Clinical evaluation of the efficacy of Perioscan® on plaque-induced gingivitis in pediatric age

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Authors' contributions: the first author wrote the article, the second and the third author collected the clinical data, the fourth author took the photographs and the fifth author designed the study and did the statistical analysis.

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Abstract

Background: Perioscan® is an ultrasonic dental scaler that informs the clinician, right during the treatment, of the location of calculus optically, and if desired, also through an acoustic signal.
Material & Methods: This is a split mouth randomized clinical trial.The study population consists of 9 pediatric patients (from 9 to 17 years) affected by gingivitis which were undergoing dental cures at the Unit of Operative and Pediatric Dentistry (Department of surgical Science for head and neck diseases) of "Agostino Gemelli" Teaching Hospital.
All patients received a split mouth treatment with one quadrant of scaling involving Perioscan® (site-group 1), and the others with an ultrasonic conventional dental scaler (site-group 2). Patients were interviewed about the pain felt during the two professional dental hygiene procedures. All participants were instructed to brush their teeth at least twice a day.
Patients were clinically monitored at baseline and 8 weeks after initial therapy; probing pocket depth (PPD), plaque index (PI) and bleeding index (BI) were recorded at all times.
Results: At week 8, in the entire oral cavity, there was a statistically significant improvement ($p < 0.05$) in all clinical parameters when compared to the baseline values, while no significant differences were found between sites-groups 1 and 2.
There was significantly more intensity of pain reduction ($p < 0.05$) in the site-group 1.
Conclusions: The results indicate that the efficacy of Perioscan® was similar to that of ultrasonic conventional dental scaler in improving gingival conditions. Perioscan® revealed smaller injury potential, combined with a lower intensity of pain felt from the patients than the conventional instruments. Thus Perioscan®, reducing or eliminating the pain during treatment, can be effective in the treatment of pediatric patients, dental phobic or those particularly sensitive to pain.

Keywords: *Gingivitis, dental calculus, ultrasonic dental scaler, pain, children.*

Introduction

Gingivitis is a common inflammatory disease that affects periodontal marginal and clinically appears as redness of the gingival margin, spontaneous bleeding and/or provoked by probing (BOP), hypertrophy and tissue edema. The most common cause of gingivitis is poor oral hygiene. Since gingivitis can be mild, patients may not be aware of their condition, but it is necessary to

treat it promptly, because it can lead to much more serious gum disease (periodontitis) and eventual tooth loss.

Prompt treatment of gingivitis usually reverses its symptoms and prevents its progression.

Professional care, followed by stepped up oral hygiene at home, are essential to achieve and maintain an ideal state of health and to prevent the progression of the disease (1).

The use of manual tools, like courette and ultrasonic scaler is considered the effective treatment required in case of gum disease related with the presence of bacterial plaque (2).

The aim of the initial professional cleaning, known as scaling, is to remove all traces of dental plaque and calculus from the teeth surfaces.

Despite this, previous studies have shown that, if the periodontal pockets depth is < 3 mm, an aggressive manual or ultrasonic cleaning can be the cause of damages to the epithelial attack and consequently cause gingival recessions, hypersensitivity and, in some cases, root caries (3).

Perioscan® is an ultrasonic dental scaler that informs the clinician, right during the treatment, of the location of dental calculus: it is able to recognize and selectively remove the concretions of dental calculus from the tooth surface.

The detection technology is based on the software's ability to discern the kind of surface in contact with the ultrasonic tip, thanks to different oscillation patterns.

As soon as the ultrasonic tip touches the tooth root during the treatment, the signal ring on the handpiece will reveal the condition of its surface: the green light (**fig.1**) indicates a healthy root surface, while the blue light (**fig. 2**) the presence of calculus.

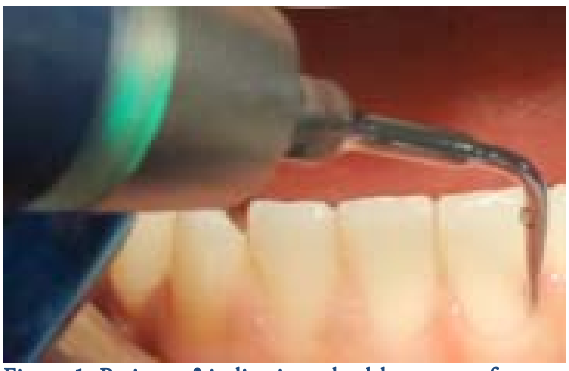

Figure 1. Perioscan® indicating a healthy root surface.

