over the last 35 years I have encountered several fantastic changes in our thinking in periodontology. Probably the most important change for me was the understanding of the fact that the bacteria on teeth and implants form a biofilm. The latter has significant clinical consequences.

- Due to the dens packing of the bacteria in a biofilm and the formation of a matrix around them, the biofilm becomes very difficult to penetrate, both for antispetics as well as for antibiotics.
- Some bacteria from the plaque biofilm can produce molecules (e.g. β-lactamase, produced by Streptococci) that can simply neutralize antimicrobial components (e.g. Penicilline). As such these organisms protect themselves, but also other species within the biofilm, against some antibiotics.
- Bacteria in the deeper part of the biofilm, close to the tooth surface, no longer multiply because of a lack of substrate. They are so to say in a steady stage

(stand-by phase). Antibiotics that primarily work via bacterial growth inhibition, will have no impact on these bacteria.

- The bacteria in a biofilm live very close together and exchange DNA with each other. As such, super resistant bacteria are created, which, if an antibiotic is used, will require higher concentrations of the antibiotic and probably several types of antibiotics at the same time.

Research has clearly indicated that, in comparison to bacteria in a planktonic condition, bacteria in a biofilm will be 1000x more resistant to antibiotics. It is of course impossible to increase the dosage of antibiotics with a factor 1000x. The only solution is to destroy the biofilm (for example subgingivally via ultrasonic instrumentation or root planning; supragingival via proper plaque control or polishing) before an antibiotic (or even an antiseptic) can be applied. Only under these conditions a maximal benefit can be expected.

Also my understanding of the aetiology of periodontitis has changed significantly over time. Whereas in the beginning plaque was seen as the important aetiological factor, today we realise that many more factors are involved (Table 1). Three important conditions have to be fulfilled in order for a patient to develop periodontitis: (i) the patient has to be susceptible (indicating that a part of our population might be considered resistant to periodontal infections), (ii) the patient has to be infected by a number of periopathogens, (iii) but the concentration of beneficial bacteria might not be too high. The susceptibility of the patient for periodontitis is primarily genetically predetermined, but is further influenced by additional factors such as smoking, the presence of diabetes, medication (for example medication that reduces the salivary secretion, or that reduces the immune response). Also stress can lead to a very rapidly progressing periodontitis. The understanding of the role of beneficial species also significantly influenced our way of thinking. The latter opened the door for the use of prebiotics or probiotics. More recently the impact of patient's diet and obesity has been proven. In the aetiology but also the treatment of periodontitis, all 3 conditions have to be considered, since periodontitis is not only dependent on the bacterial load

and composition of the biofilm. Unfortunately, today we are not able to measure patient's susceptibility to periodontal disease.

Finally, the clarification of the impact of periodontitis on the general health of the patient further underlined the need of periodontal health. It is however still very difficult to convince the medical world about this important relationship.

"Susceptible" host	Pathogenic species	< Beneficial species
Immune reaction inefficient/genetics	*A. actinomycetem-comitans*	Actinomyces sp.
Smoking	*P. gingivalis*	*S. mitis*
Diabetes	*T. forsythensis*	*S. sanguis*
Medication	Spirochetes	
Stress	etc...	
Viral infections?		

OH, obesitas, diet

Table 1. Schematic illustration of the aetiology of periodontitis with 3 specific domains: the susceptibility of the host, the presence of pathogenic species, and the role of beneficial species. Some patient risk factors are behavioural based, and thus modifiable by adequate compliance (for example improved oral hygiene and smoking cessation), while others are not modifiable and change the patient susceptibility (genetic susceptibility, previous history of periodontitis) or systemic status (e.g. diabetes)

2. And what do you expect to gain from future research in periodontitis?

Difficult to say! A better understanding of the threshold level of perio-pathogens needed to start the development of periodontitis, this in relation to the susceptibility of the patient, would be extremely important. The latter could help the clinician to personalize both patient's prevention as well as the treatment endpoint. Moreover, it would be nice to further improve the outcome of periodontal therapy, preferably with the use of antiseptics and eventually pro- or prebiotics, in the therapeutic phase, but also during secondary prevention.

3. Back in 1995, you discovered the concept of the full-mouth disinfection for periodontal treatment. How do you see that procedure nowadays?

Perio-pathogens do colonize the entire oral cavity (thus also the saliva, the tongue, the epithelial surfaces of the cheeks and lips, and even the tonsils). In order to reduce the chance for an intra-oral transmission (also called cross-contamination), we introduced in the nineties the so called "one-stage, full-mouth disinfection". It consists of a combination of following therapeutic efforts: a full mouth scaling and root planning within 24 to reduce the number of subgingival pathogenic organisms, a subgingival irrigation of all pockets with a 1% chlorhexidine gel in order to kill remaining bacteria, tongue brushing with an antiseptic to suppress the bacteria in this niche, mouth rinsing with an antiseptic to reduce the bacteria in the saliva and on the tonsils.

