New Chairside Whitening System Summary of Clinical Study: ZOOM2 versus Original ZOOM!

Discus Dental Original Research

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INTRODUCTION

Discus Dental Inc. has developed Zoom2, the "second generation" of the popular Zoom! Chairside Whitening System. Like its predecessor, this product uses a specially designed lamp to activate a peroxide / activator tooth bleaching gel to whiten teeth an average of approximately eight shades.

Zoom2's improvements and innovations summarized in Table 1 were intended to result in a sophisticated product that works faster, makes teeth whiter, and causes less transient dentinal hypersensitivity. A clinical study was designed to test these hypotheses. The research has recently been completed and the results and conclusions of the 50 subject, "head-to-head," longitudinal, double blinded, clinical study is summarized on the next page in Table 2.

ZOOM2 LIGHT

The Zoom2 System employs a whitening lamp, which emits ultraviolet energy to activate a hydrogen peroxide gel that is catalyzed by a photo-Fenton reaction of peroxide and dissolved iron. This chemical reaction will be discussed in more detail in the "Zoom2 Chemistry" section found below. Aside from the lamp itself, the system has many new convenience features that benefit the operator and patient in terms of convenience, safety and comfort.

To enhance comfort, efficiency and safety, the bulb located within the head of the light has been situated so that is closer and more directly focused onto patients' teeth. The design change allowed for incorporating a lower wattage lamp that runs cooler, warms-up faster, emits less light onto patient's soft tissues and more effectively works to whiten teeth. The housing of the head has also been redesigned so that it is streamlined and very easy to position, using a unique optical alignment mechanism.

ZOOM2 CHEMISTRY

In order to achieve maximum effectiveness and patient comfort, the gel has been reformulated to include ferrous gluconate (peroxide activation) and amorphous calcium phosphate (to help prevent tooth sensitivity and increase enamel luster). When combined in the dispenser's mixing tip, the Zoom2 hydrogen peroxide gel is mixed with an activator gel that contains iron so that a Fenton's reaction can occur.

FENTON REACTION

$$Fe^{2+} + H_2O_2 \longleftrightarrow Fe^{3+} + OH^- + OH^\bullet$$

In the presence of a suitable chromophoric substrate, such as the stains found on teeth, the hydroxyl radicals generated are capable of whitening teeth via oxidation of the stain's carbon molecular bonds.

Irradiating the bleaching gel with ultraviolet light energy generated by the Zoom2 lamp even further enhances the catalytic whitening effect of Fe^{2+}, so that a photo-Fenton process begins. The advantage of photo-Fenton chemistry is that provides enhanced amounts of bleaching free radicals via a remarkable "never-ending" regeneration reaction as shown by the reaction below:

PHOTO-FENTON REGENERATION OF FENTON'S REACTION

$$Fe^{3+} + \text{UV light} + OH^- \longleftrightarrow Fe^{2+} + OH^\bullet$$

Furthermore the Zoom2 bleaching system employs amorphous calcium phosphate (ACP) technology to theoretically achieve superior results.

TABLE 1: SUMMARY OF ZOOM2 FEATURES

Faster & Less Chair Time
Three 15-minute Applications
Instant-on light with no warm-up time

Easier
Advanced Optical Guidance System
Ergonomic Rolling Lamp Stand

More Comfortable
Light & Gel Enhance Patient Comfort
ACP & KNO3 Technologies

Superior Clinical Performance
Eight Shades
Many Patients Sensitivity-Free

TABLE 2: SUMMARY OF RESULTS

	IMMEDIATE AFTER TREATMENT		POST TREATMENT DAY 7	
	ORIGINAL	ZOOM2	ORIGINAL	ZOOM2
Change in Vita Tooth Color	7.69 ± 0.72	8.31* ± 0.85	6.99 ± 1.46	8.07* ± 1.44
Change in Tooth Sensitivity	2.01 ± 0.14	0.54* ± 0.08	0.12 ± 0.09	0.11 ± 0.007
Change in Gingival Index	0.36 ± 0.18	0.32 ± 0.0.17	0.15 ± 0.05	0.12 ± 0.06
Change in Oral Health	ALL HEALTHY NO ADVERSE EVENTS	ALL HEALTHY NO ADVERSE EVENTS	ALL HEALTHY NO ADVERSE EVENTS	ALL HEALTHY NO ADVERSE EVENTS

*Statistically different, Student's T-Test, alpha = 0.05

Discus Dental has licensed the rights from the American Dental Association Foundation to create whitening gels containing ACP. It was thought that ACP technology included in the Zoom2 gel might create a glossier enamel surface and help to prevent transient tooth sensitivity. Additionally, a new hybrid fluoride / KNO_3 desensitizing gel has been devloped for placement onto teeth immediately following the final bleaching gel with the intention of further enhancing patient comfort.

Hence a clinical trial was designed and carried out to assess any enhanced whitening efficacy (as judged by Vita® shade tabs), as well as any effect on transient dentinal hypersensitivity, gingival health and overall oral soft tissue health. The methods and results of that study are summarized below.

MATERIALS AND METHODS

The study was an examiner-blind, randomized and controlled clinical trial conducted in a dental setting. A total of 50 subjects were selected from a pool of New York City based volunteers, based on meeting certain study criteria including Vita® shade A3 or darker maxillary anterior teeth, amongst others. After qualifying, subjects were asked to read and sign a study consent form prior to admission to the research project. At the time of enrollment, each was given a non-whitening toothpaste, floss and straight-handle toothbrush to use during the study. Subjects received a supragingival prophylaxis and all six maxillary anterior teeth were again assessed for tooth shade. Additionally baseline self-reported tooth sensitivity, gingival health (assessed by Löe and Sillness Gingival Index), soft tissue health readings were also recorded.

Subjects were assigned to one of the two treatment groups and they were treated with three applications of their assigned product, following the manufacturer's instructions for the product (Original Zoom! – total of 60 minutes; Zoom2 – total of 45 minutes). Immediately after completion of the treatment phase, and on post-treatment day +7, new clinical examinations were performed.

RESULTS

At the termination of the study, the statistical analysis of the shade scores indicated that both products significantly ($P < 0.01$) lightened the color of the teeth compared to baseline, but Zoom2 subjects had significantly lighter teeth ($P < 0.05$) as shown in Table 2 and Figure 1.

Table 2 shows that the average improvement was 7.69 ± 0.72 shades for the Original Zoom! Group and 8.31 ± 0.85 shades for the Zoom2 Group.

Additionally, the Zoom2 Group performed significantly better at the post-treatment day +7 follow-up exam. The fade-back was only 0.24 shades in this group and therefore not likely perceptible by humans. These subjects still exhibited an improvement of greater than 8 shades and this was 15.45% better than the Original Zoom! subjects' results.

Furthermore, the residual sensitivity reported by Zoom2 subjects on post-treatment day +7 was significantly better than the control subjects response and highly clinically relevant. They reported an average sensitivity score of only 0.54 units (on a scale of 1 – 10), while the Original Zoom! Group subjects reported an average change in sensitivity of about 2.01 units. Thus Zoom2 Group subjects had 73% less transient tooth sensitivity than Original Zoom! Group subjects.

FIGURE 1: Bar Graphs of Whitening & Tooth Sensitivity