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Laser Diode Vs Conventional Teeth Whiteninig after Orthodontic Trerapy
(A *Comparative In Vivo Study)*

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Abstract

In the environment in which they function must of dental material used in our clinics have a potential effect on the enamel tooth surface .45 patients have (35-45) years old were collected from random area in Emirate and subdivided into 23 males and 22femals were subjected to conventional teeth whitening to lower jaws of patient and laser diode whitening procedures for the upper jaws after fixed orthodontic appliances removed from patients mouth with similar grade of discoloration. The bleaching scores declined from 10 to2 score in 90% of patients (female) and 84% of patients (males) were subject to conventional bleaching technique. While, scores declined from 10 to 4 scores in both males and females were subject to diode leaser bleaching. Sensitivity of teeth restricted to group who treated with conventional technique. the total session time the approximately if the lasers time session to each tooth collected (40-45minutes) but for single bleaching tooth was widely deferent .laser session for bleaching single tooth was 2-3 minutes. Also, 45 minutes with conventional technique. The cost is very high with laser due to the cost price of the laser compared with conventional light bleaching. The safety precautions and soft tissue hazard were same for both kind of treatment.

الخلاصة

بينت هذه الدراسة المقارنة إن اغلب المواد السنية المستخدمة في عيادات طب الأسنان لها تأثيرات محتملة على ميناء سطح الأسنان. 45 مريضا تتراوح أعمارهم (35 –45) سنة من مناطق مختلفة في دولة الإمارات العربية المتحدة. تم تقسيمهم إلى 23 ذكر و22 أنثى وتم قصر أسنانهم باستخدام عملية قصر الأسنان التقليدية للفك السفلي واستخدام عملية القصر بالدايود ليزر للفك العلوي لكلا الجنسين بعد رفع أجهزة التقويم الثابتة منهم بحيث تظهر درجة تلون بأسنانهم بدرجات متماثلة أظهرت النتائج إن درجة التلون تنحدر من 10 إلى 2 درجة في 90% من الإناث و84% من الذكور بينما الدرجات تنحدر من 10 إلى 4 درجات في كلا الجنسين اللذين تم قصر أسنانهم باستخدام عملية قصر الأسنان باستخدام الدايود ليزر . كما تبين أن حساسية الأسنان اقتصرت في المجموعة التي قصرت أسنانها بالطريقة التقليدية. إن فترة الجلسة الكلي تقريبا إذا جمع لفترة القصر بالليزر لكل آلا سنان حوالي (40–45 دقيقة) لكن القصر للسن المفرد مختلف كثيرا. وقت الجلسة للسن المنفرد من 2–3 دقيقة .45 دقيقة أيضا لعملية القصر التقليدية. كما تبين إن الكلفة عالية باستخدام عملية القصر بالليزر بسب كلفة الليزر مقارنة بعملية القصر التقليدية كما إن إجراءات الأمان والخطورة للأنسجة الناعمة نفسه لكلا نوعي المعالجة .

Introduction

There are few teeth whitening procedures available that correct discoloration of the teeth by removing the brown and yellow staining after orthodontic treatments by direct bonding of fixed appliances. With laser bleaching a dentist applies a peroxide solution to teeth and then uses light or a laser to accelerate the whitening process (Caroth and Mckenzi, 1985).

Lasers are now part of our lives in many ways. They are in our computer printers and compact disc players, they record prices at the supermarket check out, they light up rock concerts, and they guide weapons and measure distances between planets. Lasers have also revolutionized many surgical procedures, minimizing bleeding, swelling, scarring, and pain. Now, they are beginning to blaze a new trail in dentistry (Tteraja and Chand, 1987; Kandela, 1991and Castro, 1992).

Present research needs to describe the advantageous of laser whiting teeth procedure over conventional whiting procedure or visa versa. By using diode laser device and conventional technique, the esthetic of any person considered one of the

one important goals of our dentistry field, done in U.A.E country because diode laser device not available in Iraq now .

Laser Tissue Interaction

The light energy from a laser can have four different interactions with the Target tissue, and these interactions will depend on the optical properties of the tissue. These interactions are:

1-Reflection: which is simply the beam redirecting itself off the surface, having no effect on the target tissue.

2-Absorption: the laser energy can be absorbed by the target tissue. This effect is the usual desirable effect, and the amount of energy that is absorbed by the tissue. Depends on the tissue characteristics, such as pigmentation and water content, and on the laser wavelength and emission mode.

3-Transmission: of the laser energy directly through the tissue, with no effect on the target tissue.

4-Scattering.: of the laser light, weakening the intended energy and possibly producing no useful biological effect. Scattering of the laser beam could cause heat transfer to the tissue adjacent to the surgical side, and unwanted damage could occur.

Different components of target tissues effect different levels of absorption of specific laser wavelengths. An example of this is the higher level absorption of the Nd:YAG wavelength by pigmented tissue, as opposed to the Co2 laser. Conversely, the Co2 laser energy is highly absorbed by water, the principle soft tissue component, whereas the Nd:YAG laser is comparatively poorly absorbed by water (Avuylsteke, 1960; Maiman, 1960; McGraw Hilly, 1963; Altakins, 1986; Hitz, 1991; Altshuler, 1991; Cawson, 2002 ; Berkovits, 2002).

The desired effect of lasers in biologic tissue is that of controlled coagulation, vaporization, photo ablation or acoustic damage of the tissue. As such, for a laser to have any specific effect on any given tissue, the target tissue must adequately absorb that specific wavelength of laser energy in order to generate the heat necessary to alter the tissue. Laser energy can very substantially among systems and the delivery system can be altered to allow the energy to be focused in a small area or spread over a larger site. The energy applied over given area or spread over a larger site. The energy applied over a given area is termed energy density. The depth of laser penetration is also a function of the power setting and the duration of exposure of the tissue to the laser light. Therefore, the wavelength, power setting, duration of exposure, and spot size of the beam will all be significant modifiers in the net effect produced by the laser (Sternand, 1964; Tterajaand, 1987, Frentzenetal, 1989; Frank, 1989; Kellerand,1989; Frentzenetal, 1990; Dederich, 1991; Koubaasy, 1992; Sieversetal, 1992; Dederh, 1993; Charstpheretal, 1995 ; Markolf, 2003).

