GRADUATION PROJECT

Degree in Dentistry

NEW BLEACHING TECHNIQUE

Madrid, academic year 2022/2023

Identification number: 80

ABSTRAT:

Introduction : In today's world, with high expectations of health and beauty, as well as the influence of social media, having a beautiful smile is critical and demands of whitening treatment has risen. Also, methods of dental whitening have been developed by using Microabrasion, in-office, home bleaching, and in certain circumstances, non-vital bleaching were successful procedures. Although bleaching treatment have some flaws such as sensitivity, cost, and time consumption, as reported in the literature, several clinical trial studies have been conducted to minimize the adverse effects.

Objective: The main goal of this study is to determine and describe different new bleaching techniques. The second objective is, presenting effects and also side effects of bleaching treatment.

Methodology: 33 articles used Cochrane library including , Pubmed, Medline, Wiley

Result :6 anterior superior arched was used as samples and they excluded teeth with caries, periodontal disease or previous dental bleaching. While few investigations has been done to evaluate the effect of bleaching agents on restorative teeth. Various methods were employed such as modification of concentration of bleaching agents, tray design, or adding some materials to reduce the flaws.

Conclusion : Among all bleaching treatments , using 10% carbamide peroxide is the safest methods ,more simple , economic; in some other cases non vital bleaching were successful methods. According to current researches, bleaching chemicals had no massive impact on color shifting on restorative teeth with hybrid composite, despite the fact that the amount of bleaching agents identified in pulp was higher in restorative teeth than sound teeth. Teeth sensitivity can be reduced by using sodium perborate or sodium hexametaphosphate (SHMP). Using charcoal dentifrices can be effective in color changing to a lighter tone.

Key Words: tooth discoloration, bleaching techniques, ‘AND ‘ efficacy , sensitivity, tooth whitening and sensitivity

Resumen

Introducción: en el mundo actual, debido a las altas expectativas de salud y belleza, así como con la influencia de las redes sociales, la estética dental es fundamental y esto ha provocado un aumentado en la demanda de tratamientos de blanqueamiento.

Además, se han desarrollado técnicas de blanqueamiento por microabrasión, uso clínico, uso domiciliario e incluso blanqueamiento no vital, todos con resultados exitosos. Aunque el tratamiento de blanqueamiento tiene algunos efectos negativos como la sensibilidad, el coste y el consumo de tiempo, como refiere la literatura; se han realizado varios estudios de ensayos clínicos para minimizar dichos efectos.

Objetivo: El objetivo principal de este estudio es exponer diferentes técnicas de blanqueamiento. El objetivo secundario es introducir algunos efectos y efectos secundarios del tratamiento de decoloración.

Metodología: 34 artículos utilizados Cochrane, Pubmed, Medline, Wiley

Resultado: Se utilizaron como muestras 6 arcadas anterosuperiores y se excluyeron dientes con caries, enfermedad periodontal o blanqueamiento dental previo, mientras que se han realizado pocas investigaciones para evaluar el efecto de los agentes blanqueadores en los dientes restauradores. Se emplearon varios métodos, como la modificación de la concentración de los agentes blanqueadores, el diseño de la cubeta de impresión o la inclusión de algunos materiales para reducir los defectos.

Conclusión: Entre todos los tratamientos de blanqueamiento, el uso de peróxido de carbamida al 10% es el método más seguro, más simple, económico, en algunos otros casos los métodos de blanqueamiento no vitales fueron exitosos. Según la investigación actual, los productos químicos blanqueadores no tuvieron un impacto masivo en el cambio de color en los dientes restaurados con composite híbrido, a pesar de que la cantidad de agentes blanqueadores identificados en la pulpa fue mayor en los dientes restaurados que en los dientes sanos. La sensibilidad de los dientes se puede reducir usando perborato de sodio o hexametafosfato de sodio (SHMP). El uso de dentífricos de carbón puede ser efectivo para cambiar el color a un tono más claro.

Palabras clave: decoloración dental, técnicas de blanqueamiento y eficacia, sensibilidad, blanqueamiento dental y sensibilidad.

Abbreviation

ACP	Amorphous calcium phosphate
BG	Bioglass
CP	Carbamide peroxide
E tray	Extended Tray
EXP	Experimental group
Gb	Bencer toothpaste
Go	Optic white toothpaste
GP	Perfect White Black tooth paste
GT	Colgate toothpaste
HA	Hydroxyapatite
HP	Hydrogen peroxide (H2O2)
ITB	In office bleaching
LED	Light Emitting Diode
MTA	Mineral trioxide aggregate
N-BM	Bioactive nanoparticles
NE tray	Non Extended Tray
OTC	Over counter
SHMP	Sodium hexametaphosphate
SP	Sodium perborate
TS	Tooth sensitivity
V-LED	violet Light Emitting Diode

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1. INTRODUCTION;

Now days having aligned, bright, shiny and white teeth demands are increased , which not only considered as a beauty scale but also as a healthy mouth. Therefore, cosmetic awareness has increased the trend of tooth whitening among patients and dentists. (1,2)In today world, people life have been impacted by social media . People awareness of cosmetic , and beauty caused the transformation of predilection for having a nice smile .(3)

Healthy and a beautiful smile have provided many psychological and emotional benefits and creates confident and self-esteem . Also, positive communication can be generated by a great smile. Several studies have revealed that discolored teeth in adults and children adversely affected socialskills, relationship and mental creativity. Negative psychological judgment has been demonstrated in children and adults based on teeth appearances. (4)

In modern oral health care is focused on prevention of caries and periodontitis plus whitening and oral esthetic. In addition, toothpastes have complicated formulations which contain many different agents for prevention of caries and periodontitis, different concentration of fluorides, chlorhexidine, zinc salts and calcium phosphates such as hydroxyapatite or amorphous calcium phosphates, and surfactants as well as different abrasives for an efficient plaque removal. Furthermore , oral product companies present different whitening products because of high demands.(5)

1.1 History

One of the most important fields of esthetic dentistry is the treatment of discoloration. Whitening treatment methods have been improved, by using simple pure chemical peroxides, till recently using light or laser. The first professional whitening was written In 1876, by M'Quillen, who stated, that the most prevalent tooth discoloration was changing tooth color to pink, which was caused by distribution of hemoglobin into dentinal tubules, called "rosy tooth."

