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Prevalence of Dental Fluorosis and Evaluation of Conservative and Esthetics Management of Dental Fluorosis in North Bihar Population

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ABSTRACT

Background: The fluoride can be beneficial as well as harmful to teeth. The impact of fluorosis on teeth varies from white opaque areas to extreme pitting of brown or black discoloration of the teeth. Teeth discoloration induces an unattractive appearance and necessitates rehabilitation. The aim of this study was to determine the prevalence of dental flourosis in the North Bihar population, as well as to evaluate conservative and aesthetic dental flourosis management options.

Methods and Materials: The patients in this study ranged in age from 12 to 52 years old (1,158 males and 1,354 females). Over the course of twelve months, data was collected from four dentists' exams. The examiners' training and examination procedures were standardised and calibrated by using the same index and re-examining a selection of patients by different dentists; in addition, we re-examined the same patients by the same dentists who performed the previous examination one month later to ensure reliability.The patients who were ready to have treatment for dental flourosis were divided into two groups each having 30 patients: **Group 1:** Management of dental fluorosis by using in office bleaching using hydrogen peroxide (concentrations varying from 15% to38%) **Group 2:** Management of dental flourosis by using porcelain veneers. Then there was evaluation of the periodontal and orthodontic outcomes of the both the techniques. The treatment outcomes were compared after 6 monyhs and 12 months.

Results: Fluorosis was found in a total of 1,002 patients (39.9%), and it was more prevalent in females in the 12- to 30-year-old age group. Fluorosis with a localised effect was more common (44.7 percent of the total sample; 67.4 percent of patients with fluorosis).When the comparison was made between the office in bleaching method and porcelain veneers then it was found that there was no significant difference between post operative outcomes like periodontal problems, hypersensitivity, pain and patient satisfaction. But the patient satisfaction was greater with in office bleaching in cases with mild to moderate flourosis while the patient satisfaction was greater with porcelain veneers in case of severe dental fluorosis.

Conclusion: The prevalence of fluorosis was found out to be about 40% in North Bihar and continuous monitoring and further investigation was needed into the sources that contribute to total fluoride intake. Both the methods of in office bleaching and use of porcelain veneers were effective in management of dental fluorosis but in office bleaching is the better method for mild flourosis while porcelain veneers is better option in severe fluorosis.

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INTRODUCTION

Since Mc-Kay and Black published the impact of fluoride on dentition, it has been well known that fluoride can have both beneficial and harmful effects on the dentition.[1] The topical effect of fluoride after the teeth have exploded in the oral cavity is responsible for fluoride's beneficial impact on dental caries. Conversely, negative effects are caused by systemic fluoride absorption during tooth growth, which results in dental fluorosis.[2] Fluorosis wreaks havoc on enamel and has a negative impact on appearance, causing psychological distress in those who are affected.[3]

Dental fluorosis can manifest in a variety of ways, ranging from white flecks in the enamel to mild changes and white opaque areas affecting more of the tooth surface, to moderate and serious changes in tooth tissue, such as pitting and mottling of the surfaces with or without brown to black staining, to severe corrosion of tooth surfaces.[4,5] The restorative dentist faces a major challenge in deciding between noninvasive, minimally invasive, and invasive restorative procedures to cosmetically treat such fluorosis-affected teeth. The dentist's approach requires a thorough comprehension of all available care options.[6]

Treatment options range from micro/macroabrasion to bleaching, composite restorations, veneers, and full coverage restorations, depending on the severity. Shortt geological crust of India discovered fluorosis in India in 1937 in Nellore, Andhra Pradesh. Fluoride-rich minerals can contaminate underground aquifers, especially in South India. The maximum allowable amount of fluoride in drinking water has been set at 1 ppm by the Bureau of Indian Standards (BIS). However, there are some places in India where fluoride levels in the water range from 0.5 to 29 parts per million.[7] The resulting tooth discoloration, whether due to malformation or not, can jeopardise an individual's appearance, social integration, and quality of life. As a result, the treatment of discoloured teeth has become more common in aesthetic dentistry. Bleaching is a safe and effective way to change the colour of your teeth. Bleaching of critical teeth may be performed in-office, at home with a dentist's supervision, or at home with over-the-counter items. In an in-office bleaching procedure, hydrogen peroxide (concentrations ranging from 15% to 38%) is added directly to the tooth surface. The bleaching agent can be "photo" triggered using light-emitting diodes, plasma arc, quartz halogen, ultraviolet units, and lasers to speed up the bleaching process. This is referred to as "power bleaching. "Application of light-activation method leads to a decrease in treatment time and reduction in adverse effects of bleaching materials.[8]

Therefore, this study was carried with the purpose to find out the prevalence of dental fluorosis and evaluation of conservative and esthetics means of management of dental fluorosis in North Bihar Population.

