In-Office Whitening

A Randomized, Parallel-Design Clinical Trial to Assess Tooth Bleaching Efficacy and Safety of Light versus non-Light Activated Chairside Whitening

*in vivo* study


Objective:

To characterize the extent to which the safety and efficacy profile of Philips Zoom WhiteSpeed and Ultradent Opalescence Boost PF cosmetic whitening regimens differ immediately following and seven days post bleaching application.

Materials:

- Philips Zoom WhiteSpeed
- Ultradent Opalescence Boost

Methodology:

One hundred thirty-six of 394 subjects screened participated in an IRB approved double-blind, randomized, parallel-design clinical trial in a population of healthy adults aged 18-75. Fifty-nine subjects were female, 76 were male; with a mean age of 49.6 years. Eligible subjects had a minimum of four maxillary anterior teeth with a tooth shade of A3 or darker assessed per VITA Classical (VC) shade guide. Sixty-eight subjects were randomized to Opalescence Boost and 69 to Philips Zoom. Efficacy was assessed by VITA EasyShade for ∆E characterization using a custom jig fabricated for a single anterior site in addition to VC and VITA Bleachedguide 3D-Master (BG) shade assessment. Safety was characterized by subject report of sensitivity, oral examination and subject use of sensitivity-reducing agents (Relief ACP or UltraEZ) applied and dispensed per manufacturer’s instructions. Study endpoints were assessed pre- and post-bleaching and at Day 7. The outcomes presented here are the final analyses associated with these endpoints. Day 30 and 90 results are pending.

Results:

Median ∆E values per Kruskal-Wallis analysis for color change immediately post-whitening were 5.12 for Zoom and 2.55 for Boost (p<.0001). At Day 7, ∆E outcomes were 6.34 and 4.08 for Zoom and Boost treatment groups respectively (p=0.0059). The difference between treatments at each timepoint was statistically significant.

For VC visual shade assessment, LS Mean (SE) immediately post-whitening values were 5.86 (0.18) for Zoom and 4.47 (0.18) for Boost (p<0.0001). At Day 7, outcomes were 4.92 (0.20) for Zoom and 4.19 (0.20) for Boost (p=0.0106). The difference between treatments at each time point was statistically significant.
For BG visual shade assessment, the median shade change per Kruskal-Wallis analysis immediately post-whitening was 3.17 for Zoom and 2.00 for Boost (p<.0001). At Day 7, outcomes were 2.33 for Zoom and 1.67 for Boost (p=0.0198). The difference between treatments at each time point was statistically significant.

The percentage of subjects who reported ‘No Sensitivity’ immediately post-whitening was 98.5% for Zoom and 98.6% for Boost. At Day 7, subject-reported values for ‘No Sensitivity’ were 82.1% for Zoom and 79.4% for Boost. Of those experiencing sensitivity, one subject rated sensitivity as ‘Moderate.’ All other reports were characterized as ‘Mild’ by subjects.

There were a total of 39 adverse events reported among 33 subjects. In general, these events were associated with sensitivity. Subject use of post-whitening sensitivity gel (Relief ACP and UltraEZ) was low. Four subjects (two per treatment group) used the products at Day 1 post-bleaching, and one subject used the product on Day 2. There are no other reports of use from Day 3 to Day 7.

**Conclusion:**

Philips Zoom WhiteSpeed whitens teeth significantly better than Opalescence Boost immediately following, and at seven days post application as measured by ∆E and VITA Classical Shade Guide and VITA Bleachedguide 3D-Master.