As laser energy interacts with the target tissue, the laser will cause the target tissue to generate heat. The following effects will be noted: tissue warming at 38-60 C, tissue welding at 60-65 C, tissue coagulation at 65-90 C, protein denaturization at 90-100 C, and vaporization and carbonization of the tissue at or exceeding 100 C depending on the tissue components. Continued lasing of carbonized areas can produce temperaturesgreaterthan1000C(Boehmetal, 1977; Harrisand, 1987; Schuller, 1990; Hardeeetal, 1990; Frentzenand, 1990; Harris, 1991; Levy, 1991; Robert-Harry, 1992; Tochio, 1993).

Bleaching Mechanism

Bleaching provides a conservative solution to mild to moderately discolored vital or root filled teeth. All dental bleaching agents the carbamide peroxide in

concentration of 10%, 15%, 16%, 20%, and 22% used in tray bleaching techniques or 35% to 50% hydrogen peroxide-based power bleaching agent ionize and decompose to initiate the redo chemical reaction bleaching process (Frenzen, 1992; Frenzen and Koort, 1992a,b; Frenzen *et al*,1992).

Do all bleaching agent decompose the same way?

Does all bleaching process have the same end constituents?

The answers to booth of these question is probably no, and complex exploration is required when seeking answers to the mystery of ionization of hydrogen peroxide (HOOH).

The entire chemical bleaching process could produce different ions and proceed in different ways as follows:

1. The ionization of HOOH produces the hydroxyl ions (OH^-) because of breakage of the weakest bond between the two oxygen atoms in the hydrogen peroxide molecule (see Eq. 3) The ionization of HOOH produces the per hydroxyl ions (HOO^-) Considered to be a stronger free radical, and hydrogen ion (H^+) (see Eq.4).
2. The ionization of HOOH produces water (H^2O) molecules and oxygen ions (O^{-2}), a weaker free radical (see Eq. 5).
3. The ionization of HOOH produces water and oxygen molecules in the presence of salivary peroxides enzymes (see Eq. 2).

Free radical ions are unstable and immediately seek an available target with which to react. The large, long-chained, darker colored molecule reacts easily with the free radicals, altering the optical structure of the molecule and creating a different optical structure. The stain on the tooth surface becomes invisible, or the larger, darker colored molecule becomes virtually dissociated into a similar, shorter chained and lighter colored molecule (Golden *et al*, 1964; Kantola, 1973; Beesl, 1976; Tteraja and Chand, 1987; Robert-Harry, 1992; Frenzen and Koort, 1992b; Frenzen *et al*,1992).

Equations

Equation of carbamide peroxide (urea peroxide) decomposing to hydrogen peroxide and urea:

$$CO(NH_2)_2.H_2O_2 \rightarrow H_2O_2 + CO(NH_2)_2 \qquad \text{(Eq. 1)}$$

Equation of hydrogen peroxide dissociated into water and oxygen molecules:

$$2H_2O_2 \rightarrow H_2O + O_2 \qquad \text{(Eq. 2)}$$

Equation of hydrogen peroxide decomposed to hydroxide ions:

$$HOOH \rightarrow HO. + .OH \qquad \text{(Eq. 3)}$$

Equation of hydrogen peroxide decomposed to per hydroxide ions and hydrogen ions:

$$HOOH \rightarrow HOO^- + H^+ \qquad \text{(Eq. 4)}$$

Equation of hydrogen peroxide decomposing to water molecule and oxygen ions:

$$HOOH \rightarrow HOH + O^{-2} \qquad \text{(Eq. 5)}$$

Rate of reaction

The expeditious rate of reaction in laser bleaching makes one major beneficial difference when compared with other methods of bleaching. Because bleaching has a short history of research and study, a calculated, hard definition of how the chemical rate of reaction operates is in its infancy (ANSI,1988; Nieburger *et al*,1988; International Electronical Committee, 1990; Schuller, 1990; Harris, 1991; Koubaasyetal, 1992; Miserdendino, 1992; Haris *et al.*, 1992; ANSI, 1993: Haris, 1993; Donna *et al*, 1996 and Sadoudi,1997). Enough research has been concluded to assure clinicians that laser bleaching using the argon laser as an energy source with

the highly concentrated HOOH is the most efficient method in the tooth-whitening process. These two components, the ideal energy source and high concentration of the bleaching gel, meet all the criteria required for achieving the ultimate rate of reaction. The bleaching process is a chemical reaction composed of different factors that determine the rate of the chemical reaction. The increase of the temperature, concentration of the reactants, and intensity of the light in a photochemical reaction are all proportional to the rate of the chemical reaction of the tooth whitening (Borggorevenand VanDigk, 1980; Nelsonand, 1986; Nieburger, 1988; Hibsit, 1989; Hbstand, 1991; Burkas and Hoke, 1992; Frenzen *et a*l, 1992; Haris *et al*, 1993; Frame, 2000 and Yuichi Kimura *et al*, 2003).

The pH value plays an important role in the rate of reaction in the bleaching process as well. Ionization of buffered hydrogen peroxide in the pH rang of 9.5 to 10.8 produces more per hydroxyl HO^{-2} free radicals. The result is a 50% greater bleaching effect in the same time allotment as other pH levels. The average pH value found in various strengths of hydrogen peroxide is approximately 4. the acidity allows the hydrogen peroxide to have a longer shelf life; however, to achieve efficiency standards, it should be buffered to a much higher pH value with the salt of an alkaline base before begin used as an agent for tooth whitening. A thickening agent is added for ease of control and handling (Stern andSognnases,1964;Stern,1974;Frentzen and Koort,1992 and Sievers etal,1992).