M'Quillen used liquor soda chlorinate, chloride of lime and potassium chlorate as bleaching agents to change the color of stained teeth. In 1918 Abbot,used high-intensity light source to increase the temperature of a peroxide-based bleaching agent. In 1937 Ames and Smith used heat stimulate. They also came up with a special hand instrument a Bunsen burner to accelerate the bleaching process.(6)

1.2. Classifications of stains

Chromophores are color compound in teeth . Biotic(oganic) and non biotic origin Chromophores absorb visible light and reflect colors that is recollect it with eyes, specially yellow or brownish of the teeth. Organic chromophores are double bonded molecules that can be founded in products such as, fruits, red wine, tea , and coffe . non biotic chromophores are metal ions like Iron , cupper , mangenes ion In hemoglobin chromophores are combination of organic like, porphyrin ligand and inorganic color iron ion.(5) Stains can be classified into two groups of intrinsic and extrinsic origin. Intrinsic stains are described by discoloration in layers of the tooth, which can be enamel or dentine, also can be classified in very mild, mild and sever. (7)

1.2.1. Intrinsic discoloration

Intrinsic discoloration appears when the structural composition or thickness of the tooth hard tissues, both the enamel and the dentin, changes. This indicates that the chromogenic substance is absorbed into the dental hard tissue, either during tooth formation (pre-eruption), or after tooth eruption.(8) Intrinsic staining develops during childhood or at birth and cannot be erased with preventive stain removal. Teeth can get yellower over time as individuals age. (9) It also can be generated by different factors such as unrestricted ingesting fluoride during tooth formation (fluorosis), from tetracycline consumption, metabolic diseases or systemic factors during odontogenesis. Another choice is applying chemical bleaching elements. Nevertheless, bleaching agents will not totally eliminate some discolorations caused by fluorosis or developmental malformation, while in dentin due to microporous of dentine, stains will attach to it strongly and removing intrinsic stains, chemically or mechanically from the outside, is impossible .One of indicated treatment for removing intrinsic discoloration of dentin intrinsic is endodontic bleaching with peroxides ,but

it can only applied in dental clinics.(5) Intra-endodontic operations including as opening preparation, chemical and mechanical manual and rotatory instrumentation, and root canal sealing may result in intrinsic or internalized tooth discoloration, or a mix of the two.(10)

1.2.2. Extrinsic staining

Extrinsic discoloration is describing as stains on the surface included enamel and dentin with a thick pellicle layer which are difficult to remove. Those stains are composed of organic and inorganic chromophores, and their sources are commonly chromophores that can be found in foods, beverages, smoking .The rough surface of the teeth absorb chromophores. Most organic dyes have strong attraction to proteins , and they are presented inside plaque and pellicle.(5) Tin sulfide color arises by reaction of volatile sulfur of bacterial with stannous fluoride of toothpastes. To eliminate extrinsic stains usually there are some methods such as using , abrasive polishing routines such as dentifrice and toothbrush , or at dental clinic with treatments, for example peroxides.(6)

1.3.Bleaching products

In general, Hydrogen peroxide and carbamide peroxide are accustomed in different concentrations for chemical dental bleaching. While hydrogen peroxide is an unstable substance which breaks down into reactive oxygen free radicals, and water. Carbamide peroxide is stable, and releases its active components (hydrogen peroxide and urea)with combination of water. Hydrogen peroxide may be used as an active ingredient in bleaching agents, along with flavoring, such as carbopol, glycerin.(14,15) Some of materials used in endodontic treatments , such as calcium silicate cements, mineral trioxide aggregate (MTA), in treatments of pulpotomy, pulp capping , perforation repair, regeneration, have a significant risk of discoloring in dental tissues.(16,17)Bleaching acts through an oxidative process by breaking one or more of the double bonds within the conjugated chain of chromophores. Peroxide can penetrate into the enamel, dentin, enamel-dentin junction.(14,15)

1.4. Tooth Bleaching Methods

1.4 .1 Prophylaxis

One of the effective treatment for extrinsic staining is dental prophylaxis by professionals at dental office by using low speed rotatory and applying of an erosive and roughness materials and a coronal polishing. (11)

1.4.2. Microabrasion

A secure, preservative, esthetic procedure for enamel surface staining treatment is microabrasion, which is beneficial in removing of discoloration that may caused by fluorosis, amelogenesis imperfecta ,and hypoplasia. This whitening treatment was presented by Croll. This procedure is taking advantages of combination of physical erosive, abrasive particles and chemical factors like acids to eliminate irregularities and discoloration defect of the surface enamel layer.This technique, they use low-speed micro-motor ,various acid high concentration of Hydrochloric acid. In 1986 Croll suggested usage of low speed hand piece with mixture of water and 18% Hydrochloric acid .(12)

Fig 1.Maxillary incisors fluorosis before microabrasion. (33)

Fig 2. Maxillary incisor fluorosis after microabrasion. (33)

1.4.3. OTC bleaching: Toothpaste ,mouth rises

Over counter bleaching products (OTC) have various concentration. Different forms of for OTC tooth whitening elements are, dentifrice, whitening strips, mouth rinses, gels, varnish . OTC bleaching products' function is defined by removing and preventing

extrinsic stains. The concentration of hydrogen peroxide in whitening strips frequently is between 5-14 %. This product is used on the teeth by adhesive agent and steadily over a 6–10-minute, active bleaching agents is released. (13)

1.4.4. In-office whitening

In-Office bleaching is done by a dentist, generally for 15–20-minute periods over a 45-60-minute by using of a high concentrations of hydrogen peroxide (35-40%)in a clinical session. The process could be done several times to attain the desired whitening result.(18) Although in-office whitening with peroxides is therapeutic, it might cause to dental problem ,or tooth sensitivity to the natural organic matrix of enamel and dentin. Because of the possibility for tooth wear, the usage of erosive materials in teeth whitening, and dentifrices with high RDA(Recommended Dietary Allowance) values is restricted. Because of a lack of placebo-controlled scientific trials, the potency of various whitening elements in vivo is frequently unknown.(2)

Fig 3. Maxillary incisors before Treatment. (33)

Fig 4.Maxillary incisors After in-office bleaching with 30%H2O2 .(33)

1.4.5 At-home tray bleaching

Whitening dental treatment of home tray bleaching is a night guard crucial bleaching method is performed at the patient's house but monitored by the dentist. This procedure involves loading a bleaching tray of bleaching ingredients with a low concentration of 10-20%. The trays are normally applied overnight or 3-4 hours each day for 2-6 weeks .Since only 50% of it degraded into its active components in 2 hours, It is critical to apply at the right time.(13) The treatment of at-home bleaching has the

benefits of less chair-side time, less side effects, and minimal related costs. The fundamental drawback of this approach is its considerable reliance on patient cooperation. It has been established that the inclusion of reservoirs in bleaching trays with 10% carbamide peroxide, didn't have an impact on the color alternation, or gingival inflammation, or tooth sensitivity which is done by dentists instructions.(5)

1.4.6 Non vital bleaching

The indicated therapy has been recommended for discoloration of teeth with inherently stained and have had endodontic treatment. Garretson initially described non-vital tooth bleaching with chlorine in 1895. Originally, Hydrogen peroxide was utilized for non-vital tooth whitening in 1951.Now days, in non vital bleaching , dentists utilize carbamide peroxide ,and sodium perborate (with mixture of distilled water or hydrogen peroxide). Despite the fact that hydrogen peroxide could be an efficient bleaching elements, we should be careful ,while using of more than 30% doses. (5)Nutting and Poe adjusted this by combining carbamide peroxide with sodium perborate, which enhanced the concentration of carbamide peroxide.(19) The most significant component in bleaching success appears to be the accurate removal of all restorative materials from the access cavity without further dentin elimination. Dentine must be cleansed to allow the bleaching substance to diffuse into the dentinal tubules.(20)After introducing the bleaching chemical, dentists seals the access cavity by putting a temporary filling material for instance, Cavit, resin composite, resin modified glass ionomer, then wait for 2 or 3 days, to evaluate the result, and repeat the treatment in case, it would be necessary. After evaluation if result is satisfying ,add calcium hydroxide to reduce oxygen prevention of resin composite polymerization then, finally repair the access cavity.(19)