Philips Zoom WhiteSpeed and Ultradent Opalescence Boost are both well tolerated with low incidence of sensitivity and no significant differences in the safety profile between groups.
A Randomized, Parallel-Design Clinical Trial to Assess Tooth Bleaching Efficacy and Safety of Light versus non-Light Activated Chairside Whitening

In-Office Whitening

Efficacy

Maximum Sensitivity Experienced from Whitening Treatment

- **Zoom WhiteSpeed**
  - No Sensitivity: 82%
  - Mild Sensitivity: 16%
  - Moderate Sensitivity: 1%

- **Opalescence Boost**
  - No Sensitivity: 79%
  - Mild Sensitivity: 21%

Legend:
- Purple: Moderate Sensitivity
- Cyan: Mild Sensitivity
- Blue: No Sensitivity
In-Office Whitening

Benefit of Light vs No Light

Color Change of Vital Teeth Exposed to Bleaching Performed With and Without Supplementary Light

in vivo study


Department of Restorative Dentistry and Biomaterials, University of Texas Dental Branch at Houston, TX, USA.

Objective:
To evaluate tooth color change after exposure to 25% hydrogen peroxide in-office tooth whitening system with and without supplementary light exposure.

Materials:
• 25% hydrogen peroxide whitening gel (Zoom! 2 Kit, Discus Dental, Inc.)
• Whitening lamp (Zoom! AP, Discus Dental, Inc.)

Methodology:
A total of 20 patients were enrolled for an in-office clinical tooth whitening study using an opposing-arch design. A total of 80 teeth were analyzed (one canine and central incisor for both arches). The order of arch (maxillary or mandibular) and treatment type (light or no light) was randomized at the patient’s initial bleaching and the opposite treatment was chosen for the second appointment. The 25% hydrogen peroxide bleaching gel (Zoom! 2 Kit, Discus Dental) was applied and repeated for three 15-minute cycles for a total exposure time of 45 minutes. Visual color matching was performed at baseline before bleaching and seven days after bleaching. Two different shade guides were used: Vitapan Classical (VC) and Vita Bleachedguide 3D-Master (BG). Evaluators were blind to the assigned intervention. Instrumental color monitoring was also performed before bleaching and seven days after bleaching using an intraoral spectrophotometer (Vita Easyshade, Vita Zahnfabrik, Băd Sackingen, Germany). Data was analyzed using ANOVA, paired t-test, and Wilcoxon signed rank tests.

Results:
The instrumental measurement method revealed significant difference in color between treatment with light ($\Delta E_{ab} = 6.0$) and treatment without light ($\Delta E_{ab} = 4.7$) after seven days ($p < 0.05$). No differences were visually detected between treatment with light and without light using the VC ($p = 0.56$). However, a significant difference was recorded using the BG ($p < 0.01$). Instrumental measurements of color changes were in better accordance with visual findings using the BG guide ($R^2 = 0.60$) rather than the VC guide ($R^2 = 0.20$).
Conclusion:

Treatment with supplementary light showed significantly greater changes in color compared to treatment without light when assessed using instrumental methods. The same was determined for the visual method with Vita Bleachedguide 3d-Master. No significant difference in color change with respect to light exposure was detected for the Vitapan Classical.
Effect of ZOOM! Advanced Power Lamp on Whitening

**in vivo study**


**Objective:**

To assess tooth color changes and patient satisfaction using ZOOM! Advanced Power Lamp compared to whitening treatment without the lamp.

**Materials:**

- 25% hydrogen peroxide gel (Zoom! Advanced Power Whitening System, Discus Dental, Inc.)
- Light activation lamp (Zoom! Advanced Power Lamp, Discus Dental, Inc.)

**Methodology:**

Seventeen patients received Zoom! Advanced Power Whitening System using Zoom! Advanced Power Lamp. Eleven patients received the whitening treatment without light activation. All patients had a start shade of Vita A3 or darker, and no tetracycline stains were treated. Tooth color was measured at baseline before and immediately following the in-office procedure using the Vita Classic value arranged shade guide. Shade change was measured again at 7-10 days and 30 days post-treatment. Patients were given a survey at the 30-day follow-up appointment to rate effectiveness of treatment, sensitivity, satisfaction, and overall opinion of the treatment.

**Results:**

Upon evaluation immediately after whitening and 30 days post-treatment, whitening with the lamp resulted in an average of 1.9 shades lighter for maxillary teeth and 0.7 shades lighter for mandibular teeth compared to average whitening without the lamp.
Overall, patients who received whitening treatment using the Zoom! Advanced Power Lamp were more satisfied with their results and felt the treatment to be more effective compared with those who received whitening treatment without the lamp. However, patients who received treatment with the lamp reported more sensitivity during treatment, and many reported that the lamp was too intense and produced a burning sensation.

