The use of a gel and a dentifrice containing green tea and hyaluronic acid reduced the biofilm and inflammation around dental implants. A short-term pilot study

O uso de gel e dentifrício contendo chá verde e ácido hialurônico reduz acumulo de biofilme e inflamação ao redor de implantes. Estudo piloto de curta duração

El uso de gel y pasta de dientes que contienen té verde y ácido hialurónico reduce la acumulación de biopelícula y la inflamación alrededor de los implantes. Estudio piloto a corto plazo

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ABSTRACT
The aim of this pilot study was to evaluate the effect of different vehicles of oral hygiene containing green tea and hyaluronic acid on the peri-implant clinical parameters. In this study, 21 patients with a total of 112 implants used one of the vehicles tested: 1) dentifrice (10); 2) Gel (11). The patients who received the gel or dentifrice presented a partial fixed rehabilitation supported by implants. Patients were submitted to the clinical analysis on the implants at the baseline and after 10 days of the begging of the use of the products. The probing depth, level of the peri-implant mucosa, distance from the implant platform to the bottom the peri-implant pocket sulcus the gingival inflammation index and the visible plaque index in each of the 6 sites were evaluated. In general, the dentifrice and gel all the products showed to promote a reduction of the biofilm index and inflammation with a slight alteration at the peri-implant mucosa marginal level due to the reduction of the inflammation. It was not perceived side effects related with the use of the dentifrice or gel. So, the conclusion of this pilot study was that the use of the different vehicles containing green tea and hyaluronic acid were able to reduce the biofilm accumulation and the inflammation around the dental implants with safety in a short-term evaluation period in users of partial fixed rehabilitation supported by implants.

KEYWORDS: Dental implants. Oral hygiene. Dentifrices.

RESUMO

O objetivo deste estudo piloto foi avaliar o efeito de diferentes veículos de higiene bucal contendo chá verde e ácido hialurônico sobre os parâmetros clínicos peri-implantares. Neste estudo, 21 pacientes com um total de 112 implantes utilizaram um dos veículos testados: 1) dentifrício (10); 2) Gel (11). Os pacientes que receberam o gel ou dentifrício apresentaram reabilitação parcial fixa suportada por implantes. Os pacientes foram submetidos à análise clínica dos implantes antes e após 10 dias do início do uso dos produtos. Foram avaliados a profundidade de sondagem, nível da mucosa peri-implantar, distância da plataforma do implante ao fundo do sulco ou bolsa peri-implantar, o índice de inflamação gengival e o índice de placa visível em 6 sítios por implante. Em geral, todos os produtos mostraram promover uma redução do índice de biofilme e inflamação com uma ligeira alteração ao nível marginal da mucosa peri-implantar devido à redução da inflamação. Não foram percebidos efeitos colaterais relacionados ao uso do dentifrício ou gel. Assim, a conclusão deste estudo piloto foi que o uso dos diferentes veículos contendo chá verde e ácido hialurônico foram capazes de reduzir o acúmulo de biofilme e a inflamação ao redor dos implantes dentários com segurança em um período de avaliação de curto prazo em usuários de aparelhos fixos parciais reabilitação suportada por implantes.

PALAVRAS-CHAVE: Implantes dentários. Higiene bucal. Dentifrícios.