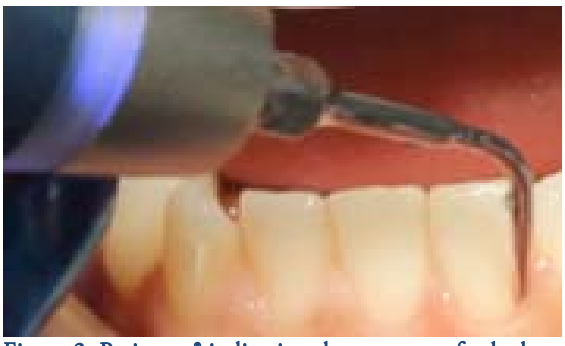

Figure 2. Perioscan® indicating the presence of calculus

Moreover, the light signal can be combined with an acoustic sound signaling the detection of calculus.

The Perioscan® combined this detection technology to a further quality: the oscillations of the tip (maximum frequency of 32,000 movements per second) are stricly controlled and they occur in a linear manner on the tooth surface.

So, differently from traditional scalers which describe lateral movements with irregular trajectories [4], the controlled oscillations performed by Perioscan® allow to minimize the perception of pain by the patient.

The aims of this study is to evaluate the effect of Perioscan® on plaque-induced gingivitis and to compare its efficacy with hand and ultrasonic instruments.

The authors also want to evaluate the pain perception during the scaling performed with Perioscan® and to compare it with the intensity of pain induced by other conventional instruments.

Materials and Methods

This is a split mouth randomized clinical trial. The study population consists of 9 pediatric patients (from 9 to 17 years) affected by gingivitis which were undergoing dental cures at the Unit of Operative and Pediatric Dentistry (Department of Surgical Science for Head and Neck Diseases) of "Agostino Gemelli" Teaching Hospital.

During the recruitment phase all participants showed signs of gingivitis due to poor oral hygiene (5); gingivitis was diagnosed according to the criteria established by the 1999 international workshop for the classification of periodontal diseases and conditions (6). The study was conducted according to the 1975 Helsinki Declaration, as revised in 2000.

All participants (or their parents if under 14 y.o.) provided written informed consent after receiving explanations on study objectives and procedures.

Patients received a split mouth treatment with one quadrant of scaling involving Perioscan® (site-group 1), and the others with an ultrasonic conventional dental scaler (site-group 2).

Patients were interviewed about the pain felt during the two professional dental hygiene procedures.

All participants were instructed to brush their teeth at least twice a day and were clinically monitored at baseline and 8 weeks after initial therapy; probing pocket depth (PPD), plaque index (PI) and bleeding index (BI) were recorded at all times.

Photos of the dental arches (occlusal, frontal and lateral side, with and without mirror) were carried by the assistant and the periodontal folder was completed by the clinician. Clinical parameters were assessed using a manual probe and recorded to the nearest millimeter.

All patients received a split mouth treatment with one quadrant of scaling involving Perioscan® (site-group 1), and the others with an ultrasonic conventional dental scaler (site-group 2). The test site (group-1) was chosen after draw.

After the hygiene procedure each patient was given a questionnaire to be completed answering the following question: "Did you feel pain after the oral hygiene session?". If the answer was "yes" the patient was asked to indicate, according to the Visual Analogic Scale (VAS) (7), the amount of pain felt during the two different procedures of dental professional hygiene.

The patients marked on the line the point that they feel represents their perception of the current state. The VAS score is determined by measuring in millimetres from the left hand end of the line to the point that the patient marks. (**fig. 3**).

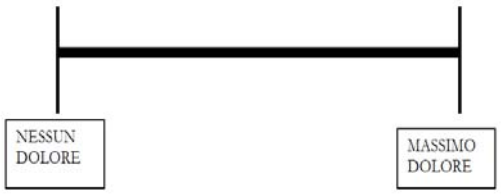

Figure 3.The Visual Analogic Scale used in the study.

After treatment, all participants received the same oral hygiene instructions (modified Bass technique) and the use of the electric toothbrush at least twice a day was also recommended.

Patients were clinically monitored at baseline and a subsequent evaluation was performed at 8 weeks after initial therapy: probing pocket depth (PPD), plaque index (PI) and bleeding index (BI) were recorded at all times (8).

Clinical measurements were performed by a unique examiner.

Results

The BI and PI were the unit of analysis.

At baseline, there were no statistically significant differences between control and test groups for any of the recorded parameters.

The changes in clinical parameters, comparing baseline to 8 weeks values, revealed that both the hygiene procedure tested have been effective for the treatment of the initial gum disease. A statistically significant improvement ($p < 0.05$) of all clinical parameters measured at baseline can be appreciated after 8 weeks from the day of causal therapy. An independent samples t-test was done to compare whether two groups have different average values.

No statistically significant differences were found comparing the parameters obtained from the use of the two different instruments ($p > 0.05$) **(fig.4).**

In Perioscan® treated quadrants a significant reduction of patients' pain perception ($p < 0.05$) if compared to sites treated with the traditional method was reported.

Immediately after treatment the average rating of the VAS in the Perioscan® treated group was: 3.44, while in the traditional method treated group it was 5.67 (**fig.5a-b-c**).