**Conclusion:**

When the Zoom! Advanced Power Lamp was used, a greater difference in shade change was seen immediately after treatment, 7-10 days after treatment, and 30 days post-treatment than resulted from whitening performed without the lamp.
Effect of Light Treatment on \textit{in vitro} Tooth Bleaching Efficacy

\textit{in vitro} study


Objective:
To evaluate the effects of light treatment on tooth bleaching efficacy of Zoom! 2 gel using extracted human incisors.

Materials:
• 20 extracted human incisors stored in 10% formalin solution
• Zoom! 2 Gel (Discus Dental)
• Zoom! 2 Light (Discus Dental)

Methodology:
Twenty extracted human incisors were randomized into two groups of ten each. The roots were embedded in denture resin to form a gingival contour. Each tooth was assessed for a baseline shade (Vitapan Classical Shade Guide, Vita Zahnfabrick GMbH, Sackingen, Germany) and L*a*b values (Shade Vision, X-Rite, Inc., Grandville, MI). Both groups of specimens were treated with Balancing Pre-Treatment Gel (Discus Dental) then covered with Zoom! 2 Gel (Discus Dental). Group A was exposed to Zoom! 2 Light (Discus Dental) for 15 minutes, while Group B did not receive light exposure. The gel application and light exposure (Group A) was repeated two additional times. Satin Finish Gel (Discus Dental) was applied to the enamel surfaces for five minutes after the final bleaching treatment. Post procedure Shade and L*a*b values were measured again and the data analyzed.

Results:
The shade reduction was 4.50 and 3.80 for Groups A and B respectively. The Shade Vision data showed significant differences between the two groups in delta b* and delta E*.
Conclusion:

Under the conditions of the study, Zoom! 2 Light exposure significantly enhances the efficacy of Zoom! 2 Gel in reducing the $b^*$ and increasing the delta $E_{ab}^*$. 
Clinical Study to Compare Two In-Office Whitening Systems

*in vivo study*


1Hill Top Research, Inc, West Palm Beach, FL, USA, 2Discus Dental, Inc, Culver City, USA

**Objective:**

To compare the efficacy of two in-office whitening systems: Discus Dental Zoom! Chairside System (25% hydrogen peroxide whitening gel) and Opalescence Xtra Boost Kit (38% hydrogen peroxide whitening gel).

**Materials:**

• 25% hydrogen peroxide whitening gel (Zoom! Discus Dental, Inc., Culver City, CA, USA)
• 38% hydrogen peroxide whitening gel (Opalescence Xtra Boost Kit, Ultradent, South Jordan, UT, USA)

**Methodology:**

Twenty-two healthy adults over the age of 18 were enrolled in a single-center, examiner-blind, randomized trial. At the outset of the study, all subjects had a tooth shade greater than or equal to A3 (Vita Shade guide, Vita Zahnfabrick GMbH, Sackingen, Germany) for a minimum of four of the six maxillary anterior teeth. Whitening procedures were completed using three applications per treatment according to the manufacturers’ instructions. Immediately following completion of the whitening treatment, Vita Shade assessments of the maxillary anterior teeth and chromameter shade assessments were recorded. Patients were questioned on their level of tooth sensitivity and the condition of the oral soft tissue was examined. The same procedures were performed on post-treatment Day 7.

