

## **Esthetic Rehabilitation Of Anterior Discolored Teeth Due To Tetracycline Staining With All-Ceramic Restorations**

### Authors

Dr. Renita Soares, Senior Resident

Dr. Ida de Noronha de Ataíde, Professor and HoD

Dr. Marina Fernandes, Asst Professor

Dr. Rajan Lambor, Asst Professor

### Introduction

“45% of the people feel insecure about their smile” as reported by a survey conducted by the American Academy of Cosmetic Dentistry (AACD).<sup>1</sup>

An unesthetic smile can have a great impact on a person’s self-esteem and confidence. Discolored or stained “yellow” teeth present an unsightly appearance.

The AACD conducted a survey in 2012 to assess the popularity of tooth whitening procedures. When asked, "What makes a smile unattractive?" The most common response received was; discolored, yellow, or stained teeth. The respondents were further asked, "What would you most like to improve about your smile?" To which the most common response received was: Whiter & Brighter Teeth.<sup>1</sup>

With the increased awareness about dental esthetics and the growing demand for cosmetic dental treatment, a large number of patients are now seeking answers for the unesthetic discolorations of their teeth; be it a single tooth or multiple.

Esthetic management of intrinsic tooth discoloration can be clinically challenging. Understanding the etiology underlying the tooth discoloration is of utmost importance in order to arrive at a diagnosis and outline the treatment plan. Also, the mechanism of staining (whether intrinsic or extrinsic) may have an effect on the outcome of treatment and influence the treatment options offered by the dentist to the patients.<sup>2</sup>

One of the most challenging esthetic procedures in dentistry can be the improvement in appearance of tetracycline stained teeth. This is due to the fact that the teeth are so darkly stained, masking the appearance of such is a rather difficult task.

The first cases of tetracycline-induced discolorations were reported in 1956 and since then it is well-known and well-documented that tetracycline's have the ability to induce staining of both primary and permanent dentitions during odontogenesis. The exact mechanism of tetracycline discoloration is not fully understood. It is hypothesised that the tetracycline molecule appears to chelate with calcium in hydroxyapatite crystals, predominantly involving the dentin, forming tetracycline-calcium orthophosphate complex. Dentin absorbs greater amounts of tetracycline because of the larger surface area of the dentin apatite crystals compared to enamel apatite crystals.<sup>2,3</sup>

Jordan and Boskman<sup>4</sup> classified tetracycline discoloration into 3 groups according to severity:

- first degree: light yellow gray or brown without banding
- second degree: darker and more extensive yellow or gray staining without banding
- third degree (severe staining): dark gray or blue discoloration with horizontal banding.

It is learnt that the teeth may be bright yellow at the time of eruption and after some time color of teeth may turn to gray. Discoloration may vary depending on the type of tetracycline, doses, duration of intake, and patient's age at the time of administration.<sup>5</sup>

The following case report describes the treatment protocol adopted for the management of tooth discoloration due to tetracycline therapy.

### Case report

A 43 year old female patient presented to the Dept. of Conservative dentistry and Endodontics with a fractured crown in relation to #12. Clinical examination revealed unesthetic composite restorations in #11 and #21 (Figure 1). The patient reported history of root canal treatment in #21, however radiographically the obturation appeared unsatisfactory.



Figure 1: Unesthetic composite restorations in #11 and #21 and generalised discoloration

Furthermore clinical and radiographic evaluation suggested crown root fracture in endodontically treated #12, traversing obliquely from the cervical third of the labial surface to the palatal surface with a subgingival extent (Figure 2 and 3).

The patient was also particularly concerned about the unsightly discoloration of her anterior teeth. She stated she was extremely conscious about her smile. A brief past history revealed, similar pattern of tooth discoloration in her two other siblings. A typical banded form of discoloration was noted in the anterior teeth. The discoloration was pronounced in the mandibular anterior teeth specifically the incisal third and to a lesser degree in the maxillary teeth. Clinically, owing to the anterior deep bite the mandibular anterior teeth weren't visible on smiling (Figure 4).

