



A Bibliometric Analysis of Trends in Various Treatment Modalities for Dental Fluorosis

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ABSTRACT

Background: Dental fluorosis is a condition where enamel is hypoplastic due to increased fluoride ingestion. The affected teeth appear whitish opaque or discoloration which ranges from yellowish to grey concerning the severity of fluorosis leading to breakdown and aesthetic disturbances. This study highlights the need of minimally and non-invasive approaches for the treatment of dental fluorosis in young adults as an adjuvant for invasive procedures.

Methodology: A comprehensive search and selection strategy was framed with appropriate Boolean operators to retrieve maximum and relevant results. For inclusion, the SCOPUS database, such as, in the subject area, dentistry was selected: free full-text articles were included, only abstracts were excluded, and articles only in the English language were included. All the included articles were imported as a CSV file to VOSviewer 1.6.8 software (Centre for Science and Technology Studies, Leiden University, Leiden, Netherlands) for bibliometric analyses.

Results: Among the search literature, review articles occupied the majority with 12.2% with the highest amount of documentation carried out by the United States with 6304 citations with the highest amount of literature published in Journals like Children, Clinical Dentistry Russia, International Journal of Dentistry and Oral Sciences, Clinical Oral Investigations and Scientific Reports.

Conclusion: There is a significant difference in the efficacy of bleaching and microabrasion as there is no difference between bleaching and resin infiltration in the treatment of dental fluorosis.

Keywords: Autofluorescence, Dental Fluorosis, Microabrasion, Microinvasive, Visual assessment.

Introduction

Dental fluorosis is a condition where enamel is hypoplastic due to increased fluoride ingestion.¹ Clinically, the teeth affected appear whitish opaque or discoloration which ranges from yellowish to grey with respect to the severity of fluorosis leading to breakdown and aesthetic disturbances. Studies show a correlation between the duration and quantity of fluoride consumed during tooth development and constant consumption of high levels of fluoride leading to systemic toxicity and complications.² In India, around 20 states are affected by fluorosis leading to a topic of concern as these areas rely on groundwater for their daily needs.³

Although various treatment options have been put forth depending on the extent and severity of fluorosis.⁴ Over the years the trend for the treatment for dental fluorosis has been changing. Studies state that the effects produced on the enamel surface depend on various factors like type, pH, concentration of acid, force, rotations per minute, force application, and time of application, etc.⁵ Hence, Minimally invasive and invasive approach is been followed.

Firstly, In minimally invasive techniques chemicals are used alone or in combination, bleaching for removal of stained surfaces of the teeth, use of CPP-ACP (Casein Phosphopeptide - Amorphous Calcium Phosphate) agents, enamel micro-abrasion or combination of all the methods.^{4,6} this treatment modality has a success rate but can also lead to the removal of deeper tooth structure than required.² On the contrary, the invasive approach includes prosthetic replacements like aesthetic crowns, veneers, and laminates.⁴

Recently, a technique was developed that aimed to create a barrier inside the caries lesion to replace the lost mineral. The advantage of this technique was the masking of the white-spot lesions of caries.⁶ Resin Infiltration (Hamburg, ICON* DMG), involves removal of the superficial surface by using 15% hydrochloric acid by its erosive effect. The

surface that is eroded is then infiltrated with a low-viscosity resin having optical properties similar to those of healthy enamel.⁷ Due to a change in the refractive index the affected tooth appears similar to that of healthy enamel with its masking effect.^{8,10}

This study highlights the need of minimally and non-invasive approaches for the treatment of dental fluorosis in young adults as invasive procedures can cause tooth destruction at an early age. As fluorosis develops at the time of maturation and mineralization of teeth.

Methodology

The bibliometric study investigates the publishing trends of phytotherapy use in dentistry. It is recognized that Scopus is the most authentic and reliable indexing and abstracting database globally, whereas bibliometric analysis is a statistical method to analyze the publishing trends, patterns, and scope of the published scholarly work.

Different variables such as the total citations (TC), total publications (TP), publishing year (PY), journal's impact factor (IF), and authorship patterns were identified. The most productive authors, journals, countries, and organizations were also identified from the retrieved data.

Search strategy

A comprehensive search and selection strategy was framed according to the keywords and appropriate Boolean operators to retrieve maximum and relevant results.