RESUMEN

El objetivo del estudio piloto fue evaluar el efecto de diferentes vehículos de higiene bucal que contienen té verde y ácido hialurónico sobre los parámetros clínicos periimplantarios. En este estudio, 21 pacientes con un total de 112 implantes utilizaron uno de los vehículos probados: 1) dentífrico (10); 2) Gel (11). Pacientes que recibieron el gel o dentífrico con lavabo parcial fijo soportado por implantes. Los pacientes fueron descubiertos en el análisis clínico de los implantes antes y 10 días después del inicio del uso de los productos. Se obtuvieron la profundidad de sondaje, el nivel de la mucosa periimplantaria, la distancia desde la plataforma del implante hasta el fondo del surco o bolsa periimplantaria, el índice de inflamación gingival y el índice de placa visible en 6 sitios por implante. En general, todos los productos inducidos promueven una reducción del biofilm y del índice de inflamación con un ligero cambio a nivel marginal de la mucosa periimplantaria debido a la reducción de la inflamación. No hubo efectos asociados con el uso de pasta de dientes o gel. Así, la conclusión de este estudio piloto fue que el uso de diferentes vehículos que contienen té verde y ácido hialurónico fueron capaces de reducir de forma segura la acumulación de biofilm y la inflamación alrededor de los implantes dentales en un período de evaluación a corto plazo para usuarios de aparatos fijos. Rehabilitación parcial soportado por implantes.

PALABRAS CLAVE: Implantes dentales. Higiene bucal. Dentífricos.

INTRODUCTION

The good quality of the oral hygiene is essential for the success of dental implants success in a long term[1]. However, this procedure is quite demanding for a huge rate of patients and the occurrence of low-quality oral hygiene is not uncommon to observe[2]. In this way, the use of chemical agents as adjunctive of oral hygiene procedures is extensively indicated, in as much these agents compensate for the inefficiency of biofilm removal mechanically[3]. The dentifrices and gel are the most traditional vehicles used as chemical agents in the oral hygiene procedures[4], and the fluorides are the agents most used as the active agent, since it has presented good outcomes in the reduction of the biofilm accumulation[5], inflammation[6], and incidence of caries in clinical studies[7]. However, the fluoride has been related with corrosion of the titanium alloys and this issue may jeopardize the implants success[8].

In this perspective, the search for alternative chemical agents for cleaning specifically prostheses supported by implants, that do not interfere with the chemical stability of the components used in implant-supported rehabilitation, is necessary. In this context, the use of compost based on green tea deserves highlight, since previous clinical studies in patients with gingivitis has shown that it is highly biocompatible[9], has good potential for biofilm control[9-10] and inflammation reduction[11]. In addition, it has recently been shown that hyaluronic acid has the potential to be used in the treatment of inflammatory conditions by promoting the healing and repair process during the treatment of periodontal disease[12] and in the treatment of ulcers in the cavity oral[13], which may occur due to its bacteriostatic, anti-inflammatory, and antioxidant effects[14]. The use of hyaluronic acid as a chemical agent present in mouthwashes has shown that this product decreases inflammation in patients with gingivitis at the same level as chlorhexidine[15].

Then, the proposal of this pilot study is to test the short-term safety, antibiofilm, and anti-inflammatory effects of two different vehicles of oral hygiene (a gel and a dentifrice) containing green tea and hyaluronic acid in patients that presented prostheses supported by dental implants after a session of professional biofilm control that is a part of a maintenance care program in patients after the oral rehabilitation.

MATERIAL AND METHODS

General Procedures, Eligible Criteria, and Pilot Design

This study was approved by the ethical committee of the Federal University of Uberlandia under the protocol number 549.913. All the patients read and sign the informed consent term. In this pilot study, 2 types of vehicles of oral hygiene contained green tea and hyaluronic acid were tested (Dentifrice and gel) (New Dental Care, São Paulo, Brazil). These products were evaluated in patients that presented partial fixed prothesis supported by dental implants. Twenty-one patients were clinically examined before and after 10 days of the professional biofilm control, that consisted in the removal of the screwed protheses, the execution of the peri-implants analysis, scaling and polishing of the implants and prosthesis. All these patients presented more than one year after the last maintenance visit, and all of then presented the diagnosis of mucositis. All the patients were instructed regarding the oral hygiene procedure and the use of the products during the whole time of the experimental procedure. It was provided to each patient a tube with 100 grams of dentifrice or gel. It was recommended the use of these agents daily, 3 times a day with no modification of the toothbrushing technique regularly used by the patients.

