Short Communication

Therapy of Percutaneous Infection Around Craniofacial Implants

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This study sought to develop treatment strategies for managing percutaneous infection around craniofacial implants. The present general pathogen situation together with a bacterial resistance were determined in 57 infected peri-implant sites. Forty-four implants were randomly assigned for wound cleaning and split into three groups—two with local antibiotics of proven efficacy and one with 3% hydrogen peroxide (H_2O_2). The pathogen spectrum differed depending on the severity of the infection, with *Staphylococcus aureus* clearly correlated with the degree of inflammation (positive correlation: $R = 0.72$). It was observed that the use of additional local antibiotics was not superior to conventional wound cleaning with 3% H_2O_2. It is suggested that sulcus fluid flow rate measurements could serve as a simple and reliable objective parameter for recall examinations. *Int J Prosthodont 2009;22:594–596.*

Craniofacial implants serve as secure points of fixation for facial prostheses with skin-perforating abutments or magnets.[1] The peri-implant region is regarded as a vulnerable junction or interface because of the risk of local infection and the eventual development of a latent inflammatory situation.[2]

Despite thorough implant care, including an absence of mechanical stresses, the thinned out peri-implant skin is regarded as being particularly vulnerable to peri-implant infections, as encountered in similar percutaneous connections. Consequently, there is a risk that recurrent peri-implant infections may ultimately lead to loss of the implant abutments.[3]

In periodontics, the sulcus fluid flow rate (SFFR), measured in millimeters using paper tips, permits the detection of infections before clinical symptoms are manifested (Table 1). It has therefore been proposed that this is a sensitive diagnostic method, which may be useful for monitoring purposes as well.[4]

Currently, no uniform guidelines have been described in the literature for percutaneous infection in craniofacial implants.[5]

This study sought to evaluate the efficacy of the conventional local management of percutaneous infections with 3% hydrogen peroxide (H_2O_2) when compared to supplementary therapy with local antibiotics. The SFFR technique was employed for clinical monitoring purposes.

Materials and Methods

This study was performed according to the guidelines of the Declaration of Helsinki (1964) and all recruited patients provided written informed consent before their inclusion. A total of 32 patients with 101 orbital, ear, eye, and nose implants were included in this study: 18 patients (n = 57 implants) underwent preliminary tests to clarify the bacterial spectrum in the peri-implant sulci (agar plates) and to determine suitable antibiotics (disk sensitivity test by oxoid); another 14 patients (n = 44 implants) were randomly divided into three groups and treated daily for 8 days with two of the most effective local antibiotics (Achromycin, Lederle; 30 mg/g tetracycline hydrochloride and Neobac, Dermapharm; 5 mg/g neomycin sulfate and 500 IE bacitracin) or 3% H_2O_2 only (control group).

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Table 1 Classification of SFFR Intraoral Conditions

SFFR value	Classification
0–0.7 mm	Normal gingiva
0.8–1.6 mm	Light gingivitis
1.7–3.3 mm	Gingivitis
> 3.4 mm	Severe gingivitis

SFFR = sulcus fluid flow rate.

Table 2 Empiric Classification of SFFR Extraoral Conditions

Classification	SFFR value	Therapy
Grade 0	0–2 mm	No therapy required
Grade 1	3–4 mm	Requires therapy
Grade 2	5–6 mm	Requires therapy
Grade 3	> 6 mm	Requires therapy

SFFR = sulcus fluid flow rate.

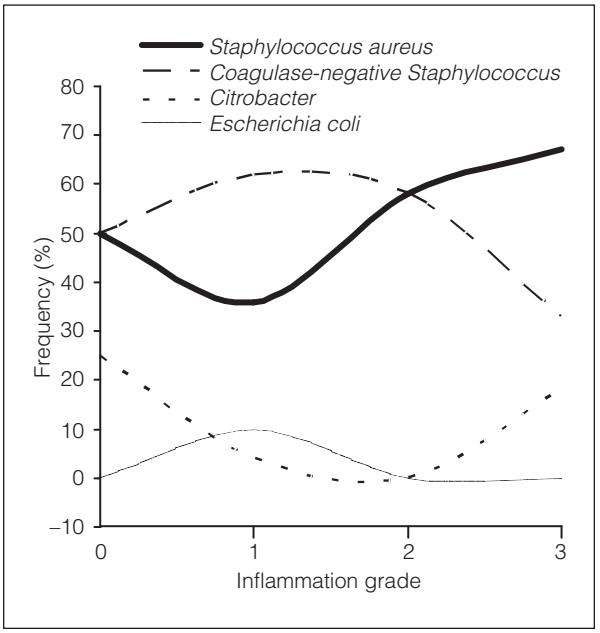

Table 3 Results of the Post Hoc Test

Local AB 1	Local AB 2	Mean difference	SD	*P**
3% H_2O_2	Achromycin	0.727	0.541	.186
3% H_2O_2	Neobac	0.210	0.570	.714
Achromycin	Neobac	0.517	0.562	.363

AB = antibiotic; SD = standard deviation.
*Significance was set at P < .05.