METHODS AND MATERIALS

Between January and December 2020, 2,512 patients aged 12 to 52 years (1,158 males and 1,354 females) seeking dental care at Sarjug Dental College and Hospital were studied. The report was accepted by the Ethics Committee. The operator received written informed consent from each patient. Over the course of ten months, data was collected from four dentists' exams. By using the same index and re-examining a sample of patients by different dentists, the training and assessment procedures were standardised and calibrated between the examiners; in addition, one month later, we re-examined the same patients by the same dentists who did the previous examination to ensure reliability. Patients filled out a questionnaire with personal details such as their name, age, gender, social security number, and the source of their drinking water. All of the recordings were made in natural light with a mouth mirror thus adhering to standard infection control protocols. For dental evaluation, the Modified Dean's Fluorosis Index was used:

(i) Unaffected (normal): the enamel was transparent, and the tooth surface was shiny and smooth. A tooth of this kind is pale or white in colour.

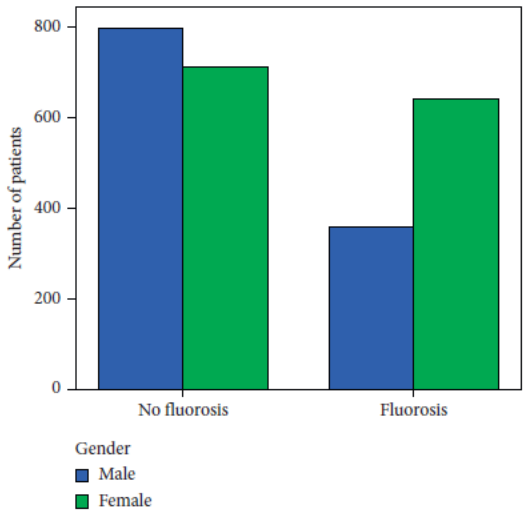

Fig 1: Incidence of fluorosis grouped by gender.

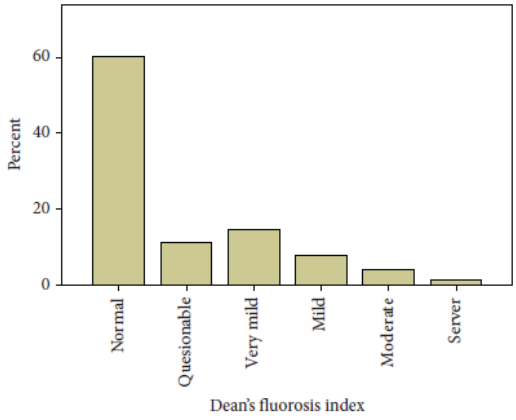

Fig 2: Distribution of fluorosis according to the Dean's Fluorosis Index.

Fig 3(A): Preoperative photograph showing severe fluorosis, (B): Post-bleaching photograph after the first bleaching session (C): Post-bleaching photograph after the second bleaching session

(ii) Questionable: The enamel here shows some differences from the previous discussion. White flecks or spots can appear on the tooth from time to time. This is true when a "definitive determination of the mildest type of fluorosis is not warranted" and a "classification of unaffected" isn't appropriate.

(iii) Very Mild: "small opaque paper-white areas are scattered across the tooth surface but do not cover more than 25% of the surface."

(iv) Mild: "white opaque areas on the surface are more widespread, but do not cover more than 50% of the surface."

(v) Moderate: White opaque patches cover 50 percent of the surface.

(vi) Severe: The complete surface of tooth's enamel is affected. This classification is marked by confluent or discrete pitting.

Fig 4(A): Pre-treatment intraoral view for porcelain veneers, (B): Prepared maxillary teeth for porcelain veneers, (C): Prepared mandibular teeth for porcelain veneers, (D): Postoperative—maxillary and mandibular porcelain veneers

The patients who were ready to have treatment for dental fluorosis were divided into two groups each having 30 patients:

Group 1: Management of dental fluorosis by using in office bleaching using hydrogen peroxide (concentrations varying from 15% to38%)

Group 2: Management of dental fluorosis by using porcelain veneers.