The patients included in this pilot study requires to have dental implants undergoing partial rehabilitation with permanent screwed prostheses installed for at least 12 months, within the age range of 18 to 60 years, and systemically healthy. Smoking, decompensated diabetics and patients with a history of radiotherapy or chemotherapy were excluded from the pilot study.

Formulations

The oral hygiene products tested in this pilot study presented the following formulations:

Dentifrice: Carboximethylcellulose, Glycerin, Sodium benzoate, Xylitol, Titanium dioxide Glucoside Lauryl, Sodium lauryl sulfate, Hyaluronic acid, Polyvinylpyrrolidone K 30, Dimethylsilanediol (DSBC), Tixosil 43 B, Tixosil 73, Tetrashodic pyrophosphate, Saccharin, Green tea extract (camellia sinensis), Ricin hydrogenate oil, Mint Aroma, Edta, Purified water.

Gel: Carboximethylcellulose, Glycerin, Sorbitol, Sodium benzoate, Xylitol, Glucoside Lauryl, Sodium lauryl sulfate, Hyaluronic acid, Polyvinylpyrrolidone K 30, Salicylate Dimethylsilanediol (DSBC), Tixosil 43 B, Tixosil 73, Tetrashodic pyrophosphate, Saccharin, Green tea extract (camellia sinensis), Ricin hydrogenate oil, Mint Aroma, Edta, Blue dye CI42090, Yellow Dye CI 19140, Purified water.

Clinical Evaluation

Six sites per implant (mesio-buccal, buccal, disto-buccal, mesio-palatine-lingual, palatine/lingual, disto-palatine/lingual) were analyzed, before and after 10 days of the professional biofilm control and the beginning of the use of the mouthwash tested in this pilot study, with the evalua-

tion of the following clinical parameters: 1) Probing Depth (PB) - distance from the peri-implant margin to the bottom of the peri-implant sulcus/pocket; 2)Peri-implant mucosal marginal level (PML)- distance from the peri-implant mucosal margin to the bottom of the peri-implant sulcus/pocket; 3) Clinical attachment level (CAL) - distance from the implant platform to the to the bottom of the peri-implant sulcus/pocket; 4) Inflammation Index (II)[16] - Score 0 = Absence of inflammation; Score = Mild inflammation - slight color change in the gingival margin associated with a small change in soft tissue texture; Score 2 = Moderate inflammation - marginal soft tissue with an aspect of vitrification, redness, edema and hypertrophy; Score 3 = Severe inflammation - abundant redness or hypertrophy associated with spontaneous bleeding; 5) Biofilm Index (BI)[17] - Score 0 = Absence of biofilm; Score 1 = Biofilm detected only by probing; Score 2 = Moderate presence of visible biofilm; Score 3 = Abundant presence of visible biofilm or formation of dental calculus.

Statistical Analysis

All data presented a normal distribution as determined by the Shapiro-Wilk test. Then, the paired t-test was used to compare the initial and final values of the clinical attachment level, mucosal marginal level, probing depth, inflammation and biofilm index. The significance level of 5% ($p < 0.05$) was used for all comparisons. The software GraphPad Prism 6 (San Diego, CA, USA) was used to perform the statistical analysis.

RESULTS

Dentifrice

Ten patients with partial fixed prothesis supported by implants were treated with the use of the dentifrice, presenting 48 implants. Only one patient had CAL = 3 mm (patient 2) at the baseline. The results showed that all the patients presented a reduction in the BI and II, with the exception of patient number 4. In general, the use of the dentifrice was associated with the reduction of the BI and II, and an increased in the PML. Tables 1 and 2 shows the peri-implant parameters at the baseline and after 10 days of the beginning of the use of the dentifrice. Table 3 shows the mean and standard deviation of the peri-implant parameters at baseline and after 10 days of the beginning of the use of the dentifrice. There were statistically significant differences ($p < 0.05$) between 10 days after treatment and Baseline periods for BI (10 Days = 0.34 ± 0.38, Baseline = 0.95 ± 0.63), II (10 Days = 0.50 ± 0.49, Baseline = 1.11 ± 0.55), and PML (10 Days = 0.24 ± 0.43, Baseline = 0.09 ± 0.54).