**Results:**

Both products achieved a statistically significant whitening from baseline (*p < 0.0001*) following treatment. After Day 7, mean changes of -7.8 and -6.8 shades were observed for the Zoom! System and the Opalescence Xtra Boost Kit respectively. The Zoom! Chairside System was an average of 1 to 2 shades better than the Opalescence Xtra Boost Kit at all time points. Results were directionally better at Day 2 (*p < 0.08*) and significantly better at Day 7 (*p < 0.0025*).
Conclusion:

Both products produced whitening of between 6 and 9 shades. However, the Zoom! System provided approximately 1 to 2 shade guide improvement over the Opalescence Xtra Boost Kit. These differences were significant at all time points. The improved whitening performance of these single-visit in-office kits was similar to home-based systems that bleach teeth continuously for 14 days. There were no statistical differences in induced sensitivity between the two products.
Clinical Evaluation of a Novel Dental Whitening Lamp and Light-Catalyzed Peroxide Gel

in vivo study


1Discus Dental, Inc, Culver City, USA, 2Houston, TX, USA

Objective:
To determine whether an ultraviolet light enhanced the whitening efficacy of a peroxide gel containing a photo-Fenton activator

Materials:
- 20% hydrogen peroxide gel with ultraviolet (UV) light (Zoom 2, Discus Dental Inc.)
- 20% hydrogen peroxide gel without ultraviolet (UV) light

Methodology:
Fifty healthy male and female adults aged 18-70 years were enrolled into an IRB-approved randomized trial. The trial was conducted at two geographically separate study sites. At the outset of the study, all subjects had a tooth shade greater than or equal to A3 (Vita Shade guide, Vita Zahnfabrick GMbH, Sackingen, Germany) for all six non-restored maxillary anterior teeth. Participants had to agree not to use any other dental whitening product except toothpaste during the course of the study. Individuals also had to refrain from smoking and consuming coffee, cola drinks, grape juice and other food or drink that could stain teeth for seven days after treatment.

Subjects who met the inclusion criteria were randomly assigned to one of two groups: Light or No-light. The investigator applied the bleaching gel (Zoom 2, Discus Dental Inc.) to the teeth of both groups for 15 minutes. At the end of the period, the gel was suctioned off and new gel was applied. This process was repeated twice more for a total of three applications for all study subjects. In the Light group, the six maxillary teeth were concurrently exposed to the whitening lamp during the gel application for a total light exposure of 45 minutes. The No-light group was not treated with the whitening lamp. Fluoride/potassium nitrate was applied to teeth according to manufacturer’s instructions for all subjects.

Subjects were examined before the whitening treatment, immediately after treatment (same day), one week after treatment and one month after treatment. Clinical data were collected on the gingival index, shade score and self-assessed dentinal hypersensitivity.
Results:
The combination of the whitening lamp and gel produced significantly better results (approximately 26% improvement; p<0.05) than did gel alone. Immediately post treatment, subjects in the Light group showed an average 7.7 shade changes compared to an average of 6.1 shade changes for the No-light group. No tissue irritation, ulceration or gross changes in teeth, gingiva or restorations were reported in either group. The sensitivity scores were similar for both the Light and No-light groups with no significant differences at any interval.

Conclusion:
The use of the Zoom 2 dental whitening lamp improved the whitening effect by approximately 26% when used with a photo-Fenton activator and 20% hydrogen peroxide gel. This trial demonstrated that this bleaching method is safe and effective for whitening teeth rapidly.
**Clinical Study of an In-Office Whitening System With and Without Light Procedures Utilizing a Split-Arch Design**

*in vitro study*


**Objective:**

To evaluate the bleaching efficacy of 25% hydrogen peroxide whitening gel (Discus Dental Zoom) with and without light activation by comparing tooth shade changes measured with Vita Shade Guide following treatment using a split-arch design.

**Materials:**

- 25% hydrogen peroxide whitening gel (Zoom, Discus Dental, Culver City, CA, USA)
- Light activator (Zoom Light Activator, Discus Dental, Culver City, CA, USA)

**Methodology:**

In this examiner-blind randomized pilot study, a split-arch design was used to compare an in-office teeth whitening product with and without light activation. Ten healthy adult subjects (five male and five female) were randomized into two groups to receive the light activator on the right or left side of the maxillary anterior teeth during treatment. One half of the maxillary anterior sextant was treated with light, and following isolation, the second half was treated without the light. Two separate rounds consisting of three whitening treatments apiece were conducted on each subject. Vita Shade scores were collected at baseline prior to treatment, immediately following treatment on the sample day, and one and seven days post-treatment.