Some of the contraindications of internal bleaching are :

- Amalgam or other metallic materials can induce discoloration (not bleachable)
- Substantial dentine loss in the cervical region (risk of breakage and bleaching agent leaking)
- Comprehensive repairs, Obvious fractures, particularly with subgingival extension.
- Patients under the age of 19.(19)

1.4.6.1 inside out bleaching

Settembrini described the inside out bleaching process in 1997 , and Liebenberg updated it in 1997 . This method involves administering a whitening substance to the exterior tooth surfaces, as well as the interior, while maintaining the access cavity open throughout this therapy. It includes a form of vacuum splint, and it has reservoirs on lingual and buccal portions of teeth that we want to bleach them. The dentist guides the patient to utilize a syringe with 10% carbamide peroxide for filling the opening cavity and the regions on the sockets splint. The patient should wear it at night, and clean the access cavity on a regular basis. The patient has to repeat in 2-3 days, until the satisfied color is observed. Next step is, cleaning the access cavity and temporarily using glass ionomer with resin modified material. After 7-10 days, a permanent resin composite restorative can be applied. One of the advantages of the procedure is that ,we can use low doses of whitening chemical materials.(23)While in compared to other type of whitening, the inside out bleaching procedure originally displayed more effectiveness. However, after 6 months of rehydration of the tooth, the therapy outcomes are comparable. The drawbacks of the treatment include the possibility of root canal bacterial infection due to the open access cavity, as well as patient cooperation. The whitening gel should be washed off and reapplied after 15-20 minutes. Because there will probably be hydrogen peroxide remains in the access cavity, it should be closed in the next dental visit. This method with high concentrations of hydrogen peroxide (35-40%) was associated with root resorption and is no more advised. Exclusive tooth tray bleaching involves the use of carbamide peroxide with low concentration ,through created bleaching tray, and the whitening gel administered just to the tooth to be bleached.(1,24)

Et al . Reitzer F study indicates the successful treatment of inside/out bleaching as following figures.(24)

Fig .5a.maxillary incisor with smile of the patient. 5b. Intraoral view of the maxillary incisors before treatment(24)

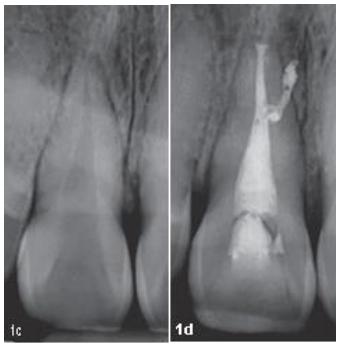


Fig .5.1.c. radiography of tooth 11 , before treatment . 5.1.d endodontic treatment of tooth 11 .(24)

Fig5. 1.e. Image of endodontic treatment.

Fig5.1.f. Image of the zinc oxide eugenol cement.

Fig5.1.g. Image of 10% carbamide peroxide placed in the access cavity.(24)

Fig 5.1.h . Nonvital tooth bleaching by using exclusive tray.
Fig 5.1.i.Applying the tray .(24)

Fig 5.2.f . shows the result of inside/out bleaching technique 18 months after the treatment.(24)

1.4.6.2 Walking Bleaching

The walking bleach process relies on the employment of chemicals that emit active oxygen, such as hydrogen peroxide (H2 O2) or sodium perborate (SP). In walking bleach procedure, we use a mixture of SP and water or H2 O2. The bleaching outcome is mostly determined by the bleaching agent's concentration, the its potential to get into the chromophore molecules, and also frequency, of the contact between the element of bleaching and chromophore molecules plays an important role in the results. SP has been frequently used with predictable results to bleach. nonvital teeth. SP is an oxidizing agent .It is 95% perborate and comes in three forms of monohydrate, trihydrate, and tetrahydrate. Perborate dissolves in water. It will degrade into sodium metaborate, H2O2, and oxygen. SP is also utilized synergistically with H2O2, but when combined with water, it produces outstanding esthetic results with minimal or no negative effects. (21) The benefits of this procedure are its relative dependability, simplicity, low cost, lack of specific equipment, and ease of use for both dentists and patients. While there is a danger of cervical root resorption, it is safe if sufficient steps are taken to place a cervical barrier conforming to the outer CEJ and 1 mm apical to it.(22)An example of effective walking bleaching treatment is illustrated et al .Thamer Almohareb case report.(21)

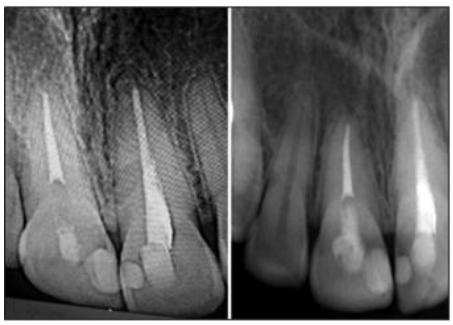


Fig 6. (a) Preoperative periapical X-ray, (b) postoperative periapical ,X-ray after 1 year.(21)

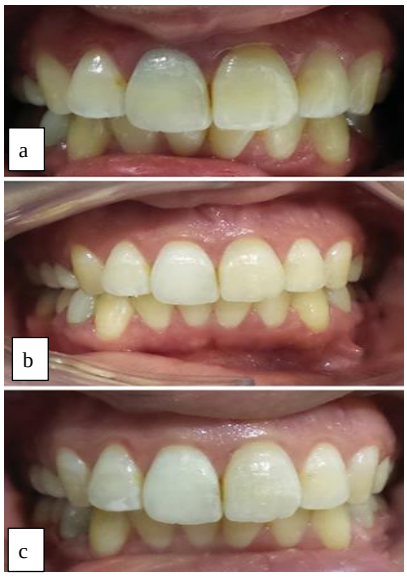


Fig 7 .Showing the case from above to bottom(a) pretreatment, (b)post treatment appearance after 5 days with walking bleaching , (c) post treatment photograph after 1 year with walking bleaching technique.(21)

1.4.7 Laser

Another bleaching option includes diode lasers, KTP laser, argon, which have been routinely applied for treatment of in-office bleaching. A diode laser has a solid medium, made of crystals that are semiconductor, containing aluminum or indium, gallium, and arsenic. The (810 nm) gallium aluminum arsenide laser and the indium gallium arsenide phosphide laser(980 nm) are the most frequent lasers in this class. They can work in pulsed or continuous wave modes.(12)

2. JUSTIFICATION :

Patients' desire for tooth whitening in the treatment of dental discolorations is expanding. Many individuals who have undergone teeth whitening realize the value of having a dazzling white smile .Dental bleaching is the safe and conservative esthetic treatment and side effects such as sensitivity and toxicity have been reduced as a result of better techniques.