Carbamide Peroxide versus Hydrogen Peroxide as a Bleaching Agent

Carbamide peroxide is synonymous with urea peroxide, hydrogen peroxide carbamide, and perhydrol urea. Typically, these products contain carbopol (Carbopol 940, BF Goodrich co., Charlott, NC) or carboxypolymethylene polymer as thickening agent to improve the texture for ease of handling of better tissue adhesion in addition to their use as bleaching agents in tray bleaching methods. Carbamide peroxide is unstable and immediately dissociates into its constituent parts on contact with tissue, saliva, or moisture(Goldman,1996; Pajhdivala, 1998; Luaraetal, 1999; Operation Manual, 2004; Clinical Guideline, 2004).

The usual tray bleaching methods uses 10% to 15% strength carbamide peroxide decomposing to 3% to 5% hydrogen peroxide and 7% to 10% urea (see Eq. 1) once the solution comes into contact with moisture. Hydrogen peroxide is the active ingredient contained within the bleaching agent. It then continues decomposing into smaller constituent molecules or atoms. Urea continues to decompose into CO_2 and ammonia. Ammonia is strong base, which then offer an elevated pH environment, one that is more favorable for bleaching and simultaneously controls the acidity associated with plaque retention. In the presence of salivary peroxidase enzymes, the hydrogen peroxide decomposes to the safer constituents of water and oxygen molecules as part of an inherent self-defense mechanism (see Eq. 2). Because of its unstable nature, hydrogen peroxide decomposes instantly to produce various free radical ions (see Eqs. 3 to 5). These ions react with the long-chained, dark-colored chromophile molecules, breaking to smaller, lighter colored structures. Its also could be the phenomenon of altering the optical structure of the chromophile molecule, rendering to stain invisible (Stern, 1964; Fretzen, 1992; Goldman,1996; Luaraetal, 1999; Operation Manual, 2004).

The an office power bleaching method most often uses 35% hydrogen peroxide, although some methods use 50% hydrogen peroxide, a strength 7 to 16 times higher than that used in at-home bleaching techniques. Some clinicians use 35% hydrogen peroxide solution without adding any salt of an alkaline base or buffering agent; instead, solution-saturated cotton or gauze is placed on the teeth. The isolation

approach for this method of treatment includes a rubber dam that has been tightly ligated to the teeth with floss and, underneath the dam, a layer of protective material, such as Oraseal (Ultradent products), applied to the gingival tissue. This bleaching method requires a close examination of the isolation technique to ensure that the caustic solution can not leak through the rubber dam (HocAdvisory Committee, 1986; Wigdor, 1993; Paghdiveala, 1998; Operation Manual,2004).

Other hydrogen peroxide agents used in the power bleaching method can be incorporated with silica powder to create the paste from for easy handling. This paste could eliminate the need for a rubber dam, requiring only the isolation and protection of the gingival tissue with paint or liquid dam or composite as a gingival barrier, and a week base, such as sodium hydroxide, as a buffering agent to raise the pH value for more efficient bleaching. Various proprietary powders, sodium per borate (waterless hydrogen peroxide), or dyes could be formulated into the clinician's referred bleaching agent depending on their own working style and knowledge (Stern,1964; Stern,1974; Luaraetal, 1999; Clinical guidlinenes,2004).

Aims of the Research

1- To asses and evaluate the conventional teeth whitening procedures results after fixed orthodontic therapy
2- To asses and evaluate the diode laser teeth whitening procedure Results after fixed orthodontic therapy.
3- To compare between this procedure results because, the function and esthetic is very important point to give patient satisfaction.

Materials and Methods

Materials

The main materials, which used in this research, are listed below: fig. (3,4,5,6and7)

A- Plasma arc curing light whitening system "non laser light" LITMEX CO., USA
B- Laser Diode (DEX company) working with 810nm infrared, ORALIA CO. GERMANY
C- Whitening gel called contrastam from spectrum Dental, INC. Germany.
D- Light cures light, LITMEX, USA.

Methods

The sample

The sample consisted of 45 patients between the ages of 25-35 years. 22 of the sample were male and 23 were female, collected from random areas .Patients were collected from random area and subdivided into males and females were subjected to conventional teeth whitening to lower jaws of patient and laser diode whitening procedures for the upper jaws. In this style of work, the individual variation was overcome.

Criteria of the samples

The teeth of each person by visible light cure device were examined after de bonding procedure to all patients who were having discoloration after eight months wearing fixed orthodontic appliance. No cracks or any defects in the enamel surface of teeth, no any anomalies such as hyper or hypo atrophy (sound tooth), also, no attrition, abrasion and erosion characteristics appear in the teeth of patient. By clinical and visual examination, vitality test also done. No any type of adhesives used specially in area of bleaching procedures done. Crown constricted previously in the area suspected to bleaching operation was avoided. No chemical materials were used previously for dental care by patients who were reported.

In the present study , the age range of the examined patients were chosen in between 25 to 35 years in order to avoid normal histological variations and deference in hydroxyapatite crystal arrangement of enamel surface also, chemical concentration difference of minerals , CHO and amino acids means difference in organic and inorganic contents between child, adolescent, and adult (McCracken,1995; Myers and *et al*, 1995;) .

The patients were selection under chief complain of discoloration after eight months of orthodontic therapy by fixed appliance. Debonding done by routine manner

The bleaching process is done after scaling and polishing which the first step in the bleaching process. Then the check retractor was applied and cotton roles in all inner sides of the pt. mouth. Isolation light cure material was applied in cervical line of each exposed to bleaching tooth. After isolation the teeth which need to bleach, bleaching gel will applied to teeth labial surfaces in even thickness (1-2 mm). All upper teeth were bleached with diode laser (DEX laser) fig. (3and4) and the lower teeth were bleached with plasma arc non laser light to make compares between them.

Plasma Arc Whitening System LITEX 685w:

Is State-of-the-art, plasma arc based on composite curing light and tooth whitening system? The high resolution, flexible liquid light guide with Special wider wavelength design from 4000 to 540 nm for tooth whitening.