Then there was evaluation of the periodontal and orthodontic outcomes of the both the techniques.

Technique for Office Bleaching

A Vita shade guide was used to measure tooth colour, and a pre-treatment clinical photograph was taken. Pumice and a rubber cup were used to polish the anterior teeth of the maxillary and mandibular jaws. The rubber dam was used to shield the soft

tissues and adjacent teeth. When the operation was finished, the patient was required to wear protective eyewear. The maxillary and mandibular anterior teeth were treated with a 35% hydrogen peroxide gel (Pola Office, SDI Limited, Australia). For 15 minutes, a power bleaching unit (Bluedent 12 BL bleaching unit) was used to "photo" triggers the bleaching gel. With gauze, the gel was removed, and the process was performed two more times.

Much of the applied gel was suctioned away at the end of the operation, and the teeth were rinsed with water. The same procedure was replicated after a week on the second visit. The patient was pleased with the lightening of his teeth's hue at the end of the second visit. At each visit, the tooth shade after treatment was registered, and clinical photographs were taken.

After the bleaching, the patient was advised that composite veneers could be used to achieve even further aesthetic improvement. Because of the possibility of post-bleaching irritation, the patient was given a desensitising mouthwash. At 1, 3, and 6 months, the patient was checked up on.(Fig 3)

Technique for Porcelain Veneers

Initial Phase (Smile Analysis, Diagnostic Wax-up)

Smile interpretation and shade selection were the first steps after the oral prophylaxis. To assess the occlusion, photographs were taken and study models were created. The decision to include maxillary 10 teeth and mandibular 8 teeth in the treatment was made based on the patient's smile line. The patient was shown a diagnostic mock-up that had been developed. The maxillary anterior teeth were completed first, followed by the mandibular anterior teeth. Step two began after the patient was happy.

Second Phase (Teeth Preparation and Impression)

The intended teeth were desensitised, and depth cutting burs were used to position three depth orientation grooves on the cervical, middle, and incisal thirds of the labial surface (LVS2). The reduction in the cervical third is shallowest with these burs because the enamel thickness is small. In the cervical, middle, and incisal thirds of the teeth, 0.3 mm depth orientation grooves were placed (Fig.4). The depth of the orientation grooves was used to eliminate any remaining islands of unprepared enamel. A long tapered medium diamond point was then used to establish definitive chamfer margins (0.3–0.4 mm in depth) (LVS3).

From the distal papilla tip to the mesial papilla tip, the subgingival finish lines were carefully formed parallel to the entire gingival margin. Both sides of the preparation were extended proximally without breaking the touch point.

With the wrap-around style, the incisal edges were prepared to provide optimum bulk for the porcelain. As a result, an incisal reduction of 1 mm was made on average, with the finish line ending lingually away from the opposing teeth's contacts (Figs 4). Using a haemostatic agent (Gel Cord, Pascal International) and a gingival cord (Ultra Pak Dental Gingival Retraction), chemical-mechanical gingival retraction was performed after the teeth preparation was completed Knitted Cord-00). Single-step impression (putty wash technique) was made using polyvinyl siloxane impression material. Temporization was not carried out since only 0.5 to 0.8 mm tooth reduction was performed.

Fabrication of Porcelain Veneers

According to the manufacturer's recommendations, the cast was poured with Type IV Gypsum Product (Kalrock). The impressions were carefully removed from the stone dies, and two coats of die spacer were added 0.5 mm short of the preparations' finish line. The designs were waxed up on the dies, and the veneers were made from lithium disilicate-reinforced glass ceramic material (IPS E-max) using the heat press technique, as directed by the manufacturer.

Try-in of Porcelain Veneers

The proper fit of the veneers was first verified on the working model, both individually and collectively. Every porcelain veneer was individually tried using trial paste (glycerin) as the temporary luting medium after the teeth surfaces were washed with a slurry of fine pumice. The central incisors were placed first, followed by the canines, premolars, and finally the lateral incisors. Each veneer's adaptation and margin were scrutinised, and interferences in eccentric

movements were removed. The porcelain veneers were finished and glazed once the patient was pleased with the form, shape, and shade.

Cementation of Porcelain Veneers

Porcelain veneers had their intaglio surfaces acid-etched with 9 percent hydrofluoric acid, then salinized. On the inner veneer surface, a silane coupling agent (Monobond S) was applied and allowed to dry for 60 seconds before air drying. To reduce crevicular fluid flow during cementation, a gingival retraction cord was mounted on the prepared teeth. Each tooth was etched for 15 seconds with 37 percent phosphoric acid, then rinsed thoroughly and gently air-dried. Scrubbing the bonding agent (Universal) on each tooth and light curing it for 30 seconds was used to apply the bonding. Following that, a thin layer of light polymerizing composite resin luting cement was applied.