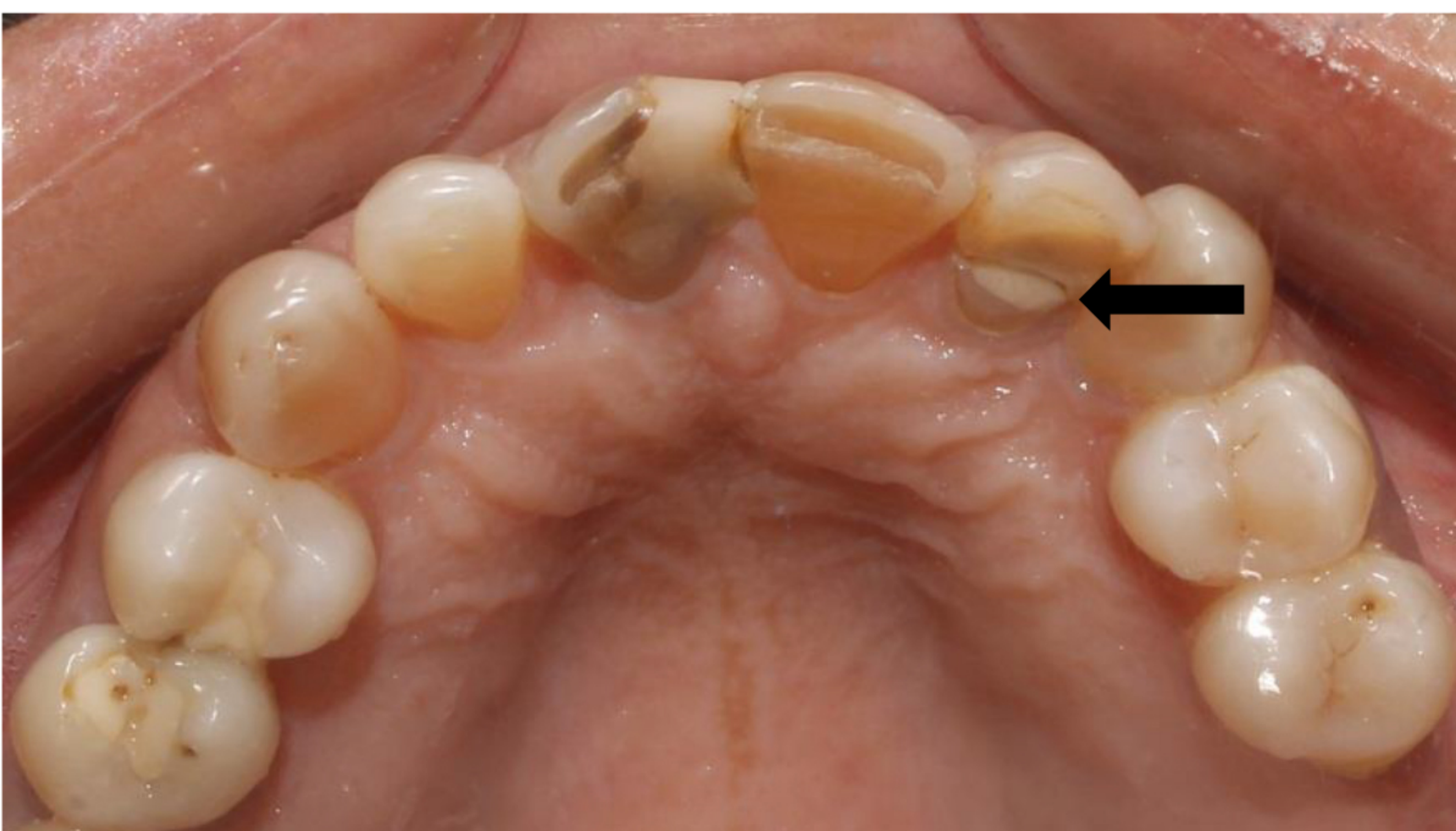


Figure 2: Crown fracture noted



Figure 3: Preoperative radiograph



Figure 4: Preoperative smile view

The treatment plan outlined was:-

- Endodontic retreatment of #21
- Extraction of #12 taking into consideration the subgingival extent of the fracture line.
- Extracoronal bleaching of maxillary and mandibular anterior teeth
- Fixed Partial Denture (FPD) spanning #13 to #11
- Full crown in #21

The patient was also presented with the option of an implant over FPD for the missing lateral incisor, followed by single full crowns extending from #13 to #23 and #33 to #43. However, owing to the cost and time factors, the patient decided to go ahead with the plan as mentioned above.

Management

### Phase I

Pretreatment photographs were taken. The fractured crown of tooth #12 was removed under local anaesthesia to assess the fracture line. Retreatment of #21 was initiated. Gutta percha removal was carried out with the aid of GP solvent (RC Solv, Prime Dent, India) and rotary files (Protaper, Dentsply) (Figure 5). The apical third of the canal which was uninstrumented and devoid of obturating material, was negotiated using #6, #8 and #10 K files (Mani, Japan) sequentially. Following working length determination with electronic apex locator, cleaning and shaping of the canal was accomplished with rotary files and 5.25% sodium hypochlorite. An interim dressing of an intracanal medicament in the form of calcium hydroxide (Avue Cal, Dental Avenue, Param Enterprises, India) was placed in the canal for 7 days. Obturation was completed with cold lateral condensation and resin based sealer (AH Plus, Dentsply DeTrey, Konstanz, Germany) (Figure 6).