Select 2-3 second curing time or 5 second step-cur cycle (low/high intensity). The preprogrammed whitening program consists of 15 whitening cycles for a total of 10 minutes. Easily rotated, magnetically held, fiber optic probe. This whitening arch designed to whiten whole anterior area of patient's mouth, and the hand piece actuated fingertip pressure ring.

LED digital display indicates timer and cycle countdown. You should use eye protection glasses fig.(2) and disposable light shields included, and the unit is available for 100-240V 59/60Hz operation (Tteraja, Chand, 1967; McGrow, 1963; Frank, 1989; Dederich, 1991; Schuller; Otary, 1990; Goldman,1964; Fretzen,1992;).

Diode laser (Dex Laser) fig. (3)

The laser diode specifications are listed below as points (Kandela, 1991 ; Atkins,1986Avuylsteke *et al*, 1960; Dederich, 1991; Derderich, 1993; Frank, 1989; Koubaasy *et al*, 1992; Kantola, 1973);

- High efficiency diode laser, Class IV
- Hard and soft laser function
- Available in 810 or 980 nm
- Pilot laser in 633 nm, 2mw max.
- 30 watt power laser
- Frequency shift up to 10.000 HZ
- Various pulse: pause relations

The bleaching gel

Contrastam whitening gel is an in-office whitening system that was developed for use with or without light activation. Whitening result is enhanced when the contrastam whitening is gel is exposed to high-intensity dental light source: bleaching lights, argon laser, plasma arc lights, or bonding lights (Sievers, Altshuier, 1992; Operation Manual, 2004; American Dental Association, 1994; Council, 2003;).

The comparative points

The comparative points were as listed:

1- Degree of bleaching
2- Time of bleaching processes

3- Teeth sensitivity
4- The Cost
5- Soft tissue hazard
6- Safety standard in the dental clinic

Results and Discussion

The bleaching scores declined from 10 to2 score in 90% of female patients and 86.9% of males patients were subject to conventional bleaching technique. The total percentage result was 88% .While, scores declined from 10 to 4 scores in both males (18) and females (19), 80% were subject to diode laser bleaching. The final result was 82% from total patients (fig 9).

This result can explain according to the laser tissue interaction (McGrow-hiilly,1963;Avuylsteke,1960;Cawson,2002;Dederrich,1993;Frank,1989).Theconventi onal blue light was highly absorbed from whitening gel while, the gel not absorbed the infrared laser light. Due to this fact, the non-laser blue light highly activated the bleaching chemical reaction.

Therefore, the bleaching was high and more significant than the infrared laser diode. In the present study, the "side" factor (left and right) which is not considered depend on Ogaard and tenBosch findings in 1994 who reported the non–significance of the factor side when averaged overall weeks, these data do not prove a difference between left and right sides at (P=0.09). Also, it depended on Ogaard findings in 1989 who reported a statistically no differences between girls and boys or between right and left sides in the maxilla and the mandible. The color of the Enamel ranges from yellowish white to grayish white, the translucency may be attributable to variations in the degree of calcification and homogeneity of the Enamel (McCracken,1995). The normal structure of a tooth surface differs considerably between young, adolescent, and adult teeth, the most evident clinical characteristics of (young) teeth just erupted into the oral cavity are the perikymata that run around the tooth over its entire surface, by S.E.M. the open Enamel prism ends are recognized as small holes, but in adolescents teeth reflect an intermediate stage (Papathanasiou and etal, 2002). A variety of responses will result due to the following (Tavares and etal, 2003):

1. Compositional differences on the surface of Enamel within a tooth.
2. Compositional and morphological differences between teeth.
3. The orientation of crystals within the prisms.
4. Presence or absence of prism less Enamel of the tooth surface.
5. The presence of the acquired organic pellicle.
6. Structural faults in either the organic and inorganic components of Enamel. The effect of bleaching on the Enamel surface varies from tooth to the tooth, individual to individual and from one area to another (Goldstein and etal,1993).

Choosing a Laser for Bleaching :

Three dental laser wavelengths have been cleared by the food and Drug Administration (FDA) for tooth whitening: argon, CO_2 and the most recent 980 - nm GaAIAs diode. In February 1996, Ion Laser Technology (ILT, Salt Lake City, UT) gained FDA clearance for ILT argon (approximately 480 nm) and ILT Genesis 2000 CO_2 laser (10,600 nm) with a patented bleaching gel and chemicals for laser tooth whitening. The laser method originally was patented bleaching gel by Yarborough, a dentist and inventor widely credited with introducing some of the presently used tooth-whitening method to the dental community. Yarborogh found Brite Smile (Birmingham, AL) to commercialize laser tooth whitening. In 1998, ILT changed the process of laser manufacturing, and the company underwent reorganization. The Brite

Smile CO. (Walnut Creek, CA) changed its protocol in 1999 and currently uses the plasma-arc lamp as an energy source for teeth whitening in their Brite Smile centers.

Yarborough's treatment concept for laser bleaching involves the mixture of 50% hydrogen peroxide in sodium per borate, proprietary powder base. Argon laser energy is used first to remove deep-colored stains, followed by a CO_2 laser, which emits the mid-infrared thermal energy that is absorbed rapidly by water and the moist bleaching paste. The bleaching paste is applied several times; the teeth are then cleaned, followed by a final coating of fluoride gel. The CO_2 laser then is activated to promote the remineralization of the tooth surface. Caution should be exercised when using the CO_2 laser because the characteristic of this wavelength is thermal and well absorbed into water and hydroxyapatite, which the primary components of enamel.

There is a need for research efforts in laser bleaching (defined by the author as a dentist-controlled, in-office procedure using a high concentration of hydrogen peroxide and an added energy source to accelerate the process of tooth whitening). The preferred energy source is argon laser energy. The visible blue light emits a high-energy photon that efficiently excites the hydrogen peroxide molecules to a molecular vibration levels without any thermal effect. The thermal effect from the CO_2 is favorable for its rate of reaction, but the potentially adverse pulpal responses are a valid concern. The author dose not has sufficient experience with the new 980-nm GaAIAs laser to comment on its efficacy in this procedure.