Table 1 - Baseline parameters of the patients that used the dentifrice.

Patient	Number of Implants	Location	PB	PML	CAL	BI	II
1	2	36, 37	0.33	0.58	0.91	1.66	2.08
2	5	14,12,11, 22, 24	2.2	-0.90	1.30	1.23	1.50
3	2	36, 37	1.83	1.16	3.00	2.08	1.83
4	3	13,36, 45	1.33	-0.05	1.27	0.33	0.50
5	5	15,12,22,25, 27	1.70	0.06	1.76	0.00	0.33
6	4	15,25,35,36	1.29	0.00	1.29	0.70	1.00
7	6	15,14,26,27, 35, 37	2.11	0.33	2.44	1.41	1.08
8	8	16,14,24,25,26, 34, 35,36, 45	1.29	0.06	1.35	0.75	0.89
9	9	14,11,21,24,35, 36,45, 46,47	1.18	0.04	1.22	0.48	0.77
10	4	16,14,12, 22	1.00	-0.37	0.62	0.95	1.16

PB - Probing depth (mm); PML - Peri-implant mucosal level (mm); CAL - Clinical attachment level (mm); BI - Biofilm index; II - Inflammation index.

Table 2 - Peri-implant parameters of the patients after 10 days of the use of the dentifrice.

Patient	Number of Implants	Location	PB	PML	CAL	BI	II
1	2	36, 37	0.40	0.55	0.95	0.00	0.00
2	5	14,12,11, 22, 24	1.85	-0.22	1.63	0.13	0.63
3	2	36, 37	1.81	1.30	3.11	0.66	1.16
4	3	-13,36, 45	1.30	0.00	1.30	0.44	0.11
5	5	15,12,22,25, 27	1.75	0.10	1.85	0.00	0.00
6	4	15,25,35,36	1.16	0.00	1.16	0.33	0.25
7	6	15,14,26,27, 35,37	2.03	0.45	2.48	1.27	1.47
8	8	16,14,24, 25, 26, 34, 35, 36, 45	1.25	0.15	1.40	0.04	0.35
9	9	14,11,21,24, 35, 36,45, 46,47	1.20	0.18	1.28	0.24	0.37
10	4	16,14,12, 22	1.00	-0.05	0.95	0.33	0.66

PB - Probing depth (mm); PML - Peri-implant mucosal level (mm); CAL - Clinical attachment level (mm); BI - Biofilm index; II - Inflammation index.

Table 3 - Mean and standard deviation of the peri-implant parameters at baseline and after 10 days of the beginning of the use of the dentifrices.

Parameter/Period	Baseline	After 10 days
PB	1.42 ± 0.55	1.37 ± 0.49
PML	0.09 ± 0.54	0.24 ± 0.43*
CAL	1.51 ± 0.71	1.61 ± 0.69
BI	0.95 ± 0.63	0.34 ± 0.38#
II	1.11 ± 0.55	0.50 ± 0.49#

PB - Probing depth (mm); PML - Peri-implant mucosal level (mm); CAL - Clinical attachment level (mm); BI - Biofilm index; II - Inflammation index.

*Higher values than the baseline; # Lower values than the baseline - Paired t-test ($p < 0.05$).