**Results:**

The Zoom Chairside System with Zoom Light Activator was significantly better than the product application without the light at all time points: post-treatment (p = 0.0026); Day 1 (p > 0.0001); Day 7 (p = 0.0002).
Conclusion:
The use of the Zoom Light Activator in conjunction with Discus Zoom whitening gel was more effective in whitening teeth than the use of the Discus Zoom gel alone. These results confirm that although the 25% hydrogen peroxide gel clearly whitens/bleaches the teeth, the use of the Zoom Light Activator significantly enhances the whitening/bleaching ability of the system.
Photo-Fenton and Conventional In-Office Dental Bleaching

in vivo study
Cardoso PE, Muench A, and Pinheiro HB, Universidade de São Paulo, São Paulo, Brazil
FDI World Dental Congress, 2011 Poster #348

Objective:
To evaluate the results of two in-office whitening treatment methods, one based on the Photo-Fenton reaction and the other a conventional in-office system, verifying shade change (ΔE) and color stability.

Materials:
• 25% hydrogen peroxide with ferrous gluconate (Discus Dental) and ultraviolet (UV) light (Zoom AP Light, Discus Dental)
• 38% hydrogen peroxide (Opalescence Xtra Boost, Ultradent)

Methodology:
Forty healthy adult volunteers were randomly divided into 2 experimental groups of 20 subjects each (Group 1: ZAP; Group 2: OPX). The whitening treatment for both groups was performed with three consecutive 15-minute applications. The ZAP group received treatment with 25% hydrogen peroxide and ferrous gluconate and ultraviolet (UV) light (Discus Dental and Zoom AP Light); the OPX group received treatment with 38% hydrogen peroxide (Opalescence Xtra Boost, Ultradent).

<table>
<thead>
<tr>
<th>Experimental Groups</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZAP (n=20)</td>
<td>25% hydrogen peroxide with ferrous gluconate ultraviolet (UV) light (Discus Dental + Zoom AP Light) – 1 treatment session</td>
</tr>
<tr>
<td>OPX (n=20)</td>
<td>38% HP-Opalescence Xtra Boost (Ultradent) – 1 treatment session</td>
</tr>
</tbody>
</table>

The shade of superior incisors and canines was assessed for each subject using a digital Vita-Easyshade Spectrophotometer immediately before and after the whitening treatment at 7, 14 and 30 days.
The Vita-Easyshade device measures the color based on a tridimensional system that supplies numerical values, which are inserted into a formula to provide color or shade variation (also known as ∆E). A custom clear EVA tray was used to ensure that measurements were taken at the same spot on each tooth. Holes in the tray on the labial surface of incisors and canines were made with a specially designed six mm bur corresponding to the size of the tip of the optical spectrophotometer reader.

Results:

Homogeneity and homoscedasticity tests were applied to the data obtained which indicated that two-way ANOVA and Tukey test were the best tests to treat the results. Statistical analysis comparing the results obtained for shade change over time (pre- and post-whitening treatment after 7, 14 and 30 days) demonstrated that ZAP Group presented a superior whitening result when compared to group OPX Shade change stability was observed for both groups.

![Whitening Results After One Treatment](image)

Conclusion:

This clinical trial indicates that even though a lower concentration HP (25%) is employed by the whitening system that uses the Photo-Fenton reaction, it presented a superior performance when compared to the conventional in-office whitening system using a higher concentration HP (38%), which indicates the efficacy of the Photo-Fenton process. Both systems presented color stability during the 30-day evaluation period.
Clinical Trial: Photo-Fenton and Conventional In-Office Dental Bleaching

in vivo study

Cardoso PE, Muench A, and Pinheiro HB, Universidade de São Paulo, São Paulo, Brazil

Academy of Dental Materials Meeting, 2011

Objective:
To evaluate the efficacy of two in-office dental bleaching methods on shade change and color stability (ΔE).

Materials:
• 25% hydrogen peroxide with light activation (Zoom2 + Zoom AP Light, Discus Dental, Inc.)
• 38% hydrogen peroxide (Opalescence Xtra Boost, Ultradent, Inc.)