Should clinicians consider the plasma-arc lamp is an energy source for tooth whitening to date; the research has focused on its application as a curing source for photo initiating a camphoroquinone-tertiary amine-type composite system. Similar to the argon laser, the plasma-arc lamp can be provided the high (>1000 mW/cm^2) to medium (>500 mW/cm^2) intensity of light needed to reduce curing time and ensure the full polymerization of the composite to gain its proper physical properties. Noted that the Apollo plasma- arc lamp emits a high intensity (>1000 mW/cm^2) for 3-second curing cycles; for bleaching cycles, ate 820 mW/cm^2. Simultaneously the radiometer reading for infrared light shows the 3-second curing cycle to be approximately 50 mW/cm2, and the bleaching cycle is 21 mW/cm^2 – similar to and slightly higher than the halogen curing lamp. Measurement of the temperature rise at the fiberoptic tip on 3-second curing cycle is approximately 20^oC; one bleaching cycle is approximately 12^oC which is higher than the controlled halogen lamp at 6^oC. Emphasized that using the halogen lamps for 30 to 60 second potentially can raise the pulpal temperature from 4^oC to 14^oC, and when using the Apollo plasma-arc lamp for a 4-second bleaching cycle, the pulpal temperature can increase2.2^oC. Before using plasma-arc lamp as an energy source for teeth whitening, clinicians must know the proper protocol and be aware of the existence of the infrared and thermal energy.

Due to that, more thermal energy was delivered and affect in the tooth leading to some sensitivity. The sensitivity was varied from patient to patient and mild to sever. According to the patient feeling, the sensitivity divided to main kind .The first on mild and can be neglected, the second one sever and need analgesic to relief the pain. 18 out of 23 of conventional bleaching the sensitivity was sever with them. While, mild sensation was with the rest patients of conventional bleaching. 0nly 2 patients out of 22 with laser bleaching were suffered sever sensitivity. Fig. (10) shows approximately idea about the sensitivity. . Analysis of the Enamel fluid revels that it is similar to lymphatic fluid, with the measurable amounts of both calcium and potassium. The fluid in the Enamel usually moves outward to the surface of the tooth, and the rate of flow of the fluid within the tooth is not constant, which is affected in a way that is similar to salivary gland secretions.

An inward movement of fluid is apparently associated with dental caries in humans, otherwise why would an actual pulpal response be manifested in an early lesion that is confined solely to the Enamel (Ploeger and etal,1993).

Finally, Sensitivity of teeth restricted to group who treated with convention technique. These facts supported by many authors study on living structures like (Yaborough, 1988 1990; Chen, Chase, 1979; Heinandetal, 2003; Newman, facq, 1971; Ogaard, 1989).

Safety Issues in Laser Bleaching

There are no compromises when it comes to safety; responsible clinicians must recognize the operational parameters of the energy source selected. The argon curing laser falls in the class III laser classification; this requires special training for operating the equipment and use of special eye protection with orange-colored lenses. The eyes are sensitive photoreceptors everyone in the operator area must ware these glasses. The intensity of the light used for bleaching must be blocked out with glasses with the proper optical density for specific wavelengths.

One most handle the caustic hydrogen peroxide with extreme caution. The patient should be acquainted fully with the procedure and well protected with a good isolation technique. There are different techniques for isolating the bleaching site, such as the well-ligated traditional rubber dam, painting a gingival barrier, or merely working with lip and cheek retractors. Whatever method the clinician feels the most confident with (this includes familiarity with each step of the procedure) is acceptable. Fig (4)

A first-aid kit should contain antioxidants such as vitamin E in liquid or capsule form and aloe Vera gel. Even with all isolation techniques in place, a single spilled droplet of hydrogen peroxide or bleaching compound, within seconds, blanches and burns gingival tissue. The patient may express discomfort with body languages because the isolation techniques in place may make verbal communication impossible. The clinician should remain calm and apply the vitamin E oil quickly; the symptoms subside within 1 minute.

The clinician must follow the protocol regarding the length of exposure time for the selected energy source, which depends on the intensity of the light (mW/cm^2) and the particular wavelength. The shorter the wavelength is the higher the energy of the photon. Conversely, longer wavelengths carry lower energy with more of the thermal effect of the photon. The general rule for avoiding unfavorable pulped responses is 30 seconds per tooth using the argon laser and 10 seconds per tooth for the plasma-arc lamp because its thermal energy is at a higher energy output. Usually, there is a recommended period for chemical oxidation followed by the light oxidation (5 minutes for argon laser and 10 minutes for plasma-arc lamp). Some bleaching compounds (power gel [Welch Allyn Dental Products, Skaneateles Falls, NY], ApolloSecret gel [DMD, Westlake, CA], and Hi-Lite [Shofu, Menio Park, CA]) give color indication when the redo process has been completed. Toxicological considerations, such as cytotoxicity or acute systemic toxicity, are much less of a problem with in-office power bleaching than with the at-home tray bleaching because there is no chance for the patient to consume any bleaching gel or have long-term contact or exposure. Health care providers always want to keep the patient's wellbeing foremost initiating any procedure. These facts also supported by (Ogaard, Tenbosch, 1994; Sheykoleslam; Buonocore, 1972; Strudevant; Robinson, 1995; Zakaria; AL-Hashimi, 1998; Bhaskar,1991).

The laser bleaching was applied to each tooth separately, (2-3minutes). The total session time for laser bleaching session was 2 multiply by number of teeth who

need to bleach. The final session time was (40-45minutes) approximately. This delay time in laser bleaching due to delivery system figure. The delivery bleaching system is designed for single tooth as shown in fig (5 and 6)

With conventional bleaching time was 45 minutes for all appeared teeth. But for single bleaching tooth was widely deferent .laser session for bleaching single tooth was 2-3 minutes while, 45minutes with conventional technique .fig (11)

The cost is very high with laser due to the cost price of the laser compared with conventional light bleaching. The cost of laser diode is ten times more than conventional system. This cost will be reflected on the patients. Fig (12)

The safety precautions and soft tissue hazard were same for both kind of treatment.