Gel

Eleven patients with partial fixed prothesis supported by implants, comprising a total of 64 implants, were treated with the dental gel. Only one patient presented CAL of 3 mm (patient 8) at the baseline. The results showed that all the patients presented a reduction in the BI and II. In general, the use of the gel was associated with the reduction of the BI and II, and an increasing in the PML. Tables 4 and 5 shows the peri-implant parameters at the baseline and after 10 days of the beginning of the use of the gel. Table 6 shows the mean and standard deviation of the peri-implant parameters at baseline and after 10 days of the beginning of the use of the gel. There were statistically significant differences ($p < 0.05$) between 10 days after treatment and Baseline periods for BI (10 Days = 0.35 ± 0.34, Baseline = 0.81 ± 0.50), II (10 Days = 0.45 ± 0.41, Baseline = 0.95 ± 0.48), and PML (10 Days = 0.41 ± 0.52, Baseline = 0.35 ± 0.47).

Table 4 - Baseline parameters of the patients that used the gel.

Patient	Number of Implants	Location	PB	PML	CAL	BI	II
1	8	24, 25, 34, 35,36, 44, 45,46	2.27	0.12	2.39	0.56	0.54
2	7	25, 11, 34,35, 36, 45,46	1.23	0.14	1.38	0.92	0.83
3	9	16,14,24, 25,26, 34,35, 36,45	1.40	0.38	1.79	0.72	0.85
4	2	45,46	0.83	0.00	0.83	0.08	0.33
5	2	43,44	0.25	0.00	0.25	0.50	0.75
6	5	33,34,36, 44, 46	1.16	0.93	2.10	1.26	1.30
7	10	17,16,22,24, 25, 26, 36,37, 46,47	1.88	0.05	1.93	0.86	1.00
8	3	24,25,26	3.00	0.00	3.00	0.77	1.83
9	2	36,46	0.75	0.08	0.83	0.25	0.25
10	12	14, 12-22, 24, 26,27, 34, 35,44, 46	1.41	0.88	2.30	1.15	1.44
11	4	33,31,41, 43	1.04	1.37	2.41	1.91	1.33

PB - Probing depth (mm); PML - Peri-implant mucosal level (mm); CAL - Clinical attachment level (mm); BI - Biofilm index; II - Inflammation index.

Table 5 - Peri-implant parameters of the patients after 10 days of the use of the gel.

Patient	Number of Implants	Location	PB	PML	CAL	BI	II
1	8	24, 25, 34, 35,36, 44, 45,46	2.14	0.06	2.20	0.14	0.35
2	7	25, 11, 34,35, 36, 45,46	1.20	0.22	1.42	0.33	0.09
3	9	16,14,24,25, 26, 34, 35,36, 45	1.36	0.55	1.91	0.22	0.42
4	2	45,46	0.58	0.00	0.58	0.00	0.00
5	2	43,44	0.16	0.00	0.16	0.00	0.00
6	5	33,34,36, 44,46	1.20	1.05	2.25	0.60	0.70
7	10	17,16,22,24, 25, 26, 36, 37, 46,47	1.98	0.06	2.04	0.50	0.63
8	3	24,25,26	2.55	0.00	2.55	0.27	1.22
9	2	36,46	0.66	0.16	0.83	0.00	0.00
10	12	14, 12-22, 24, 26, 27, 34, 35, 44,46	1.39	1.03	2.42	0.75	0.80
11	4	33,31,41,43	1.15	1.45	2.60	1.04	0.83

PB - Probing depth (mm); PML - Peri-implant mucosal level (mm); CAL - Clinical attachment level (mm); BI - Biofilm index; II - Inflammation index.

Table 6 - Mean and standard deviation of the peri-implant parameters at baseline and after 10 days of the beginning of the use of the gel.

Parameter/Period	Baseline	After 10 days
PB	1.38 ± 0.76	1.30 ± 0.70
PML	0.35 ± 0.47	0.41 ± 0.52*
CAL	1.74 ± 0.83	1.72 ± 0.84
BI	0.81 ± 0.50	0.35 ± 0.34#
II	0.95 ± 0.48	0.45 ± 0.41#

PB - Probing depth (mm); PML - Peri-implant mucosal level (mm); CAL - Clinical attachment level (mm); BI - Biofilm index; II - Inflammation index.

*Higher values than the baseline; # Lower values than the baseline - Paired t-test ($p < 0.05$).

