Prevention and Treatment of Peri-implant Disease
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Introduction: Treatment involving dental implants has raised the bar on the quality of service that dentists can provide for their patients. With dental implants, clinicians can often reconstruct an entire dentition, even when nature and all other dental services have already failed. Dentists can also replace ailing teeth without damage to adjacent teeth, and rebuild the posterior teeth to support and protect anterior teeth. Indeed, despite depleted oral health conditions, dental implant based treatment can provide a functional and esthetic result, unattainable by other means.

Peri-implant disease is a serious treatment complication, that can result in premature treatment failure. In its early stages, peri-implant disease may appear as peri-implant mucositis, which is mainly a soft tissue complication, and it may progress to cause the destruction of the hard tissues that support the implant. This later stage is called peri-implantitis. Treatment complications and failure that result from peri-implant disease can be costly for both the patient and their dentist. There appears to be a growing prevalence of peri-implantitis. Perhaps, this may have to do with the many dental implants already in the mouth, and the increasing number of implants placed every year. The prevalence of peri-implant disease is known to increase with the amount of time dental implants are in in the mouth.

According to the literature, there does not appear to be a definitive treatment for peri-implantitis. This disease seems to have many contributing factors, that include patient related factors and industry related factors. My below discussion will focus on factors that relate to the currently prevalent prosthesis installation techniques. My discussion will focus upon making intra-oral prosthesis installation safer. The proposed installation protocol is sensitive to **model inaccuracy and the "Gingival Effects".** The Gingival Effects have been discovered and described by Dr. Svoboda.

Recent reviews, that relate the incidence of peri-implant disease to installation technique, have been unable to find a difference between the two prevalent installation procedures. These two prosthesis installation techniques can be called the cement-in technique and the screw-in technique. They have some similarities, but differ in the potential risk factors that they can create for the patient. These risk factors are known to be related to the development of peri-implant disease. Preventing these risk factors can result in a decrease of related complications. "An ounce of prevention is worth a pound of cure", Benjamin Franklin.

The Problem: Almost all dental prosthetics are made to fit dental models which represent conditions in the mouth of the patient. It is unfortunate that all models are inaccurate, and some models are more inaccurate than others. This statement is true, whether models are derived from physical or digital impressions. It is also unfortunate

that the laboratory technician and the dentist are usually unable to judge the accuracy of the model and thus the accuracy of the prosthesis that is constructed upon it.

The current screw-in prosthesis installation technique can cause the "implant-abutment misfit". When the abutments and the prosthesis are joined together, according to information derived from an inaccurate model, the parts of the abutments that are to connect to implants inside the mouth, are also inaccurate. Thus, the amount of model inaccuracy determines the amount of misfit at the implant-abutment connection during the screw-in installation processes. The implant-abutment misfit is a known risk factor for peri-implant disease.

The current cement-in prosthesis installation technique can optimize the implant-abutment connection, but can cause the advent of residual subgingival cement. The cement-in protocol requires that abutments be individually installed, prior to attaching the prosthesis. The accuracy of fit, between the implants and the abutments are thus determined by the accuracy of the machined parts, and not the laboratory model. Unlike the screw-in technique, the cement-in technique can optimize the implant-abutment fit. However, the process of intra-oral cementation may cause the problem of "residual subgingival cement". Residual subgingival cement is a known risk factor for peri-implant disease.

Both the above issues are well documented in the literature and are reviewed by Dr. Svoboda's in his 2017 Chicago Presentation. (www.ReverseMargin.com). This presentation also includes relevant literature, that supports all the information presented in this article and a means of mitigating the above risk factors, to prevent related complications.

In a 2009 study, TG Wilson, a Periodontist in Texas, found that 81% of the single "cement-in" crown restorations, referred to his office with peri-implant disease, were found to have residual subgingival cement. He also found that removing this cement resulted in a resolution of the disease in 74% of the cases. This is exciting news, as 74% of the time, residual subgingival cement appears to have caused the observed peri-implant disease. Remove the cause, and that specific problem is resolved. Indeed, it appears to be prudent for a clinician to suspect residual subgingival cement, whenever persistent inflammation is observed around any cemented prosthesis. **Locating and cleaning away residual subgingival cement could eliminate related peri-implant disease 74% of the time. That could be viewed as a reasonable rate of success, for the treatment of peri-implant disease.**

What about the prosthesis that has been installed by the screw-in technique? Unlike the cemented prosthesis, there is no residual subgingival cement to worry about, because the abutment-prosthesis complex is usually joined or cemented together to fit a laboratory model outside the mouth, before being installed into the mouth. Excess cement, if used to lute the abutment-prosthesis components, can thus be effectively located and cleaned away before the prosthesis is installed. Unfortunately, because laboratory models are inaccurate, the dentist will usually need to adjust contacts, fit and occlusion during the installation process. Since the accuracy is variable, some

installations will go better than others. Indeed, if the models were accurate representations of the mouth, there would be little or no need to adjust the prosthesis during the installation process.