3. OBJECTIVE :

The main goal of this study is to determine and describe different new bleaching techniques.

Secondary objective :
To Introduce some effects and sided effects of bleaching treatments.

4. METHODOLOGY :

Searching methods & Databases

Various protocols were put in place to achieve a high quality in this literature. Throughout the research of academic articles, this literature was conducted using a variety of important phrases, key words including ," new dental whitening , bleaching technique, tooth discoloration, laser , sensitivity , effectiveness "with combination of "AND " along with the interest of achieving its most precisely desired outcomes with in specific articles. To provide the references for this review literature several databases were used including Medline, Pubmed, and Wiley and online library resources provided by Universidad Europea de Madrid .

In addition, data was gathered from articles published from 2015till 2023. Various articles were extracted by using some key words such as “bleaching technique Uem bibliocrai n=153 Pubemd n=26 ,” tooth whitening efficacy” Uem bibliocrai n=128 , “tooth discoloration” n=35, bleaching and sensitivity n= 142 ,”tooth whitening and sensitivity” pubmed= 33, and total articles of 517 were identified , after consideration of some following criteria , 33 articles were included.

Eligibility Criteria

Following Inclusion criteria in this literature are:

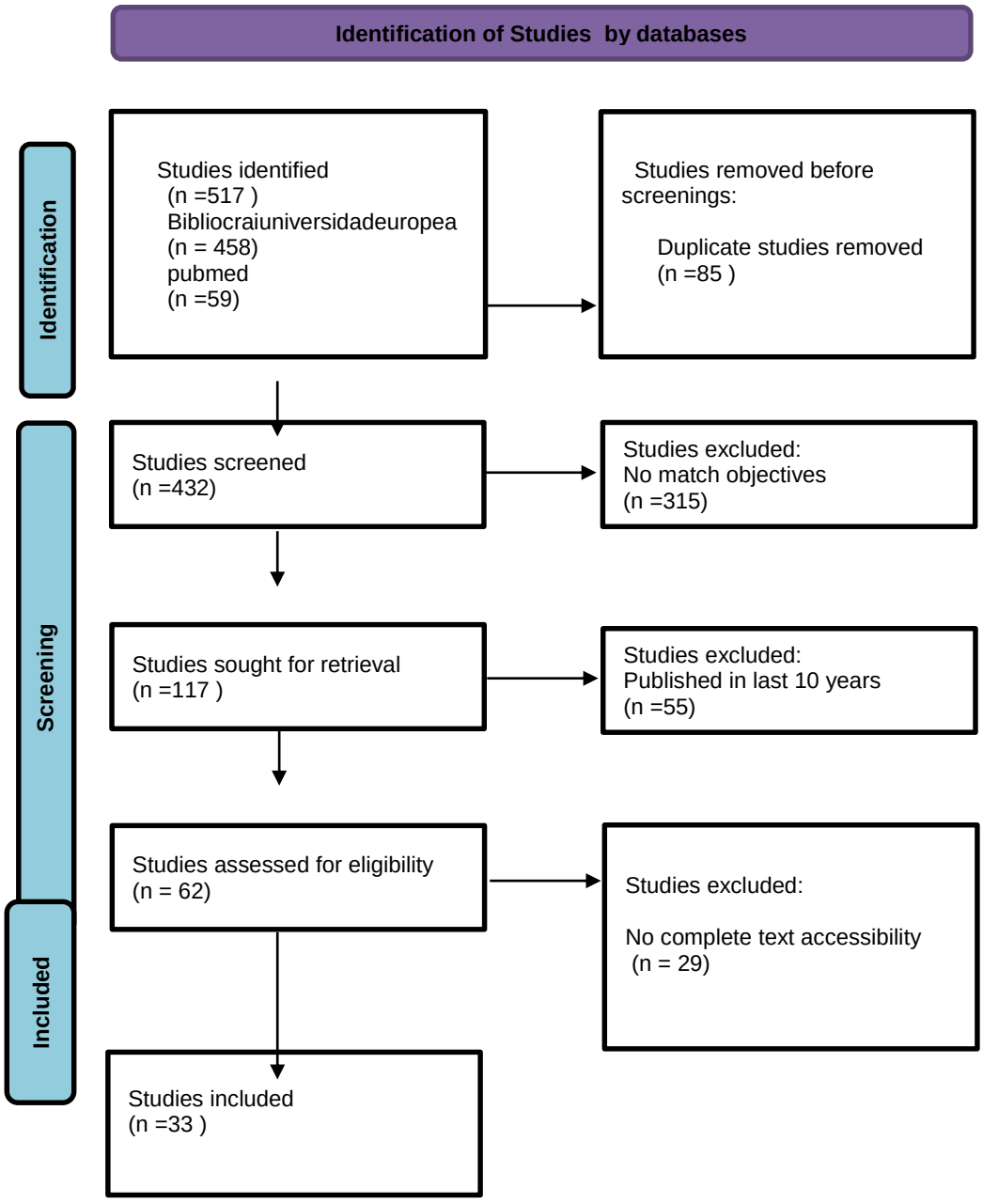
- English publications from 2015 till 20223
- Full texted academic articles
- Articles that express the content related to objectives
- Articles included clinical trial and research, systemic review

Following Exclusion criteria in this literature are:

- Articles and studies older than 2015
- Publications without complete text
- Publications that weren’t relevant to the content

5. RESULT:

The following chart shows the process of collecting data bases.



Some clinical trials studies were chosen in this literature with the purpose of discovering new information regarding the biocompatibility of bleaching treatments and discovering new materials with less side effects. Furthermore, as seen in the table below, this literature was focused on comparing new bleaching procedures, with various clinical trials .

Table.1. Articles used to compare the efficacy and sensitivity of beaching treatments

Author	Year	Study Method	sample	Control Group	Experiment Group	Teeth	Result
Et al . S. Morgan (31)	2015	Clinical trial Used kappa score	20	Un extended tray with 10% carbamide peroxide gel	Extended tray With 10% Carbamide Peroxide gel	Both arches	**color shade change** After 2 weeks : Extended: 52.5% Non extended: 50%
Et al. Pouya. Rostamzadeh (30)	2021	In vitro experiment	45 Composite bis-GMA based, microhybrid disc	Distilled water	4 whitening dentifrice. Bencer (Gb), Optic White (Go), Colgate whitening(Gt,Perfect White Black (Gp)	Both arches	**color shade change** lighter and to blue color in Gp and Gb No differences in Changing color of composite was observed in 4 groups
Et al. Matheus Kury (32)	2022	In vitro investigation	60 Enamel-dentine bock of bovine	Hydrogen peroxide 40%(Hp)	V-LED maximum peak 401.82 nm	Upper & Lower No stained teeth Black tea stain teeth Cigarette Stained teeth	**color shade change** Black tea : More luminosity with Hp 40% cigarette stained teeth: No differences in color change between control and experimental group
Et al. Adrieli Burey (26)	2021	Triple blinded randomized clinical trial	66	H2O: 27.9 H2O2: 50%—67 Sodium alginate: 5 Methyl paraben : 0.1	H2O: 22.9 H2O2 : 50%—67 Sodium alginate Methyl paraben n-Bm 5% bioactive nanoparticles	Upper canines with A2 or darker	**Sensitivity** after 24 hours: Control=18 Experimental=14 After 1 week: No spontaneous sensitivity