Methodology:
Sixty healthy adult volunteers were randomly divided into three experimental groups of 20 subjects each. The groups were treated as follows: the ZAP1 group received one treatment with 25% hydrogen peroxide and light activation (Zoom2 + Zoom AP Light, Discus Dental); the OPX2 group received two treatments with 38% hydrogen peroxide (Opalescence Xtra Boost, Ultradent); the OPX3 group received one treatment with 38% hydrogen peroxide (Opalescence Xtra Boost, Ultradent). Each treatment consisted of three applications of bleaching gel for 15 minutes each.

<table>
<thead>
<tr>
<th>Experimental Groups</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZAP1 (n=20)</td>
<td>25% hydrogen peroxide with light (Zoom2 + Zoom AP Light, Discus Dental) – 1 treatment session</td>
</tr>
<tr>
<td>OPX2 (n=20)</td>
<td>38% HP-Opalescence Xtra Boost (Ultradent) – 2 treatment sessions</td>
</tr>
<tr>
<td>OPX1 (n=20)</td>
<td>38% HP-Opalescence Xtra Boost (Ultradent) – 1 treatment session</td>
</tr>
</tbody>
</table>
The shade of superior incisors and canines was assessed for each subject using a digital Vita-Easyshade Spectrophotometer immediately before and after the whitening treatment at 7, 14 and 30 days.

The Vita-Easyshade device measures the color based on a tridimensional system that supplies numerical values, which are inserted into a formula to provide color or shade variation (also known as ∆E). A custom clear EVA tray was used to ensure that measurements were taken at the same spot on each tooth. Holes in the tray on the labial surface of incisors and canines were made with a specially designed 6 mm bur corresponding to the size of the tip of the optical spectrophotometer reader.

Results:

Homogeneity and homoscedasticity tests were applied to the data obtained which indicated that two way ANOVA and Tukey test were the best tests to treat the results. All treatment groups showed increased whitening over baseline shade at 7, 14 and 30 days post bleaching. Groups ZAP1 and OPX2 presented statistically similar bleaching results, exceeding the results obtained for OPX1 group. All groups presented shade stability over the 30-day period evaluated in this study.

Conclusion:

For more than a century, in-office dental whitening treatment has been performed in much the same way, using hydrogen peroxides in high concentrations that vary between 30 to 38%. Light and heat may be used to accelerate the HP chemical reaction (Photo-Fenton reaction) so that a lower concentration of HP can be used. In this trial, one treatment using the whitening system based on the Photo-Fenton reaction (25% HP) produced whitening results equivalent to two treatments treatment with 38% HP (without light activation) and exceeded whitening achieved with one session with 38% HP (without light activation).
The Basic Chemistry Behind Hydrogen Peroxide Tooth Whitening

In vitro study


Philips Research Laboratories, Cambridge, UK

Objective:
To examine the basic interactions between whitening agents and stain molecules in simple solutions and to give clarity on the basic chemistry and photochemistry that occurs during the process

Materials:
• Black tea stain solution
• Whitening agents of various compositions including hydrogen peroxide, ferrous gluconate, and potassium hydroxide (based on Zoom treatment, Discus Dental, Inc., Culver City, CA, USA)
• Blue light (465nm)
• Infrared light (850nm)

Methodology:
The absorbance of tea stain solution at 450nm was measured over a period of 40 minutes, with various compositions of whitening agent added (including hydrogen peroxide, ferrous gluconate and potassium hydroxide in the formulations) and at the same time the samples were subjected to blue light (465nm) or infra-red light (850nm) irradiation, or alternatively were heated.