Figure 5: Following gutta percha removal



Figure 6: Postobturation radiograph

## Phase II

#12 was extracted under local anaesthesia. Following healing of the extraction site, temporary rehabilitation for the interim period was planned using a fibre reinforced composite (Vectris Frame, Ivoclar Vivadent, Inc, Schaan, Liechtenstein) FPD. The length of the fibre required for the framework was measured and cut. No form of preparation was done for the palatal surface. Etching the palatal surface of the bonding area of #11 and #13 was carried out with 37% phosphoric acid (Conditioner 36, Dentsply DeTrey, Konstanz, Germany), followed by rinsing and drying. The total etch bonding agent (Prime and Bond NT, Dentsply Caulk, Milford, USA) was applied and light cured as per the adhesive protocol. A thin layer of flowable composite (Esthet X Flow, Dentsply Caulk, Milford, DE) was placed on the bonded area. The fibre bundle was placed onto the uncured layer of composite and adapted to the palatal surface of the adjacent teeth. Once in place, the fibres and the composite was light cured for 20 seconds. The entire fibre frame work was covered with a layer of composite to ensure complete sealing of the gap between the fibres and the enamel surface and each unit was light cured for 20 seconds. The pontic was constructed using nanofiller composite (CeramX, Dentsply DeTrey, Konstanz, Germany). Because of the inherent anterior deep bite, the pontic was designed such that it was out of occlusion. The procedure was terminated with the finishing and polishing of the composite resin (Figure 7 and 8).



Figure 7 and 8: Fibre reinforced provisional bridge fabricated

### Phase III

The next step in the planned treatment protocol was extracoronary bleaching of the maxillary and mandibular anterior teeth.

Cleaning and polishing of the teeth was done a week prior to the bleaching appointment. Adequate isolation was achieved with a cheek retractor, cotton rolls and high volume evacuation. Gingival barrier was placed around the labial gingival sulcus and light cured in order to ensure a complete seal and avoid leakage of the bleaching gel onto the gingiva. The powder and liquid were mixed according to manufacturer's instructions using an applicator tip. The gel was then applied to the labial surfaces of the maxillary and mandibular teeth and left for 8 minutes. At the completion of the stipulated time, the gel was suctioned off using high volume evacuation. The bleaching cycle was carried out once again for another 8 minutes. After the last application the gel was suctioned off, teeth were washed and dried and the gingival barrier was removed with the aid of an explorer tip.

The bleaching cycle was repeated after a period of two weeks. Following shade stabilisation at the end of one month, marginal improvement in the shade was noted.

### Phase IV

Prosthetic restorative treatment was initiated. Tooth preparation was carried out for #13, #11 and #21 to receive a full ceramic zirconia FPD spanning #13 to #11 and full crown on #21 (Figure 9). Since the patient presented with an anterior deep bite with insufficient interocclusal space, the palatal preparation was restricted to 0.6mm for full contoured zirconia crowns.



Figure 9: Crown preparation

Prior to the impression making, gingival retraction was done carried out with the aid of gingival retraction cord (Ultrapak 000, Ultradent, USA). Impressions were made with addition silicone impression material (Aquasil, Dentsply, Germany). Provisional crowns were fabricated with autopolymerising resin (Visalys Temp, Kettenbach, Germany) and cemented with non eugenol luting cement (Rely X Temp NE, 3M ESPE, Germany).

Once the zirconia copings were fabricated, try-in was carried out to assess the marginal fit (Figure 10). Thereafter the crowns were fabricated and tried intraorally for marginal fit, adaptation, occlusion and shade (Figure 11). The prosthesis was then finished, glazed and cementation was carried out with dual cure resin cement (RelyX U200, 3M ESPE, Germany) (Figure 12 and 13)



Figure 10: Coping trial

Figure 11: Bisque trial



Figure 12: Postoperative view



Figure 13: Postoperative smileview

## Discussion

As rightly stated by Goodacre and Naylor<sup>6</sup>, the purpose of diagnosis and treatment planning is to devise the longest lasting and most cost effective management protocol that not only concerns patients chief complaint but meets or exceeds their expectations.

The aim of the clinical management of tooth discoloration is to produce an acceptable cosmetic result as conservatively as possible. Tooth whitening and micro-abrasion are considered the first choice, as these procedures are able to reduce discolouration and provide satisfactory results.