Fig 1 Frequency distribution of bacteria in relation to the degree of inflammation.

The SFFR measurements were empirically classified into four grades (Table 2) and an indication for treatment was established by a measurement of at least 3 mm, as performed with paper tips (ISO 60, Berthold Klein) and stained with 1% ninhydrin (in 70% ethanol).

On days 1, 4, 6, and 8, the SFFR was measured first, followed by a cleaning of the peri-implant tissue with 3% H_2O_2. Subsequently, the antibiotic ointment was applied with a cotton swab in the two selected test groups.

Measurements were compared by distribution-free variance analysis. The qualitative analysis of the microbiologic findings was determined via a four-field table (chi-square test). The level of significance was set at $P < .05$.

Results

In the preliminary survey, all peri-implant sulci were colonized by bacteria regardless of the appearance of the degree of tissue inflammation. The pathogen spectrum clearly differed depending on the severity of the infection and the degree of inflammation correlated with the inflammatory pathogen *Staphylococcus aureus* (positive correlation: $R = 0.72$) (Fig 1). The best results in SFFR were achieved with Neobac, but the difference between it and the control group was negligible.

There were no significant differences between the groups with regard to the comparison of SFFR measurements before and after treatment or the difference values ($P = .39$).

The post hoc test also revealed no significant differences between the three groups in the multiple comparison (Table 3).

A value of $P = .86$ (maximal 1) was significantly dependent on the initial degree of inflammation: the stronger the initial inflammation, the greater SFFR regression under therapy (Fig 2).

Covariance analysis was used to evaluate the success of treatment without the effect of the initial situation (first SFFR value). No significant difference was found here ($P = .38$), as with measurements during the course of treatment.

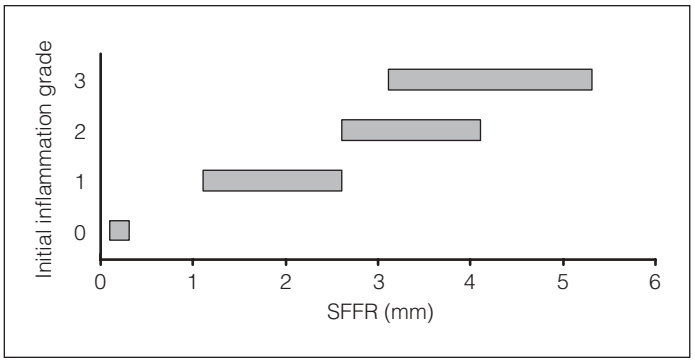

Fig 2 Relative SFFR regression in relation to the initial inflammation grade.

Discussion

Extraoral and intraoral peri-implant conditions differ in tissue structure and bacterial colonization.[6] However, animal experimentation suggests that peri-implant infections can elicit similar tissue alterations due to an enzyme presence that can destroy epithelial structures and enable an accelerated passage of inflammatory metabolites at the interface.[7] The extrapolation of this laboratory finding to implants in the human mouth and skin may not be valid since the pathogenesis of infection around implants in the two tissue sites remains quite controversial. SFFR measurement to evaluate the degree of percutaneous infection around craniofacial implants has been described as appropriate,[8] but histologic correlations remain unproven.

Described therapies of pericutaneous infection around craniofacial implants are far from specific and involve a wide range of protocols—3% H_2O_2, 0.005% sodium hypochlorite, various local antibiotics, and antibiotic or cortisone ointment preparations.[5]

Staphylococcus aureus may be considered the leading pathogen. The mucous found on *staphylococci* is water-soluble and can often be easily removed mechanically.[5] Additional local antibiotics can therefore be considered to not provide any additional benefit. Instead, regular intensive cleansing on recall and the motivation and instruction of patients in cleaning their own peri-implant regions are of great importance for a successful treatment outcome, which simulates the intraoral experience. This approach seems very promising with regard to the risk of development of antibiotic resistance and for economic reasons. However, severe percutaneous infections do require targeted antibiotic therapy.

Conclusion

Long-term data regarding the outcome of implants in cranial bone surrounded by skin as opposed to those in jaw bones surrounded by mucosa cannot be compared at this stage. Hence, observations in this study are limited by the short-term observations noted and their different host sites.

SFFR measurements can be employed as a fast, nontraumatic, inexpensive, and simple parameter for recall monitoring purposes. However, it must be noted that this suggestion is only supported anecdotally.

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