Et al. Sônia Saeger eireles(25)	2021	Single blinded Randomized clinical trial	40	carbamide peroxide (CP) 10 %	carbamide peroxide (CP) 10 %	Maxillary incior, laterals , canine Restorative: 1 restorative teeth=6 p 2 restorative =8 persons 3 restorative =3 persons 4 restorative =3 persons	**Sensitivity** No differences In two groups Were observed
Et al. Hamideh Sadat Mohammadipour (27)	2021	Triple blinded trial	26	hydrogen peroxide 3%	hydrogen peroxide 3% +1% (SHMP) sodium hexametaphosphate	Maxillary Anterior teeth	**Sensitivity** To cold air: Control:2.62 ± 2.41 Exp:1.16 ± 1.88 Tactile : Control: 0.25 ± 1.03 Exp:0.08 ± 0.40
Et al. Ruchi Singhal (33)	2022	Randomized clinical trial Double blinded	20	Hydrogen peroxide 30% Office bleaching	Etch bleach sealing(37% phosphoric acid , 5% NaOCl) Sodium perborate, microabrasion	Maxillary Anterior teeth	**Color shade Change** *Immediate* median Etch sealing=4 Sodium perborate=4.6 microabrasion =4.6 *6 months:* remarkable esthetic improvement except etch bleach seal

In addition, this figure was created to aid in the explanation of Et al. Ruchi Singhal study.

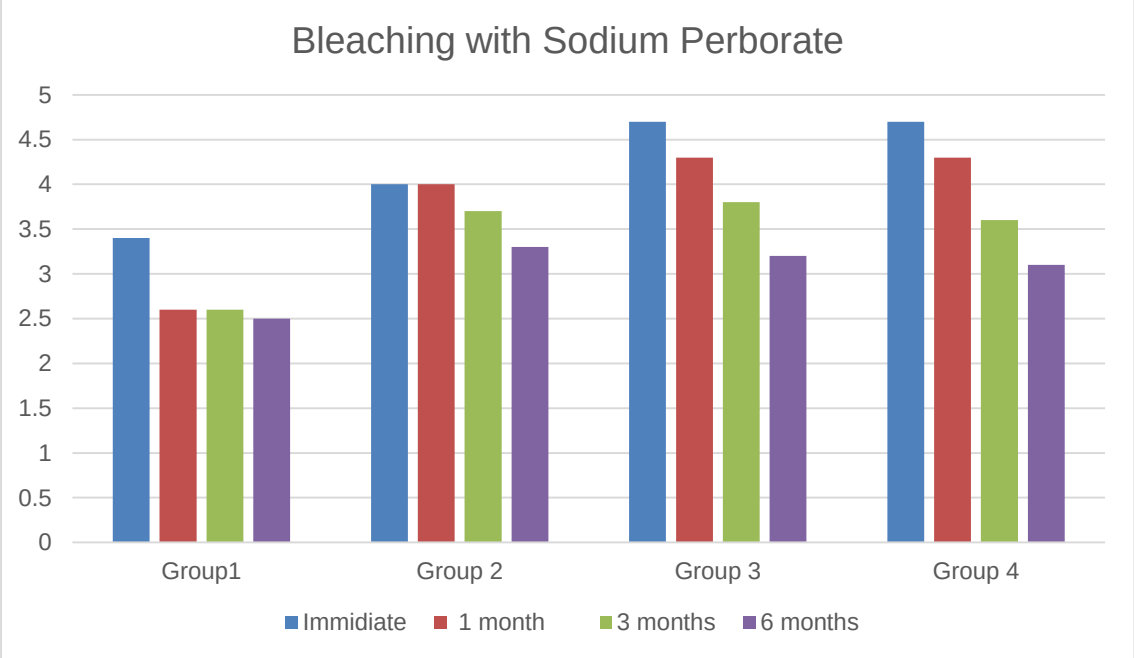


Fig 8. shows comparing result of esthetic Et al. Ruchi Singhal study .(33)

Group I -(Control group)- 30% H2O2.
Group 2- Etch bleach seal.
Group 3 -office bleaching using Sodium perborate.
Group 4- microabrasion

6. DISCUSSION:

6.1.Carbamide 10% effect

Among all of treatments for bleaching , home bleaching with 10% carbamide peroxide is now used by patients is a better choice than in-office bleaching. This is due to the fact that color enhancement is identical when utilizing both procedures.

Furthermore, as contrasted to in-office bleaching treatments, home bleaching resulted in long-term shade retention, less time, and cost less and, simplicity of usage, and improved patient pleasure. For usage with at-home essential bleaching, many bleaching tray designs have been promoted and researched. Some investigations, meanwhile, couldn't find any substantial difference between trays with and without

reservoirs because of shade differences are below the optical differentiating threshold. Although, extending the boundary in bleaching tray beyond the gingival margins might facilitate for longer bleaching agent retention, prevent contamination of the bleaching gel with saliva.Et al. S. Morgan have done the clinical trial to evaluate the design of the tray in home bleaching. They provided a custom-made bleaching tray with 10% carbamide peroxide gel for each participant. They designed the tray edges extended 5 mm beyond the gingival margins on the right side from right lower and upper incisor till molars and terminated barely at the gingival margin on the left. The samples were selected randomly from age of 18 to 56 years old. Upper and lower anterior teeth with minimum restorative or caries teeth. They excluded pregnant, breast feeding women, smokers. They asked the two groups one with extended and the other with no extended bleaching trays to wear the trays two hours in a day and use 1450 ppm fluoride dentifrice and rate the sensitivity scale from 0-10. They evaluated the color shades and sensitivity in one week and after two weeks. As a result with restriction of et al .S. Morgan clinical study, it is possible to infer that extended bleaching tray design provides no benefit over a reservoir- non-extended design regarding of effect and tooth sensitivity.(31)

6.2.OTC Bleaching effect on restorative teeth

These treatments are inexpensive that may be used at home by patients without the dental supervision. OTC(over counter) products include gel, dental floss, mouth rinses, whitening strips and dentifrices. This preference of whitening dental pastes might be attributed to their inexpensive cost and ease of usage. Color change and surface degradation of the restoration material could be induced by chemical or physical elements such as pH temperature, UV irradiation , humidity, pigment absorption, and mechanical causes. The effectiveness of whitening dentifrice is relevant to the existence of the abrasives in high concentrations. Continuous use of a high concentration of abrasive particles in these abrasive dentifrices can increase enamel illuminance, which could have results in excessive erosion and destruction of structure of the tooth. Due to the characteristics of abrasive whitening dentifrices , various components (peroxide, activated charcoal) have been added to whitening

toothpastes. Activated charcoal has become increasingly common because of many advantages .This molecule has a bleaching action that have the ability to take in the chromophores and stains. Amount of carbon and the manufacturing technique determine the abrasiveness of these dentifrices.(30)