The Figure 1 shows the clinical aspect before and after 10 days of the use of the oral device containing green tea and hyaluronic acid.

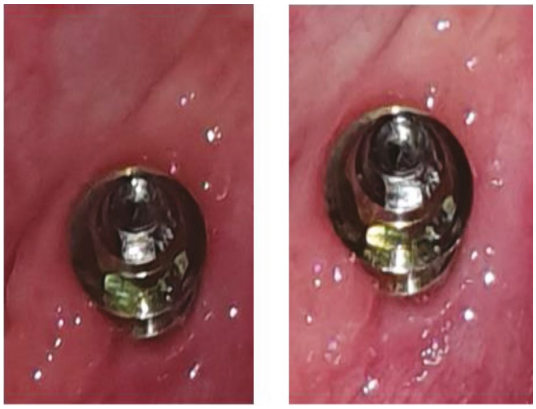

Figure 1 - Clinical aspect at the baseline and after the use of the dentifrice for 10 days.

DISCUSSION

The mechanical removal of the oral biofilms is the most traditional way to prevent the periodontitis and peri-implantitis, and treat the reversible inflammatory conditions around teeth and implants[18-19]. However, a considerable part of the population is not competent in the practice of the oral hygiene procedure, and the use of chemical agents are essential to perform the biofilm control with[1,4]. In the present study, the use of different vehicles of oral hygiene containing green tea and hyaluronic acid as an adjunct for the oral hygiene procedure was associated with the reduction of the amount of the biofilm and inflammation around dental implants that supported partial fixed prothesis.

This reduction in biofilm, and especially inflammation, around the dental implants, may have benefited from the active agents in the toothpaste and the gel. Previous clinical studies showed that a green tea-based toothpaste reduced inflammation and loss of clinical attachment after treatment of periodontal disease, and this effect was associated with an anti-oxidant effect[20], while the use of the hyaluronic acid as a mouthwash decreases inflammation in patients with gingivitis[15]. The association of the antimicrobial properties of the green tea[21-22], and the anti-inflammatory properties of the hyaluronic acid[14] may have directly benefited the patients of the present study.

An interesting finding of this study was that both vehicles were effective in reducing the inflammatory process and controlling the biofilm accumulation. In fact, both types of vehicles have been used effectively to control gingivitis as carriers of different types of chemical agents[23-24]. Both vehicles have abrasives in their composition that complement the mechanical removal of biofilms, and these properties may justify the effectiveness of the gel and dentifrice[25]. However, it is worth noting that the clinical outcomes showed in this pilot study were also due to the professional biofilm control that was performed after baseline examination, and that the chemical agents in the gel and the dentifrice were probably more related with the maintenance of these outcomes. It is important to note that no side or adverse effects, such as the changes in palate or pigmentations in restorations and teeth, or lesion in the oral mucosa was noted, and this finding showed that these products are safe for use. Furthermore, some patients related that the use of the NDC was pleasant associated with a good taste. However, this impression was subjective and require more information´s in future.

The present study has some drawbacks that must be taken into account when interpreting our data. This is a pilot study with limited sample size, absence of a control group, and short follow-up time. So, these characteristics generate a large number of biases and effects that may have interfered with the results obtained. Furthermore, as the patients were submitted to the professional biofilm control, it can be only be speculated that the dentifrice and gel based on green tea and hyaluronic acid can maintain the good clinical outcomes, acting as adjunctive agents of this therapy. In the future, a randomized controlled clinical trial with a larger sample size, control group without the use of the products, and longer follow-up evaluations should be performed to assess the real effect of these vehicles on maintaining peri-implant health.

CONCLUSION

The conclusion of this pilot study was that the use of two different vehicles (gel and dentifrice), containing green tea and hyaluronic acid, were able to reduce the biofilm accumulation and the inflammation around dental implants with safety, in a short-term evaluation period, in users of partial fixed prosthesis supported by implants.

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