The veneer was carefully put on the prepared teeth with the cement, flash curing was performed, and all excess cement was extracted. The marginal area was then finished and polished with abrasive discs after complete light polymerization for 40 seconds from the palatal, labial, and incisal sides. Occlusal interferences were tested in both the central and eccentric directions. The mandibular teeth were then treated in the same way, restoring the patient's initial occlusion. After the mandibular veneers were cemented, the contacts and occlusion were tested again. After the procedure, postoperative instructions were provided about oral hygiene and the avoidance of behaviours that could cause damage to the veneered teeth. (Figure 4)

RESULTS

A total of 2,512 patients (46.1 percent male; 53.9 percent female) were included in the report, with an average age of 21.5 years and 9.7 years. Fluorosis was found in a total of 1,002 patients (39.9%), and it was more prevalent in females in the 12- to 30-year-old age group. Fluorosis with a localised effect was more common (44.7 percent of the total sample; 67.4 percent of patients with fluorosis). The fluorosis index ranged from the lowest and least extreme (very mild: 15.0 percent of the total sample and 37.6 percent of patients with fluorosis) to the highest and most severe (very severe: 15.0 percent of the total sample and 37.6 percent of patients with fluorosis) (severe form: 1.6 percent of the total sample and 3.9 percent of patients with fluorosis).

Table 1: Incidence of fluorosis grouped by patient age.

Age Group (years)	Fluorosis		
	No fluorosis	Fluorosis	Total
12–20	622	896	1518
21–30	449	95	544
31–40	295	09	304
>40	144	2	146
Total	1510 (60.1%)	1002 (39.9%)	2512

Table 2: Location of incidence of fluorosis.

	Location of fluorosis			
	Localized	Generalized	Normal	Total
No fluorosis	0	0	1510	1510
Fluorosis	675	327	0	1002
Total	675	327	1510	2512

Table 3: Comparison between office in bleach and porcelain veneers in management of dental fluorosis

	Percentage of cases		
Post Operative Outcomes	Office in bleach	Porcelain Veneers	p value
Periodontal problems	13.23	14.21	0.42
Hypersensitivity	12.46	13.14	0.36
Pain	11.43	10.25	0.41
Patient satisfaction	90.23	91.23	0.21

In the first 10 years of life, fluorosis was more prevalent in patients who consumed drinking water (56.8%) and less common in patients who drank treated water (28.1%). (Table1, Table2, Fig 1 and Fig 2)

When the office bleaching process was compared to porcelain veneers, it was discovered that there was no substantial difference in post-operative outcomes such as periodontal problems, hypersensitivity, discomfort, or patient satisfaction. However, in cases of mild to moderate fluorosis, patient satisfaction was higher with in-office

bleaching, and in cases of severe dental fluorosis, patient satisfaction was higher with porcelain veneers. (Table 3).

DISCUSSION

This study was focused on gauging how prevalent the issue was within North Bihar population, and to measure the fluorosis distribution according to gender, drinkable source of water, and its extent and influence. Further there was comparison between the in office bleach and porcelain veneers in the management of dental fluorosis. Fluorosis has become more severe and common as the amount of fluoride in drinking water has increased. Furthermore, it had a high prevalence in ideal regions. The probability of it occurring in this sample, on the other hand, was strikingly close to research in the United States of America (USA) and Mexico that indicate a rise in fluorosis prevalence. Several years ago, Hamdan et al. conducted a study in Jordan.[8] Furthermore, no significant changes have been made to the water supply in this area. Fraysse et al. discovered in 1989 that the percentage was a significant 80 percent.

The result is significantly higher than that recorded in the study. In the light of data from other Arab countries, there was an apparent difference in the fluorosis prevalence discussed in this report.[10] Rugg-Gunn et al. conducted a report on 14-year-olds in Riyadh and found that 83 percent of the participants had enamel mottling. In a study conducted in Saudi Arabia, Akpata et al. discovered that 90 percent of school-aged children were affected by hail. When Vigild et al. looked at low fluoride areas in Kuwait, they discovered a 6% prevalence in the 12–15 age group.[11] The outcome is substantially less than that of this study. When it comes to dental fluorosis, North Bihar has an endemic.