Several comparative studies between the one-stage, full-mouth approach and the standard therapy (root planning per quadrant with 2 week intervals), clearly illustrated the benefits of such a full-mouth approach (more gain in attachment, pocket depth reduction, and more favourable microbiological shifts). A similar approach during guided tissue regeneration and/or the application of local antibiotics also resulted in significant additional improvements.

Today, we still follow this approach. The only aspect that we have changed over time, is that we only conduct our full-mouth disinfection, after the patient has clearly obtained a perfect plaque control. During the "training period" in plaque removal, we will destroy the supra- and subgingival biofilm with ultrasonic devices, and we will wait for an optimal plaque control capacity as long as it takes before the full-mouth disinfection is conducted, because the patient should realise the importance of a perfect oral hygiene.

5. Another very interesting research topic that you are involved in at the moment is peri-implantitis. Do you think that it will be possible to fully understand and manage properly this pathology in a near future?

In healthy patients, dental implants placed under favourable conditions have resulted in high success rates (over 95%), even after 15 years' follow-up. In spite of this excellent efficacy, technical, biological and aesthetic complications may and do occur. The outcome can be different when dental implants are placed in patients affected with systemic diseases or other compromising conditions. Metabolic disorders or immune deficiencies can, for example, give rise to surgical complications and may also interfere with bone apposition and/or remodelling at the implant-bone interface. Similarly, radiation therapy in the surgical area may significantly reduce cellularity and vascularity, and hence also affect the healing of oral implants. In these compromised patients and situations, implant-based treatment may be questionable. Medication, such as biphosphonates and/or anticoagulants may also affect the outcome of implant therapy or increase the frequency of post-operative complications. In these patients, the placement of dental implants should be done under strict guidelines.

Over the last years nearly at every dental meeting speakers are warning for a tsunami of patients with peri-implantitis, with incidences up to 50%. Why is this?? First of all we have to accept that the clinical protocol for the placement of dental implants has changed significantly over the past 35 years (Table 2). From a very strict "biocompatibility"-oriented protocol, aiming for osseointegration and long-term success, there has been an evolution towards less stringent conditions with the aim of "speeding the healing process" and "improving the aesthetic results". Whether these changes have increased the susceptibility for peri-implantitis has not been proven, even though some changes might increase the chance for infection or for a less favorable hard tissue response.

CURRENT CHANGES TO IMPLANT PROTOCOL "original" protocol strict, biocompatibility = crucial	 "present" protocol less strict, speed & aesthetics = crucial
indication / planning	
primarily full edentulous patients	all type of indications
strict inclusion/exclusion criteria	rare exclusion criteria
minimal jaw bone width of 7 - 8 mm	GBR for horizontal augmentation
minimal jaw bone height of 10 mm	GBR for vertical augmentation
planning based on 2-D radiographs	3-D CBCT and virtual planning
6 to 8 implants in edentulous jaw	3 to 6 implants
anterior to sinus maxillaris	sinus augmentation techniques
timing	
4-6 months healing after tooth extraction	immediate placement
2-stage surgery	1-stage surgery
submerged healing (3-6 months)	non-submerged healing
no denture after implant insertion	immediate loading
surgical protocol	
only specialists	general dentists
no surgical guides	guided implant placement
pre-surgical antibiotics	no standard antibiotic prophylaxis
pre-surgical atropine to reduce saliva	no atropine
low speed placement + excessive cooling	higher speed, no cooling
2 surgical aspirators (OP area & mouth)	single aspiration
palatally/lingually pediculated flap	crestal incision
prosthetic protocol	
abutments not removed after 2nd surgery	prosthesis on implant level
Ti-abutments	different materials in mucosa
implants inter-connected	free standing implants
screw retained	cemented
cast CrCo/Au framework	CNC milled framework
occlusion in resin	occlusion in porcelain/metal
prosthesis design focused on cleansability	prosthesis design focused on aesthetics
implant material/design	
minimally rough implants	moderately rough implants
CP Grade I Ti implants	Grade III-V Ti implant
external hex connection implant abutment	internal connection
implants ∅: ≥ 3.5 mm and length: ≥ 10 mm	short / narrow implants
no platform switch	platform switch
OVERALL APPRECIATION: **very "strict" protocol,** **biocompatibility = crucial**	 **"less" strict protocol,** **speed & aesthetics = crucial**

Table 2. Changes to the original "standard" protocol of most clinicians in the seventies & eighties.