Et al . Pouya Rostamzadeh used 4 different dentifrices named(Bencer) Gb, (Optic White) Go, (Colgate Total Whitening) Gt, and (Perfect White Black)Gp. They used Gb(Bencer) dentifrices, contain dicalcium phosphate which is used to clean natural teeth and dental composite. Gb also has abrasive hydrated silica, which has been used as an abrasive and a thickener. Gp that is another charcoal dentifrice with two types of surfactants, cocamidopropyl betaine, and sodium lauryl sulfate. Because of these materials , this product with hydrophobic part can have the access to spread the particles in the mouth. For this study they made the samples and used stainless mold made of steel. They employed A2 shade of Spectrum microhybrid composite in the mold and put it on glass slab with transparent Mylar strip, then employed the composite and put another glass slab and press so the excess composite will be removed and then light cure for 20 seconds on both sides .In next step they polished and test the surface with markers. To measure the color , they used International Commission on Illumination.To resemble the 1 year composite they use a device with a filter and works by switching energy spectrum to distribute xenon. In controlled situations, they held the samples with clasps to make sure that all the samples have been exposed to the light. The device was calibrated at 37° C with humidity. Also they used the mechanical tooth brush to control the brushing technique. With limitation of vitro study Et.al. Pouya Rostamzadeh mentioned that they didn't find a notable change in the modification of the color characteristics of spectrum composite after two weeks by brushing with Gp, Gb, Gt, and Go. Nevertheless after teeth brushing, teeth became much lighter and shifted to green and blue post brushing with charcoal dentifrices (Gp and Gb).(30)

6.3 .Risk of sensitivity

Bleaching can cause gingival irritation, tooth sensitivity, external cervical resorption, and alterations in the structure of the enamel (1). The highest prevalent complexities

of in-office tooth bleaching (ITB) is tooth sensitivity, which has been repeatedly documented by patients having this procedure. This deleterious impact of tooth sensitivity has been explained in part by pulp cell destruction produced by trans-dentinal diffusion of large quantities of H_2O_2 or reactive oxygen that are generated by whitening gels.(8) Although concentration of whitening gel plays an important role in dental sensitivity ,the transmission of cytotoxicity of a 10% H_2O_2 by using bleaching gel through enamel, dentin ,or dental pulp cells is influenced by enamel/dentin thickness. Furthermore, the time of applying the gel is another aspect that we need to consider, for instance applying whitening 10% H_2O_2 for 45 or 15 minutes on enamel-dentin disks reduced cell toxicity significantly when compared to that affected 35% H_2O_2 and defined a comparable esthetic result by completed the treatment.(11)

Among all of the whitening treatments, customized trays home bleaching is recommended more than other type of bleaching ,such as in-office bleaching since this could be a simple protocol ,less expensive and takes less time. Additionally, at-home bleaching achieves the same bleaching outcomes as professional dental bleaching . Furthermore, because of the lower amounts of hydrogen peroxide (HP) utilized, this approach reduces the risk of gingival irritation and tooth sensitivity. Gingivitis that occurs at the end of therapy usually resolves on its own within 24-48 hours . Nevertheless, tooth sensitivity (TS) is the common side effect, following the bleaching procedures . While TS after bleaching is often described as moderate and temporary, it may also could be severe and induce irritation , causing the patient to discontinue the whitening therapy.(26)Although currently in professional protocols using gingival barriers and tissue isolation reduces irritation of gingiva and soft tissue.(7)

Based on recent studies, roughly 67–100% of patients who receive hydrogen peroxide(H_2O_2) treatment in-office, have shown tooth sensitivity. TS was reported, due to H_2O_2that can be changed into the lower molecule weight that makes it easier to penetrate easily into enamel and dentin and get into the pulp tissue and makes various level of TS, which makes the patients to stop the treatment due to an unpleasant experience . However, porosity that are present on the enamel surface of

the tooth can increase the diffusion of H2O2, which will lower the hardness of the enamel. These deficiencies might be caused by the bleaching agents' acidic pH, which could lead to some changes, especially in the interprismatic area.(26)

Microscopically, surface pores under, and inter-prismatic gaps in enamel may allow whitening chemicals enter pulp tissue quickly. This can result in bleaching sensitivity due to brief inflammatory responses, reversible histologic alterations, and pulp bleeding. Patients typically experience abrupt, intense shooting, and shock-like pain that subsides within a few days. In certain circumstances, it might last for many days after the treatment is finished.(28,29)

As an illustration , many clinical studies revealed that TS reports from patients significantly increased when there were cracks and/or fissures.(26)

Products that enables to repair the microscopic defects and decrease tooth sensitivity due to H2O2 diffusion ,have thus been investigated. Clinical trials have shown that the use of bioactive materials such as HA (hydroxyapatite) , ACP (amorphous calcium phosphate), or ACP in combination with the phosphopeptide casein can reduce TS caused by bleaching methods. In spite of that , many clinical studies include these compounds in gels or pastes before or after bleaching.(26)

Among organic materials bioglass (BG) is an amorphous ceramic material and its mechanism of action is precipitation of ions of phosphate ,calcium, plus boosting displacement of hydroxyapatite on surface and yield to remineralization, and repairing of teeth .Furthermore, if BG could be consumed as nanoparticles, it can have a high bioactivity. Regarding this, Et.al . Adrieli Bure study was chosen 66 volunteers for the clinical study. Participants in that clinical study were at least 18 years old ,and being healthy generally and orally. Participants had to have no caries in anterior maxillary teeth with no, periodontal disease, restorations or endodontic treatment, and canines that were darker A2 or when compared to a shade guide. The main goal of that study was to identify the absolute risk of TS (percentage of patients that experienced pain during 48 hours after treatment in office beaching) They used n-Bm 5% bioactive nanoparticles in interventional group in addition to hydrogen peroxide . As a result, in this superiority trial with 59 participants a significant decline from 90% in the control group to 70% in the experimental group appears. (20% difference shows

the absolute risk of TS). A pH meter with a circular and flat surface with a 6 mm pH electrode was placed directly on, canines and central incisors and put it until the pH is steady on the screen. The pH was recorded for each of the three session applications. This examination was carried out with six members with the goal of learning about the sensitivity , and ability of bleaching agents.(26)

The outcome results were divided into two groups absolute risk of TS which is the percentage of individuals that experienced TS at least once throughout treatment and general TS with each examination. They measured shade before, the first bleaching session, the second bleaching session one week after, and one month after the bleaching treatment ended. (16)