Conclusion

1. Bleaching degree clinically higher in group treated by conventional method if compared with laser whiting group.

2. Delivery of bleaching arches have more time consuming if compare with bleaching of single tooth in both conventional and laser methods.

3.Teeth sensitivity and cost are higher with laser bleaching method due to heat generation during procedures and delivery system figure.

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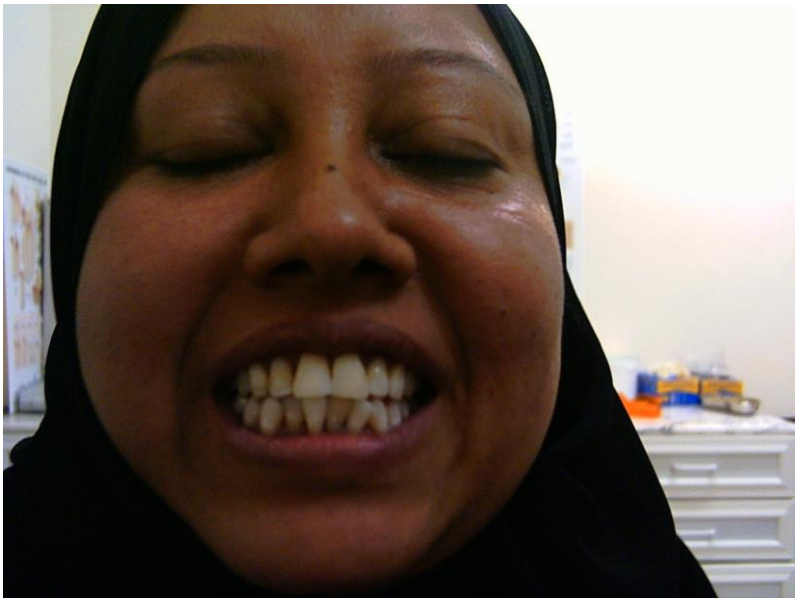