Results:
The reaction rates between chromophores in the tea solution and hydrogen peroxide can be accelerated significantly using ferrous gluconate activator and blue light irradiation. Infra-red irradiation was not found to increase the reaction rate through photochemistry but increases the temperature. While raising the temperature can give a slight increase in reaction rate, it can easily lead to inefficiency through the acceleration of exothermic decomposition reactions of hydrogen peroxide.
Conclusion:
By carrying out work in simple solution, it was possible to separate the basic chemistry of tooth whitening from the complex physical processes which occur in the tooth during whitening. Ferrous activators and blue light irradiation were shown unambiguously to significantly enhance the whitening process, whereas infrared irradiation or heating has a smaller effect.
**Novel Method for Efficacy Assessment of Whitening Agents**

*in vitro study*


**Objective:**
To evaluate the whitening efficacy of four in-office whitening systems using a direct measurement method, which evaluated the discoloration of a stain solution prepared with the most common food color used in beverages and industrial food.

**Materials:**
- Caramel solution
- 25% hydrogen peroxide
- 25% hydrogen peroxide + ferrous complex
- UVA lamp

**Methodology:**
A caramel solution (CS) was prepared in water, using Caramel Class IV AP 100 (Sethness Products Company, USA), at a proportion of 0.1% in weight (w/v). Five experimental groups were designed: Group 1. Control: caramel solution (CS) not submitted to any discoloration process; Group 2. CS+HP 25% (Lase Peroxide, DMC, Brazil); Group 3. CS+HP 25% + visible light LED for 45 min (480nm, Whitening Lase Plus, DMC, Brazil); Group 4. CS+HP 25% and Fe2+ (Zoom 2 gel, Discus Dental, USA); 5. CS + HP 25% and Fe2+ + UVA light (360-400nm) during 45min (Zoom AP lamp, Discus Dental). Five repetitions were conducted for each experimental group and the results were measured using a Shimadzu spectrophotometer UV-1650PC (Shimadzu Scientific Instruments, Japan) and converted into a percent that indicates the color that remained in the solution.

**Results:**
One-Way ANOVA showed all groups were statistically different except for Groups 1 and 2, which were statistically similar.
Conclusion:
The 25% hydrogen peroxide gel associated with ferrous complex reached higher discoloration than the 25% hydrogen peroxide gel. The 25% hydrogen peroxide gel associated with ferric complex submitted to UVA light emission offered the highest whitening potential when compared to all the other groups.
Light-Activated System for Bleaching Teeth

in vivo study


1Private Practice, Houston, TX, USA, 2Discus Dental, Inc., Culver City, CA, USA

Objective:
To examine the Zoom! Advanced Power light-assisted dental bleaching system, which combines a light source that emits strongly in the ultraviolet and blue-visible light wavelengths, with a 25% hydrogen peroxide gel.

Materials:
• 25% hydrogen peroxide gel (Zoom! Advance Power whitening gel, Discus Dental, Inc.)
• Light source (Zoom! Advanced Power whitening lamp, Discus Dental, Inc.)

Methodology:
Thirty-two healthy male and female patients age 18 to 70 years were enrolled in at a single site. Prior to treatment, all patients had a tooth shade greater than or equal to A3 for all six non-restored maxillary anterior teeth. After isolation of gingival and other oral soft tissue, 25% hydrogen peroxide gel was applied to the teeth, and the teeth were exposed to the Zoom! Advanced Power whitening lamp (Discus Dental, Inc., Culver City, CA, USA). After 15 minutes, the gel was removed and replaced twice with fresh gel and exposed to the light for three 15-minute sessions, for a total of 45 minutes. Vita Shades were assessed immediately before and after the treatment by the same examiner. A t-test for paired samples, using α = 0.05, was employed to compare shade changes (SPSS 11.0.1).

Results:
Overall, the 32 patients had an average Vita shade of D3 prior to treatment and A1 after treatment, for an average reduction of 7.8 Vita shades. One week after treatment, patients lost an average of 0.4 shade, making the average shade B2. Thus, the average shade change after one week was 7.4 shades. Importantly, 50% of all study patients achieved an ending shade of B1 or lighter immediately after treatment. Those patients who started with an average shade of A3, and had an average ending shade lighter than B1, had an average reduction of 8.3 shades. Patients who did not achieve an ending shade of B1 or lighter had an average starting shade of B3, and in them we saw an ending shade of B2; an average reduction of 7.7 shades.
Light-Activated System for Bleaching Teeth