The screw-in technique stipulates that the prosthesis be connected to the retaining abutments on the laboratory model prior to being installed into the mouth. Once the abutments are physically connected to the prosthesis that has been made to fit the inaccurate model, it will be difficult or impossible to properly align the abutment connector parts with the implants in the mouth, and achieve an optimal fit. Indeed, the implant industry created the multi-unit abutment that does not closely engage the internal configuration of the implant. Its design builds a little tolerance into the screw-in system, and allows the dentist to insert their prosthetics into slightly off-parallel implants and feel that the fit of the implant-abutment connection is optimized, or at least adequate. Unfortunately, this may not usually be the case.

In addition to a misfit caused by mal-aligned abutments, the ability of the abutment to optimally connect to the implant, may be frustrated by tight contacts between the inaccurate prosthesis and adjacent teeth. Tight contacts can push abutments off their implant base. The implant-abutment misfit or macrogap can result in both mechanical and biological problems. Indeed, the stress of tightening the abutment base onto/into the implant retainers may irreversibly distort the implant-abutment components and even put the peri-implant bone into a pathological stress situation. (Misch 2015)

The implant-abutment misfit can be difficult to diagnose and very difficult to clean or correct. How does the patient clean a misfit implant-abutment connection? How does the clinician clean a misfit implant-abutment connection? How effective would it be to raise a surgical flap to clean the misfit connection? How effective would it be to remove the prosthesis, graft a peri-implant bony defect and replace the prosthesis? If the Implant-abutment misfit was the cause of the original peri-implant bone being lost, what hope could a clinician have that the new graft will survive the continuing challenge from oral pathogens residing in the spaces between the abutment and the prosthesis?

Treatment for peri-implant disease, for prosthetics installed by the screw-in technique would be expected to have a poor to guarded prognosis. The best solution may involve the replacement of the prosthesis in such a manner as to prevent the implant-abutment misfit. Dr. Svoboda describes such a process that includes the "Svoboda modification". (Retrievability Article 2016, Chicago Presentation 2017). For a remake situation, this could work if the implant connectors have not already been damaged/distorted by the previous installation attempt, or by function on a poorly fitting implant-abutment connection.

In addition to the above “relatively irreversible implant-abutment misfit complications”, the current screw-in technique may require the prosthesis to be cantilevered facially, to allow for a hidden and accessible screw access hole. This type of “technique related cantilever” can add additional load stress on an already mechanically compromised implant-abutment connection. This cantilever may also compromise the ability of the patient or

clinician to access and maintain the implant-abutment-prosthesis complex. **Existence of peri-implant plaque is another known risk factor for peri-implant disease**.

It is the authors opinion, that recovery from the problems of an implant-abutment misfit/macrogap and the other screw-in technique related problems, are very difficult, while its prevention can be relatively simple. Including the “Svoboda Modification” to the screw-in installation process can, at least optimize the implant-abutment connection, and prevent its’ related complications.

Much has already been accomplished by Dr. Svoboda, through his research and deep understanding of the prosthesis installation processes. He has discovered and described several ways to make the process of intra-oral cementation safer, including the **prevention of residual subgingival cement**. In order to accomplish the safer cementation process, it is important to understand 1) the effect of margin design on the flow of excess cement exiting the margins, 2) the Gingival Effects, that describe how the base of the prosthesis can interact with adjacent gingiva to cause cement to be propelled deep into the tissues 3) how to mitigate the Gingival Effects by the use of “well designed “ custom abutments and prosthetics and 4) how to prevent dangerous cement voids under the prosthesis, especially as related to some techniques that use venting or the retainer replica techniques to control the occurrence of residual subgingival cement.

In addition to the above findings, **Dr. Svoboda is presently working on the cause and prevention of open margins and prosthesis overhangs.** These problems may also contribute to peri-implant disease. **Register your name and email address on his website, to be the first to find out about these problems and how to prevent their related complications.**

Dr. Svoboda encourages you to become familiar with his basic research that led to the development of his safer cementation designs and procedures, that he named the Cement Control System. The implications of his work are already far-reaching and pertinent to the prevention of peri-implant disease. Many of his safer cementation concepts can also be applied to the restoration of natural teeth, to make that process safer too.

Extrapolated from TJ Wilson’s study and the large reviews mentioned earlier, we can expect a 60% reduction in peri-implant disease, if we can optimize implant-abutment connections and prevent the occurrence of residual subgingival cement. That reduction of technique related disease is pertinent for both the screw-in and the cement-in prosthesis installation techniques.

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