The whole sample expressly preferred Perioscan® to traditional ultrasonic scaler and in 4 of 9 cases patients reported no pain in Perioscan® treated sites.

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Tradizionale Bleeding Index – Perioscan Bleeding Index	-,111	,782	,261	-,712	,490	-,426	8	,681
Pair 2 Tradizionale Plaque Index – Perioscan Plaque Index	-,111	1,453	,484	-1,228	1,006	-,229	8	,824

Figure 4. Statistical analysis revealing no significant differences comparing data of BI and PI.

Group Statistics

	Strumento	N	Mean	Std. Deviation	Std. Error Mean
VAS	Tradizionale	9	5,67	1,414	,471
	Periostat	9	3,44	1,130	,377

Figure 5a. Data comparing VAS score in the two groups analyzed.

Independent Samples Test

		t-test for Equality of Means			
		T	df	Sig. (2-tailed)	Mean Difference
VAS	Equal variances assumed	3,682	16	,002	2,222
	Equal Variances not assumed	3,682	15,259	,002	2,222

Independent Samples Test

		t-test for Equality of Means		
			95% confidence Interval of the Difference	
		Std. Error Difference	Lower	Upper
VAS	Equal variances assumed	,603	,943	3,502
	Equal Variances not assumed	,603	,938	3,507

Figure 5b. Data showing the statistical significance of VAS score reduction.

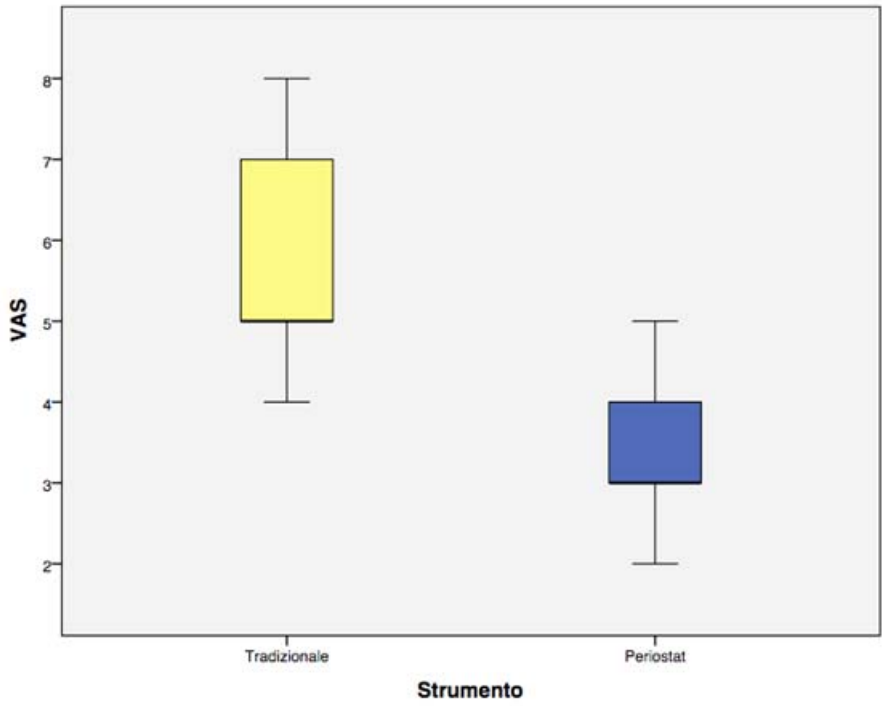

Figure 5c. Diagram showing the figure 5a data.

Discussion

The first aim of this study was to assess the effect of Perioscan® on plaque-induced gingivitis and to compare its efficacy with hand and ultrasonic instruments.

The authors also want to evaluate the pain perception during the scaling performed with Perioscan• and to compare it with the intensity of pain provoked by other conventional instruments.

When a clinician choose his work instruments, he should evaluate not only the efficacy of the instruments themselves but also the possibility to get the best result with the minor damage for the gingival tissue and the less pain for the patients. These factors can even be the most important ones if the clinician manages with children.

A recent literature review confirm that the control and resolution of clinical gingivitis can be achieved through regular professional hygiene sessions associated with a proper domestic oral hygiene (8).

The results indicate that the efficacy of Perioscan® technology in improving periodontal conditions is comparable to the traditional ultrasonic scalers one but the potential damage that a manual instrument can cause is definitely more severe than the one provoked by Perioscan®.

Conclusions

As clearly demonstrated Perioscan®, combining its technology whit the elimination of the over-instrumentation problem in shallow pockets, can lead to an overall painless therapy. Since the intensity of pain referred by patients in Perioscan® treated sites is less than the one felt in conventional instruments treated sites Perioscan® can bethe eligible instrument in the treatment of all the patient particularly sensitive to pain, especially dental phobic or pediatric patients.

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