This is valid even in areas where fluoride levels are minimal. Ibrahim et al. conducted a study that yielded findings ranging from 91 to 100 percent, with 91 percent in low-income areas and 100 percent in high-income areas. The disparity in prevalence is due in part to differences in how diagnostic criteria are implemented, screening methods, and the amount of fluoride ingested from different sources.[12]

The severity of the lesion decides the treatment options for enamel fluorosis, which may vary from ceramic veneers to free-hand bonding restorations to minimally invasive micro abrasion techniques. Laser-assisted bleaching and abrasion of abrasive pastes are two other treatment choices and even combination of various treatment modalities.[13] Indirect, prefabricated composite veneers called Compomers (Coltène Whaledent) are a newer choice for restoring teeth in a single visit. Porcelain veneers, on the other hand, are also the best choice for conservative aesthetic treatment since they leave almost all of the enamel intact before applying the veneer. Ceramic veneers not only reduce the invasiveness of complete crowns and the likelihood of gingival reaction, but they also imitate the translucency of natural tooth structure, resulting in more promising aesthetic outcomes.[14] The aesthetic efficiency, biocompatibility, and durability of porcelain laminate veneers have been identified in several clinical studies, and their success rate has been clinically tested, with a longevity of more than 10 to 15 years. Debonding, microleakage, fracture, and caries were the causes of a small number of failures. In all of these longitudinal studies, the rate of irreversible failure was less than 7%.[15]

Veneers, on the other hand, are not appropriate for all cases of dental fluorosis. Minor fluorosis does not necessitate the removal of tooth structure, while porcelain veneers may not be enough to conceal the stains of a heavily flourished dentition. Indications must be carefully monitored, and tooth tissue preservation must be prioritised. Veneers were used in this situation since the condition was mild fluorosis. The patient was delighted with the final outcome, which was a pleasing result. After a 3-month follow-up, all restorations were in progress, and the aesthetics were excellent, with sound margins and no staining or discoloration.

Power bleaching, for example, is a conservative treatment option that can dramatically improve the appearance of discoloured teeth to the point where no further treatment is needed.[16] If bleaching fails to provide adequate aesthetic results, direct or indirect restorative procedures such as composite veneers or resin infiltration can be used, which are invasive, damaging of natural tooth tissue, costly, and time-consuming. As a consequence, power bleaching can result in a satisfactory treatment outcome or reduce the amount of enamel and

dentin removal required for composite veneers. Bleaching before direct composite veneer placement had a major impact on the final shade of the veneer, according to Jarad et al., which was also based on the thickness or shade of the restoration. Composite veneers may have been used on the maxillary anterior teeth in our case.[17] The patient, on the other hand, was not ready for it because he was happy with the bleaching results.

More recently, resin penetration has been used to treat dental fluorosis as a safe and efficient treatment option. After conditioning with hydrochloric acid, low-viscosity resin is injected into the fluorotic opacities. Prior in-office power bleaching strengthened the "masking effect" of resin penetration on fluorotic opacities, according to Schoppmeier et al. power bleaching may be used as a pre-treatment for better aesthetic performance with resin penetration in this way. The increase in surface and intra-pulpal temperature associated with the use of bleaching lamps is one of the concerns about light-activated in-office vital bleaching. Except for the laser-based lamp, Sulieman et al. found that the rise in intra-pulpal temperature with the use of different lamps (plasma arc lamp, xenon-halogen lamp, and regular halogen lamp) was below the critical threshold of 5.5°C.

The percolation of peroxide to the pulp via dentin causes post-bleaching sensitivity, which is a common side effect of bleaching. According to Moghadam et al., 42.9 percent of patients experienced sensitivity after home bleaching, while 57.1 percent of patients experienced sensitivity after power bleaching. Kabil et al. investigated the effect of a "descending light intensity protocol (high intensity, moderate, and finally low intensity)" on post-bleaching sensitivity and discovered that this protocol had lower sensitivity than the traditional "high light intensity protocol." After bleaching, desensitising agents may be used to minimise post-bleaching sensitivity.[18]

CONCLUSION

In conclusion, the prevalence of fluorosis was found out to be about 40% in North Bihar and continuous monitoring and further investigation was needed into the sources that contribute to total fluoride intake. Both the methods of in office bleaching and use of porcelain veneers were effective in management of dental fluorosis but in office bleaching is the better method for mild fluorosis while porcelain veneers is better option in severe fluorosis.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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