### In-Office Whitening

#### Efficacy

<table>
<thead>
<tr>
<th>Starting Shade</th>
<th>Power Shade Change</th>
<th>Vita Shade Changes</th>
<th>Ending Shade Shade Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Power Shade Change

(For Patients Whose Final Shade was B1 or Lighter)

<table>
<thead>
<tr>
<th>Starting Shade</th>
<th>Power Shade Change</th>
<th>Vita Shade Changes</th>
<th>Ending Shade Shade Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.4</td>
<td>2.6</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Power Shade Change

(For Patients Whose Final Shade was B1 or Lighter)

<table>
<thead>
<tr>
<th>Starting Shade</th>
<th>Power Shade Change</th>
<th>Vita Shade Changes</th>
<th>Ending Shade Shade Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.2</td>
<td>9.6</td>
<td>7.2</td>
<td>8.3</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Conclusion:**

The Zoom! Advanced Power whitening system is effective at whitening teeth after three 15-minute sessions (45 minutes total treatment time). The gel and lamp combined to give study subjects an average improvement of approximately eight shade changes. This is typical of Zoom! treatments, but the number of patients achieving B1 or lighter shades is significantly better than with previous systems. Fifty percent of patients ended at B1 or lighter. The most important indicator of final shade was starting shade. Patients with a starting shade of B3 or darker have a significantly reduced chance of ending at B1 or lighter (p = 0.04). Patients whose starting shade was A3 or lighter have an improved chance of ending at B1 or lighter.
Clinical Evaluation Comparing Two H\textsubscript{2}O\textsubscript{2} Concentrations Used with a Light-Assisted Chairside Tooth Whitening System

in vivo study


\textsuperscript{1}Private Practice, Houston, TX, USA; \textsuperscript{2}Discus Dental, Inc., Culver City, CA, USA

**Objective:**
To assess the efficacy of two concentrations of hydrogen peroxide (H\textsubscript{2}O\textsubscript{2}) gels in a split-arch protocol in a clinical setting when used in conjunction with the BriteSmile BS4000 light.

**Materials:**
- 15% hydrogen peroxide whitening gel
- 25% hydrogen peroxide whitening gel (Philips Discus Dental, Inc., Culver City, CA, USA)
- Chairside whitening lamp (BriteSmile BS4000, Philips Discus Dental, Inc., Culver City, CA, USA)

**Methodology:**
Fifteen healthy adults over age 18 with a tooth shade greater than or equal to A3 (Vita Shade guide, Vita Zahnfabrick GMbH, Sackingen, Germany) for all six nonrestored maxillary anterior teeth were enrolled in a single-center trial. Tooth shade was assessed before whitening treatment, immediately after whitening treatment (same day), and one week after treatment. All study subjects were treated with three 20-minute exposures of the BriteSmile BS4000 lamp with 15% H\textsubscript{2}O\textsubscript{2} on three of the teeth and 25% H\textsubscript{2}O\textsubscript{2} on the other three teeth. The gel was removed and reapplied between light exposures. Total exposure time was 60 minutes. Subjects were treated with ACP gel at the conclusion of treatment.

**Results:**
Both groups had significant lightening immediately after treatment. Changes in tooth shade were better for the teeth treated with 25% H\textsubscript{2}O\textsubscript{2} (average of 8.0 shade changes) than the teeth treated with 15% H\textsubscript{2}O\textsubscript{2} (average of 7.6 shade changes). The same held true one week post treatment (7.4 shade changes with 25% H\textsubscript{2}O\textsubscript{2} versus 7.3 shade changes with 15% H\textsubscript{2}O\textsubscript{2}). However, the difference in shade change was not statistically significant immediately or at one week post treatment. There was no significant difference in tooth sensitivity scores between the two groups.
Conclusion:

In-office treatment using a chairside whitening lamp and either 25% $\text{H}_2\text{O}_2$ or 15% $\text{H}_2\text{O}_2$ is a safe and effective method for whitening teeth within one hour.