Another related aspect of the sensitivity which is considered, is teeth with restoration .Although some authors believe that teeth sensitivity is more in teeth with restoration rather than sounds teeth .Some clinical investigations have assessed the reaction of tooth bleaching in discoloration and TS in individuals with repaired teeth are being used 35% hydrogen peroxide in-office bleaching and have reported the notable risk of TS. Based on author's knowledge regarding home bleaching and evaluation of sensitivity on restorative teeth, there are no productive investigations. Et al. Sônia Saeger Meireles was carried out a blind, randomized clinical trial , which investigate changing color plus sensitivity cause by treatment of home bleaching in participants with healthy and restorative teeth. Forty participants were selected into two different groups based on inclusion and exclusion criteria in away that the first group includes participants with six superior incisor, laterals , canine teeth with no caries and Re group (participants with at least one restoration in the six superior incisor, lateral and canine teeth). In both groups they applied 10% carbamide peroxide (CP) home bleaching . A spectrophotometer was used to measure color change, after two weeks, and one month and three months after bleaching. Participants used a numeric rating scale to record their TS (0–4). The absolute risk and severity of TS were compared using Fisher's to compare in between the participant of that group and Mann-Whitney tests to compare between two groups. In this trial they excluded sever dental internal discoloration (such as: fluorosis, tetracycline stains) ,orthodontics, or dental prostheses. During the first appointment, alginate

impressions were taken of each participant's maxillary arch, and disinfected and filled with dental stone. The dental stone was then carved to form a reservoir (six anterior superior teeth).Then they made custom-fitted tray to put the whitening gel in it. They made the tray out of Plastvac P7, soft vinyl material. Then they trimmed the tray and remove excess 1mm away from vestibular and palatal of the gingival junction. In the second dental visit, they asked all participants to wear the bleaching tray that had the bleaching agent for 2 weeks ,every night for four hours and to take off the tray following each bleaching time, then wash it with water, and brush their teeth in a normal bases. At this point, both trays were evaluated, and they showed to each patient amount of bleaching gel and cleaning the trays. To mask of the product used, sealer identification was pulled out from each bleaching agent syringe. They weighed each syringe in analytical balance after and before doing each session to assess adherence to the experimental protocol. (25)

To assess the sensitivity ,they asked each patient to fill out the daily log of feeling sensitivity and keep the record. The patient was asked to rate his or her level of sensitivity which is none to mild, moderate , sever and scaling from 0,to 4. For statistical purposes, the worst score after two weeks bleaching treatments was take into account. They divided the values into two categories: overall TS intensity , and absolute risk of TS. Results show that in between the groups in terms of the absolute TS, there wasn’t a significant difference TS produced by bleaching agent. When both groups were examined, the risk ratio and 95% confidence interval demonstrated that no serious risk of TS caused by bleaching agent was founded.(25)

Nevertheless, when they applied 10% CP, they measure HP inside the pulp chamber for teeth with restoration, and they found similar amount of HP in compare to sound teeth when they applied 35% HP in office bleaching. Based on that, the results suggest that when they used 10% CP for home bleaching, in teeth with adhesive restorations, the amount of HP inside the pulp chamber is reduced. Some features can change the results, such as thickness of dentin and enamel, pH, gel viscosity, HP concentration, and they may all have effect on HP diffusion into the pulp. Even though restored group had more HP than the control group , the lower concentration of HP in treatment of home bleaching was enough to the pulp tissue to create adequate defensive cells to

protect the pulp from Injury , and because of that we couldn't see serious increased of TS. According to certain investigations, using Cp in the treatment of home bleaching makes the micro hardness less and increased roughness of composite. As a result, home bleaching gel is predicted to remove only extrinsic stains from restorative composite materials. Although after applying 10% CP gel they could have seen some whitening effect, some minor color alterations in composite resins was founded. In conclusion of this trial study ,the existence of esthetic restorations had no effect on tooth sensitivity when CP 10% was employed, two weeks of home bleaching were insufficient to achieve a similar color shift when patients with esthetic restorations were compared to patients with sound teeth.(25)

6.4. Violet LED light effect in-office bleaching

Dentists frequently utilize light-assisted, chair-side teeth whitening, and numerous light devices are available to improve whitening outcomes . Nevertheless, new information suggests that blue LEDs or halogen lights do not improve the final result of whitening when combined with HP or CP.LED with a visible violet wavelength is presently being used for bleaching in the absence of gels. This latest generation of LED gadget features an acrylic tip with light capable of simultaneously lighting all teeth. There is little literature on the efficacy of this procedure. Nevertheless, recent researches demonstrate violet LED exposure, can increase the efficacy of peroxide gels. Since these compounds are very reactive, it make chemical bond unstable, resulting in bond breaking and increasing bleaching effect .V-LEDs ability to produce color alterations and removing black tea stains was evaluated. In addition Et al. Matheus Kury experimental study includes whiteness evaluation assessment at colorimetric changes in bovine enamel stained with cigarette smoke or black tea ,following whitening with the V-LED unit or 40% hydrogen peroxide gel without v-LED and 60 enamel,dentin blocks of bovine teeth, subjected into different types of stains .In this experiment , they collected anterior bovine teeth and kept them in a 0.1% thymol solution. To eliminate extrinsic discoloration, they cleansed teeth with a periodontal scaler and air abrasion by sodium bicarbonate. They segmented crowns

with diamond saw, sixty blocks were prepared. The blocks were placed in a container with enamel surface down.(33)

The following conclusions may be derived within the constraints given by the approach utilized in this study:

1) The frequent exposures, and tip distance of 8-mm, had a negative impact on the V-LED irradiance

2) Although V-LED exposure by itself is capable of producing a perceptible discoloration, the result was comparable with HP ,in case of smoke stains

3) Approximately V-LED couldn't transmit in enamel with 1mm thickness .(33)

6.5. Desensitizing

In addition, Several ways of avoiding or diminishing negative impact of bleaching treatments have been suggested, including lowering the dosage of HP utilized, reducing time of application .(30)Recently using Sodium hexametaphosphate (SHMP) or polypyrophosphate. ($Na_6P_6O_{18}$) seems to be a solution of sensitivity . SHMP has a negative charge that can be absorbed by positive part of enamel and makes the coat on enamel surface and protect against acid and erosive material and restrict absorption of acid. This product has anti caries properties by binding to ions like calcium ion. Another positive effect of this product is preventing calculus and stains by binding to the minerals, release of protein in pigments of pellicle stain.Et al. Hamideh Sadat Mohammadipour, randomized clinical trial was registered in the Iranian Registry of Clinical Trials. This trial evaluates using remineralizing agents to solve tooth sensitivity side effect of bleaching. These compounds can obstruct dentinal tubules, limit fluid movement, diminish hydrodynamic, and decrease sensitivity of pulp while having no deleterious effect on bleaching results. Many calcium-containing substances, including casein phosphopeptide-amorphous calcium phosphate ,hydroxyapatite, and sodium fluoride, have been shown in the literature to minimize bleaching sensitivity, without affecting with bleaching efficiency. Adding 1% SHMP with 3% HP at-home bleaching gels results in fewer bleaching sensitivity while preserving the gels' teeth whitening efficacy. As a result, it might be beneficial in individuals who require teeth whitening treatment.(27)