In the pathogenesis of peri-implantitis we can identify 3 major pathways: infection, occlusal overload, and, what is often forgotten, the compromised healing/adaptation of the alveolar bone after implant insertion/loading. The latter can be explained by: (i) a poor surgical technique killing the cells needed for bone repair, (ii) a host bed disturbance due to genetic disorders, disease, or drugs, or previous irradiation, (iii) too much strain for bone cell adjustment due to implant misfit or prosthodontic errors, (iv) smoking and allergies or similar conditions that disturb bone cells and or their vascular supply.

Similar to periodontitis, the aetiology of peri-implantitis is thus multi-factorial (Figure 1). The inflammation is thus not only dependent on the bacterial load, but also on different factors at implant, patient, and clinician (surgeon, dentist) level. As for most chronic infections, one can apply a multi-causality model to explain peri-implantitis in order to understand its complexity. Such a multi-causality model is justified because: (i) peri-implantitis can be caused by more than 1 causal mechanism, (ii) every causal mechanism involves the joint action of several causes, (iii) most causes are neither necessary nor sufficient to produce disease by them self, (iv) removal of a single cause will not necessarily leads to prevention of the disease, and (v) blocking of a cause will reduce significantly the incidence of the disease. Besides the host (genetics, quality of immune response), the environment (concentration of perio-pathogens, anaerobism), and the life style of the patient (smoking, oral hygiene, ….), factors such as the hardware (implant and abutment surface roughness, platform switch, internal vs. external connection, …), the procedure (GBR, bone condensing, bone compression, cement vs screw retained) and especially the quality of the hard/soft tissues (bone density and vascularisation, quality of soft tissues, ….) can have a significant impact on the final outcome of the implant (Figure 1).

So far no treatment strategy for peri-implantitis performs significantly better than another. Prevention of this disease therefore is the issue. The observation that only one surgeon/one prosthodontist from a team of more than 10 surgeons and 10 prosthodontics was found to be involved with more than 40% of all patients with peri-

implantitis clearly points to the significant role of the clinician.

Today the concept of total inflammatory burden gains more and more acceptance. It suggests that a patient can cover/survive a certain amount of infections, but once a certain threshold is overpassed, the pathogens seem to overrule the immune response and resistance, so that tissues are damaged. It might therefore be wise to reduce the general infectious burden in a patient to a minimum, although this philosophy still has to be explored and proven. Easy factors to consider are: cleansable prostheses, improved oral maintenance, strict supportive periodontal therapy schedule, reduce smoking, increase physical exercise, improve diet (e.g. antioxidants), reduce corrosion, include other auto/inflammatory diseases in therapy.

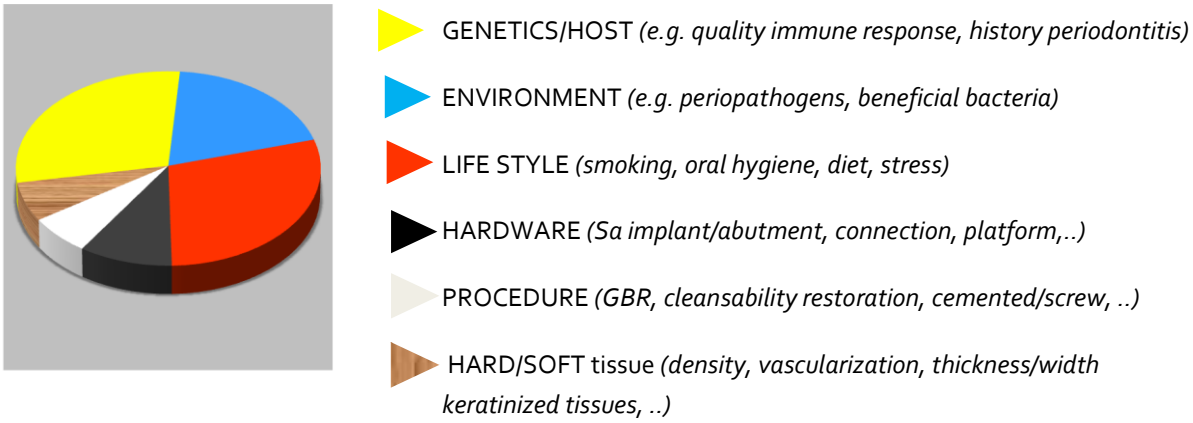

Figure 1. Multi-causality model for the aetiology of peri-implantitis

6. Looking back at your enormous career and what you have achieved so far, what are your plans for the future regarding research?

My priority in research is to find strategies to improve the outcome of periodontal therapy, including oral implants and oral malodour, and to facilitate the prevention of disease recurrence. I am thinking at: (i) the stimulation of the "beneficial bacteria" via pro- and prebiotics, (ii) the facilitation of optimal plaque control, (iii) an improved 3-D planning of oral implants, (iv) a simplification of tissue regeneration (for example via the use of leucocyte and platelet rich fibrin.