Fig.1 Female patient before bleaching

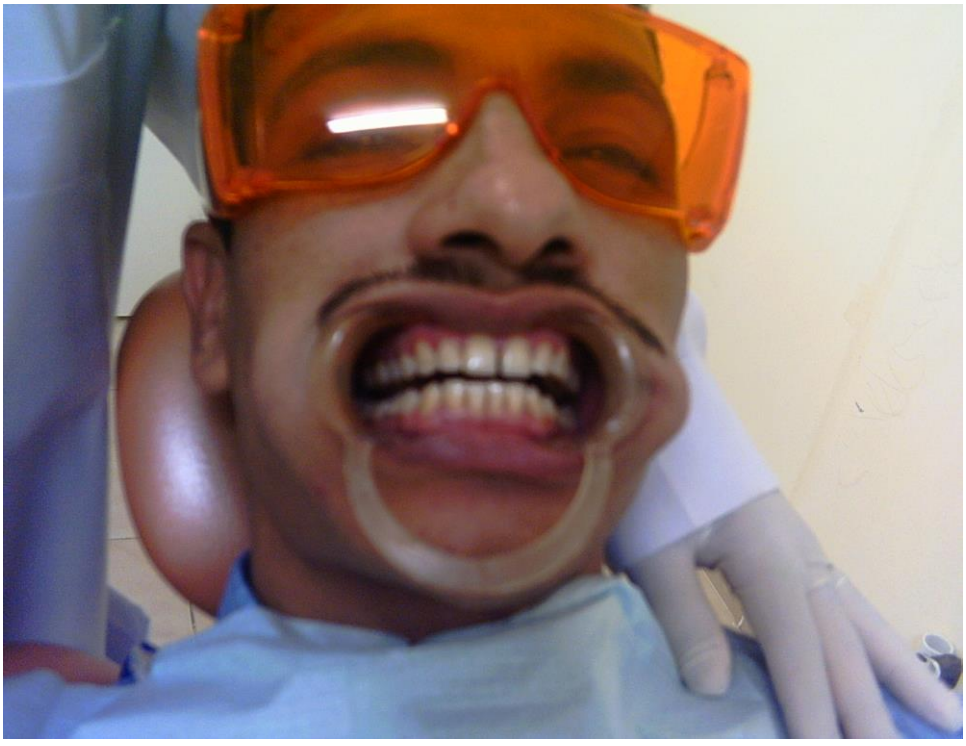

Fig.2 male patient is prepared for bleaching

Fig.3 plasma arc whitening system

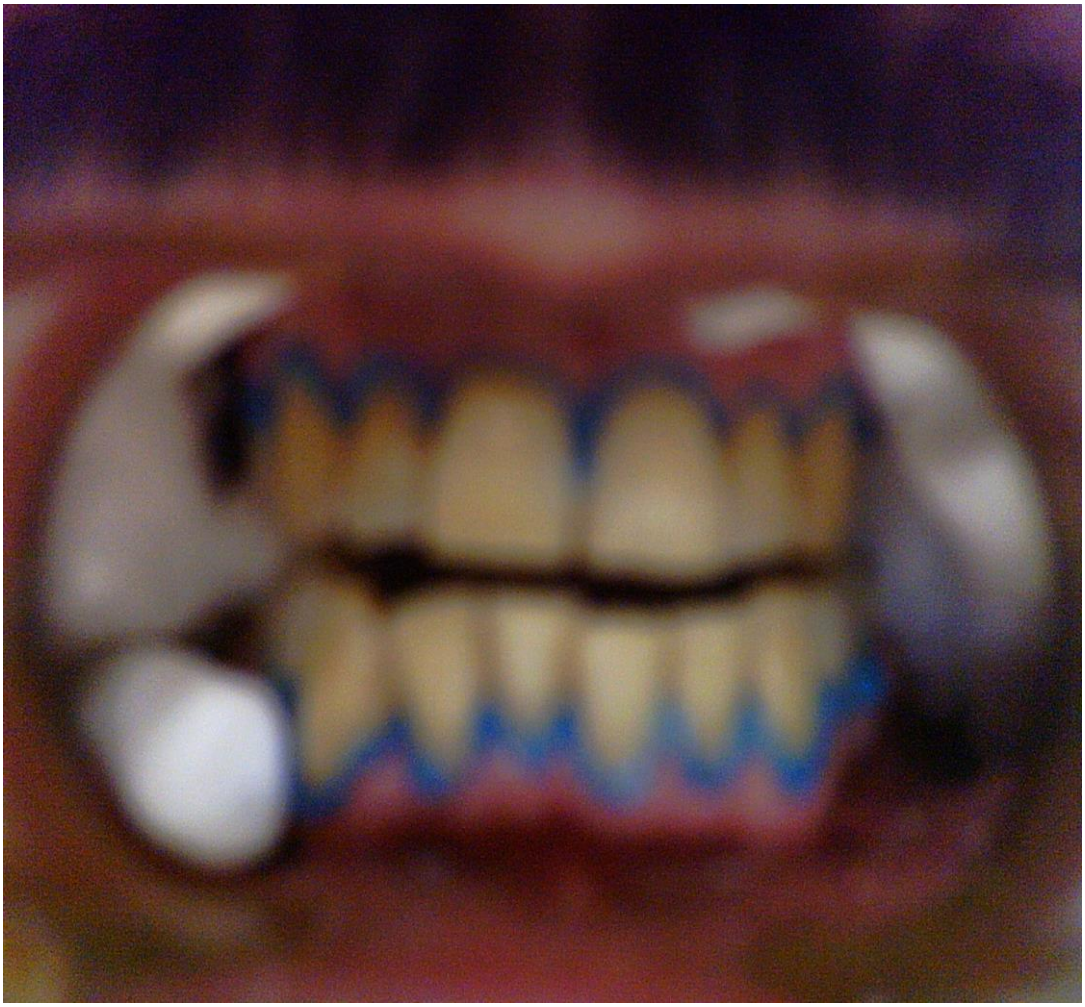

Fig.4 Isolation the hard structures from soft tissues before applied the bleaching Gel.

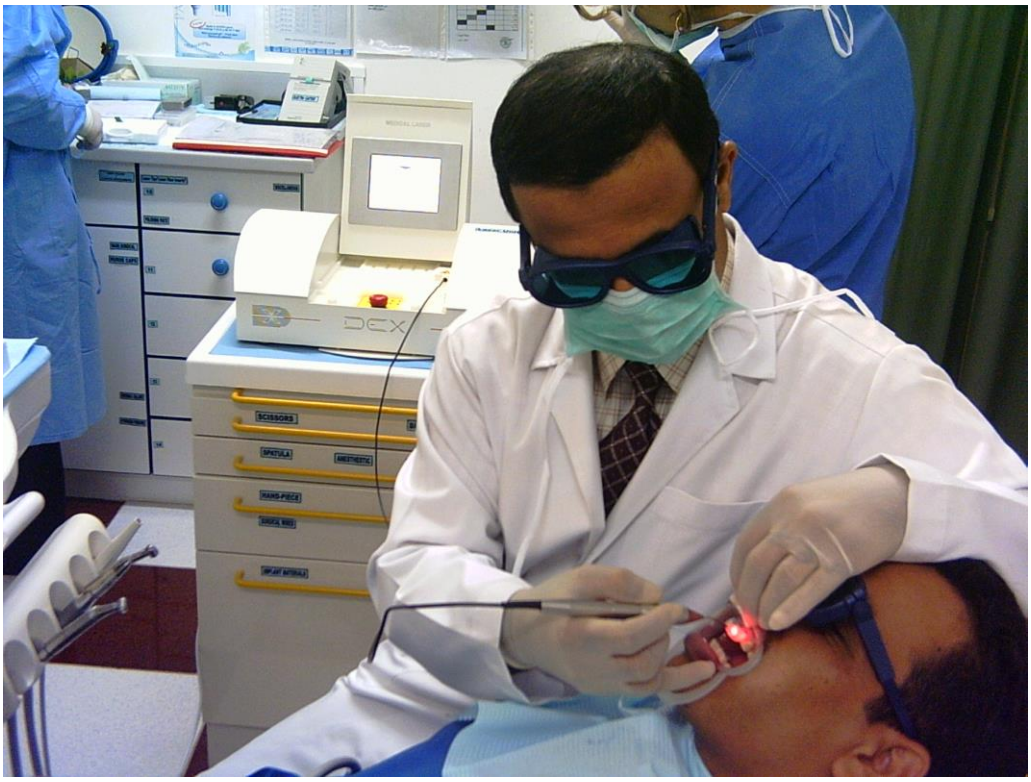

Fig. 5 laser diode through the bleaching process (male).

Fig.6 laser diode through the bleaching process (female).

Fig.7 conventional light bleaching system (female)

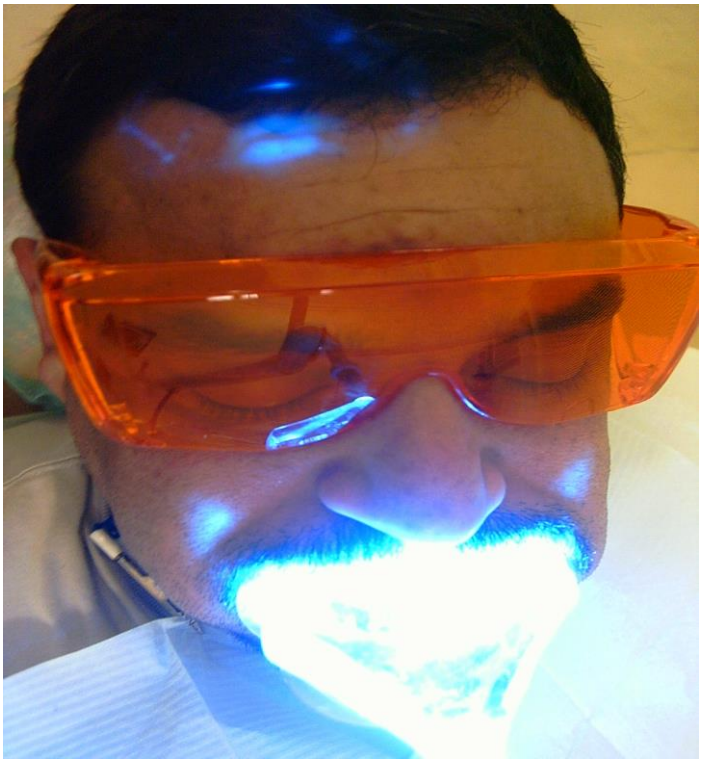

Fig.8 conventional bleaching process (male)