This study assessed the degree of sensitivity to tooth whitening, changing color, and participant's acceptance of desensitizing products. In this clinical trial, the inclusion factors are 6 maxillary, 2incisors , 2lateral incisor and 2canine teeth without caries, periodontal disease, lack of vitality , restorative teeth. Exclusion factors are including previous bleaching done by dentists recently, smoking, pregnancy or breast feeding, and consuming of desensitizing dentifrice for at least past 6 months. 35 participants were elected and after excluding some that didn't match the factors, finally 26 participant was elected from age of 18 to 40 years old. They used two components to make two different home bleaching gels, one with and one without 1 wt% SHMP. To evaluate both different bleaching gels, a split-mouth design is being used whereby the identical patient was allocated randomly to various treatments in the right and left sides of the maxillary arch. Each individual received 2 mL of bleaching gel with and without 1% SHMP to be administered based on the treatment and control assignment. Furthermore, the volunteers were told to follow the at-home bleaching method for a minimum of six hours overnight for 14 days in a row utilizing provided tray. The individuals were advised to stop using bleaching chemicals if they experienced tooth hypersensitivity or gingival concerns and to contact the study team quickly. Only lateral incisors on both the right and left sides were evaluated for color and sensitivity. Canines were not tested. An evaluation process of sensitivity records was performed to use a visual analog scale .Directly afterward the end of a 2-week bleaching phase, the individuals have been instructed to evaluate the strength of their reactions to three stimulus assessments of pain level from 0-10 To test the sensitivity tactile , they used sharp dental explorer was run all over the vestibular surface in the cervical portion of every tooth, perpendicular to its long axis, with a uniform leaded force .They used cold air force to evaluate the sensitivity by applying the dental air syringe perpendicular to the surface for 1 second. Individuals are being asked to describe any unexpected sensitivity they experienced before and after the trial. A spectrophotometer was used to take color measurements within defined settings (Vita Easyshade). Color intensity have also been identified by comparing the variations in the number of shade guide units recorded by the spectrophotometer before and after the investigation (Vita Easyshade). For each tooth, the CIE Lab system's L*, a*,

and b* were calculated. L* means brightness, while a* and b* means hue, a* axis shows intensity in the red-green axis, and the b* axis shows the intensity in the blue-yellow axis. Each time before and after the treatment the colors difference, E, calculated as following formula: ΔE = [(ΔL) 2 + (Δa) 2 + (Δb)2] 1/2, with ΔL = Lfinal − Linitial ; Δa = afinal − ainitial ; Δb = bfinal − binitial . In result, the color shift was great in both groups with and without SHMP, but cold and touch sensitivity have been reduced considerably in the experimental group compared to the control group. Additionally, sensitivity to cold and touch stimuli is increased remarkably in control group after home bleaching treatment but in experimental group in all stimuli of sensitivity , no differences appears.(27)

Furthermore, one of the disadvantages of hydrogen peroxide in bleaching ,is producing free radicals. Acidic based bleaching chemicals, usually connected with hydroxyl radicals (OH), which have several negative consequences such as post-bleaching sensitivity and cervical root resorption. A different strategy can assist to avoid these negative consequences. Sodium perborate has never been studied for extra coronal whitening of stained fluorosis teeth but have been used in internal bleaching .Et.al.Ruchi Singhal Study goal was evaluating the effect of this material. In this blinded study, 20 children divided into, 4 groups .Group 1(Control group): In-office bleaching using 30% H2O2,Group 2.experiment group using Etch bleach seal.
Group 3.experimental group with in-office bleaching using Sodium
perborate. Group 4.Experimental group by enamel microabrasion. (33)
In Control group, they used hydrogen peroxide solution with concentration of 30% administered to the vestibular surface of teeth and massaged 10 minutes. The leftover H2O2 was completely rinsed away with water and extracted by air suction. They repeat it for the second time.(33)
In group 2 with etch bleach seal, the first step was applying 60 seconds of 37% phosphoric acid gel. Then cleaned etchant. After 30 seconds, they rinsed it with water and dry it. The second step is to apply 5% NaOCl with an applicator tip. For 10 minutes, the solution was continually massaged over the teeth's surface. The residual solution was carefully rinsed and dried with air suction. The teeth were checked again. They

repeated the treatment for the second time. In next step they applied a low viscosity bonding compound that has been light cured for 40 seconds. (33)

In group 3. in-office bleaching they crushed sodium perborate tablets combined with 0.3 ml of 30% hydrogen peroxide. Then used an applicator tip, a uniform and thick coating was then placed on vestibular part for 10 minutes, the paste was continually spread over the teeth's surface. The residual paste was completely rinsed away with and extracted by air suction. The teeth were checked again. Then repeat the treatment for second time.In Group 4. Enamel microabrasion intervention.
Pumice was combined with 37% phosphoric acid gel for the microabrasion procedure. Using an applicator tip, a uniform coating was used to the vestibular side. For 10 minutes, used a low-speed rubber cup on the tooth. The residual gel was properly rinsed. The teeth were checked again. They repeated the treatment for the second time . In this study they used Cohen's Kappa statistics to calculate calculated intra-examiner and inter-examiner reliability. Any adverse effects including staining, sensitivity, and gingival problems within the course of study were also recorded. The data was compiled and put to statistical analysis.(33)

7.CONCLUSION :

In conclusion, nowadays dental bleaching is one of the most popular esthetic treatments, so it is critical to be aware of new techniques. Also, it is important to be aware of the side effects of each material, the consequences, and to keep up to date on new methods to minimize the flaws of these treatments. Although most of the methods such as microabrasion, office bleaching, home bleaching, non-vital bleaching such as walking in bleaching, inside out bleaching, are functional for teeth whitening. Each dentist employs a very unique treatment for each patient depends on the classification of stains, causes of stains, patent's habits, vitality, cooperation of patient and economic reasons. So far, carbamid peroxide 10% used in home bleaching therapy

has proven to be the most beneficial treatment among others due to its inexpensive cost, short treatment period, and less tooth sensitivity, while non vital bleaching is efficient for sever intrinsic discoloration. Nevertheless, bleaching chemicals in treatment of office bleaching may affect tooth with restoration, and may penetrate the pulp more than a sound tooth. Although additional researches are required to prove it. On the other hand, Sensitivity, is one of the most prevalent and serious adverse effects of this therapy. According to many studies and research publications, sensitivity is connected to tooth thickness, duration of whitening agents, and frequency of application. Yet, according to recent clinical trials, carbamide peroxide 10% causes less sensitivity, and there are some new materials that may decrease teeth sensitivity, such as sodium hexametaphosphate and sodium perborate, although these clinical trials had certain limitations, and further investigations are essential to validate these findings

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