Rotstein<sup>7</sup> recommends two methods for the management of tetracycline stained teeth

- bleaching the external enamel surface
- intracoronal bleaching following intentional root canal therapy

Tooth bleaching provides a viable, conservative and cost effective option. Hence being the least invasive option, to begin with, in the above case report extracoronal vital tooth bleaching was performed using Pola Office (SDI, Australia), containing 35% hydrogen peroxide. Although the mechanism underlying bleaching still remains unclear, the rationale behind utilising hydrogen peroxide as an active ingredient is that, it has been hypothesized that hydrogen peroxide diffuses through enamel and dentin, in the process producing free radicals that react with pigment molecules, breaking their double bonds. The change in pigment configuration and/or size may result in changes in the optical properties of the altered pigment molecules and consequently result in perception of a lighter colour.<sup>8,9</sup>

A systematic protocol needs to be followed while carrying out the bleaching procedure. The patient should be instructed prior to the procedure to report any discomfort, careful examination of the seal of the barrier after the gel application, and frequent monitoring of the seal throughout the bleaching process are all essential to minimize the risk of gingival damage and irritation.<sup>10</sup>

However, since the bleaching process did not yield any appreciable results due to the extensive internal discoloration, and also owing to the loss of the lateral incisor, esthetic correction had to be planned accordingly. In order to mask the darker tooth shades, it was proposed to rehabilitate the pontic site and adjacent teeth with zirconia crowns.



The purpose of the fixed FRC bridge in this case was to maintain the pontic site until the fabrication of the definitive prosthesis. Fibre reinforced FPD's are highly desirable due to their ease of fabrication at the chairside, superior bondability and reparability. This technique is a time saving option and serves to restore esthetics and function. It is also more comfortable than a removable appliance, non-irritating and hygienic.<sup>11</sup>

In the final phase of the treatment, prosthetic rehabilitation was carried out using zirconia crowns. The benefits<sup>12,13</sup> of utilising zirconia in this case were multiple including

- adequate strength
- superior esthetics over porcelain fused to metal crowns along with the ability to mask the discoloration
- achieving thickness of 0.6mm on the palatal surface with the full contoured zirconia owing to the deep bite and minimal interocclusal clearance

A metal-free ceramic crown can transmit a great amount of incident light through a ceramic core where light is scattered in a natural fashion. Thus, the appearance of definitive restorations may be very close to that of a natural tooth.<sup>13</sup>

## Conclusion

Managing tooth discolorations necessitates careful consideration of all patient factors. As clinicians and more specifically esthetic specialists, we should be capable of assessing individual patient needs in order to establish suitable treatment plans and obtain the best treatment outcomes. More importantly an understanding of the mechanism underlying the discoloration can be highly valuable in the decision making process when chalking out the treatment plan.

An integrated approach involving diagnosis, a sequenced treatment protocol, techniques and skill contributes to a successful outcome in a large way.

## References

1. Available from [www.aacd.com](http://www.aacd.com)
2. Manuel ST, Abhishek P, Kundabala M. Etiology of tooth discoloration- a review. *Nig Dent J* 2010;18:56-63.
3. Hattab F, Qudeimat M, Al-Rimawi H. Dental Discoloration: An Overview. *Journal of Esthetic dentistry* 1999;11:291-310.
4. Jordan RE, Boksman L. Conservative vital bleaching treatment of discolored dentition. *Compendcontineduc dent* 1984;10:803-07.
5. Arun Kumar, Vijay Kumar, Janardhan Singh, Anita Hooda, Samir Dutta. Drug-Induced Discoloration of Teeth: An Updated Review. *Clinical Pediatrics* 2012;51:181–85.
6. Impact of outcomes data on diagnosis and treatment planning Charles Goodacre, W. Patrick Naylor. Contemporary restoration of endodontically treated teeth Nadim Baba Quintessence publishing 2013.
7. Ilan Rotstein. Tooth discoloration and bleaching. In: John Ide Ingle, Leif K. Bakland, editor. *Textbook of Endodontics*, 5<sup>th</sup> edition, Vol 1; 2002:845-860.
8. So-Ran Kwon, Seok-Hoon Ko, Linda H. Greenwall. Tooth Whitening in Esthetic Dentistry Principles and Techniques. In: So-Ran Kwon Seok-Hoon Ko Linda H. Greenwall, editors. *Diagnosis and treatment planning*. Quintessence Publishing Co, Ltd.
9. Krithika Dutta, V Gopikrishna. Management of discoloured teeth. In: Anil Kohli, *Textbook of Endodontics*. Elsevier 2010.
10. Yiming Li. Safety Controversies in Tooth Bleaching. *Dent Clin N Am* 2011;55:255–263.
11. Amir Chafaie, Richard Portier. Anterior Fiber-reinforced Composite Resin Bridge: A Case Report. *Pediatric Dentistry* 2004;26:530-34.
12. Atul Bhardwaj, Smita Singh, Koyena Mishra, Mazood Ahmad. Advance All-Ceramic Restoration by CAD/CAM: A Case Report. *J Dent Health Oral Disord Ther* 2014;1:00021.
13. Manish Agrawal, Banashree Sankeshwari, Channaveer V. Pattanshetti. Use of Zirconia to Restore Severely Worn Dentition: A Case Report. *Case Reports in Dentistry* 2012:1-4.