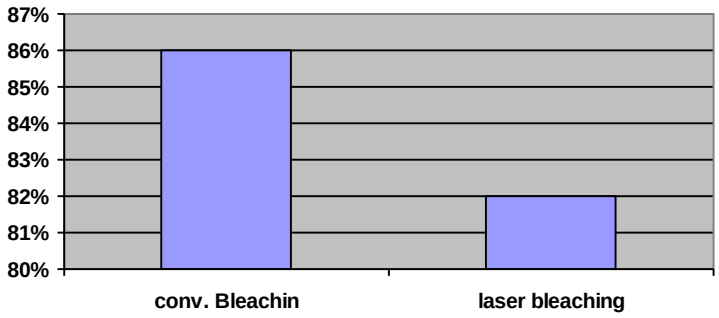

Fig.9 conv. and laser bleachin %

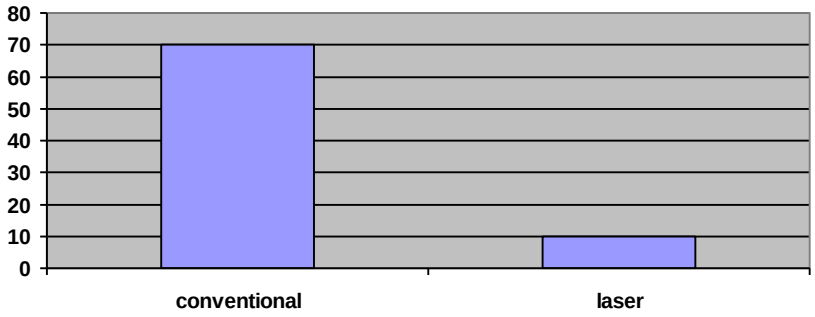

Fig.10 sensitivity related to the conventional and laser bleaching

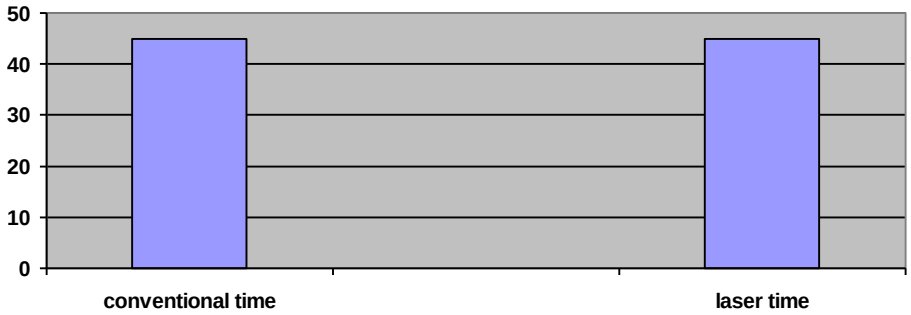

Fig. 11 time bleaching to the conventional and laser

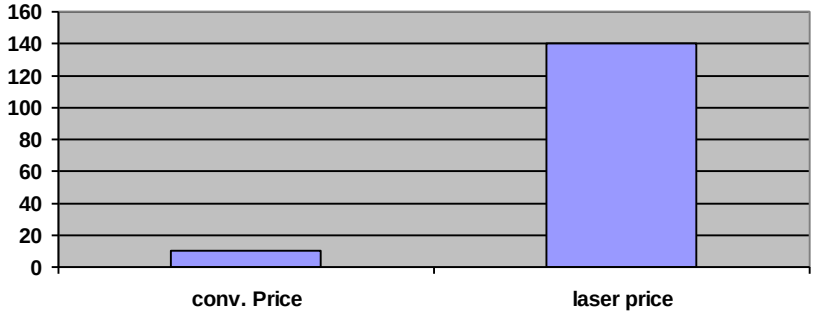

Fig. 12 cost price of conv. bleaching system and diode laser system

Fig. 13 female patients before bleaching

Fig. 14 laser bleaching

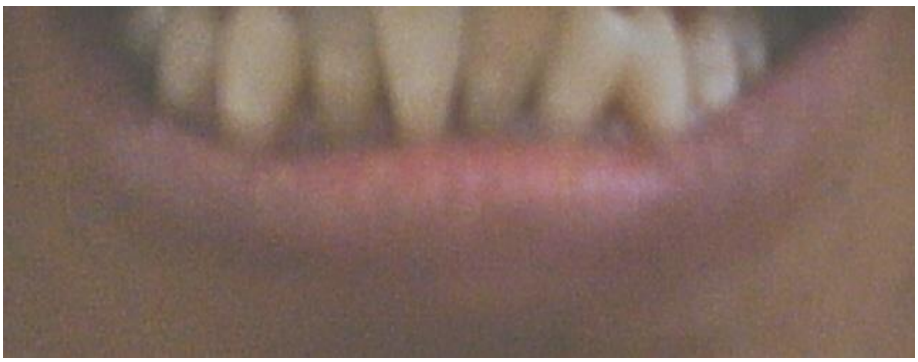

Fig. 15 laser bleaching

Fig.16 male patient before bleaching

Fig. 17 conventional bleaching of previous figure