(((((dental fluorosis) OR (dental fluoroses)) OR (mottled enamels)) OR (mottled enamel)) OR (fluorosis)) OR (fluoroses)) AND (((((((microabrasion) OR (bleaching)) OR (deciduous dentition)) OR (resin-infiltration)) OR (baby teeth)) OR (baby tooth)) OR (milk tooth)) OR (milk teeth)) OR (primary dentition)) OR (primary dentitions))) AND (((((((Randomized controlled trial) OR (experimental studies)) OR

(disease frequency survey)) OR (disease frequency surveys)).

Inclusion criteria

For inclusion and recall of maximum relevant records, we used certain filters in the SCOPUS database, such as, in the subject area, dentistry was selected; for documents we selected Articles, free full text articles were included, only abstracts were excluded, articles only in English language were included. There was no filter applied on time span.

Data Analysis and Visualization

All the included articles were imported as a .CSV file to VOSviewer 1.6.8 software (Centre for Science and Technology Studies, Leiden University, Leiden, Netherlands) for bibliometric analyses. The threshold for the number of documents per author/country was set at "1," and for citations, it was set at "0" to optimize the analyses. VOSviewer generates a collective network for contrasting variables and keywords. The illustrations in the form of maps had different dimensions of the bubbles which showed the publications count in numbers, while the area between two bubbles demonstrated the resemblance between two items, which was further distinguished by the color having distinct meanings in each visualization.

The following visualization maps were prepared and interpreted:

authorship/ Coauthorship based on the number of articles for all research clusters around the globe, authorship/co-authorship based on the number of articles only for collaborating clusters, authorship/Co-authorship based on the number of citations only for collaborating clusters, and geographic distribution (based on the number of publications and the number of citations) for all articles.

The nodes generated by VOSviewer represent the relative number of items (publication or citation). A group of linked nodes forms a cluster. The cluster is a group of connected nodes illustrated with the same color. The link between nodes shows the collaboration. The "link strength" represents the relative level of collaborations. This strength is shown using 2 factors: the distance and the thickness of the line between the 2 nodes. In other words, the closer the nodes, the higher the relative number of collaborations and the thicker the line between 2 nodes, the higher the relative number of collaborations.

Results

The increase in a number of documents was seen from the year 2005, with the highest number of documents in the year 2020. Before 2005, the number of documents regarding the topic was between 0-20. The highest number of documents was in the year 2020 (N=70).

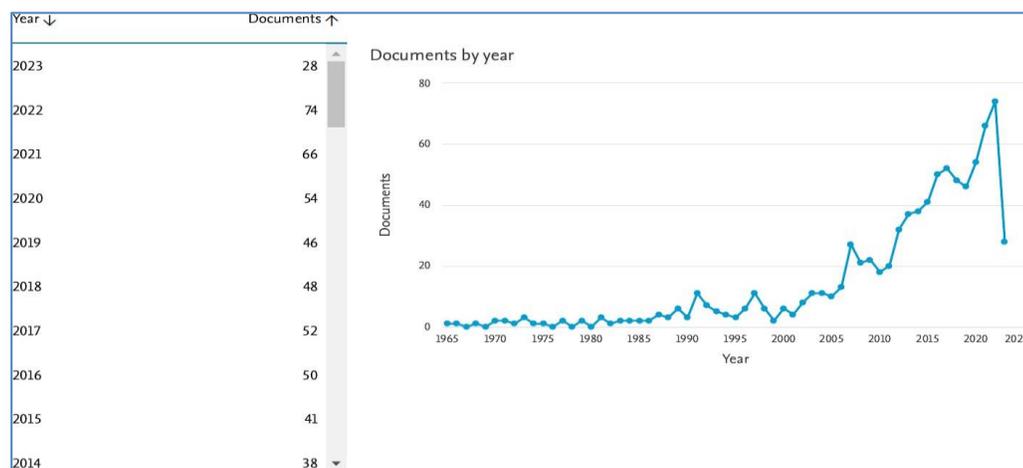


Figure 1: Growth Trend of Literature Related to Dental Fluorosis.

A total of 794 authors were present of which 21 met the threshold of minimum 2 documents with 2 citations it was found that Croll. T. P et al had 8 documents published for which they received 149

citations and there were 3 documents which were published by Haywood V.B et al which received 432 citations however it was observed that no author exhibited Link Strength amongst them.

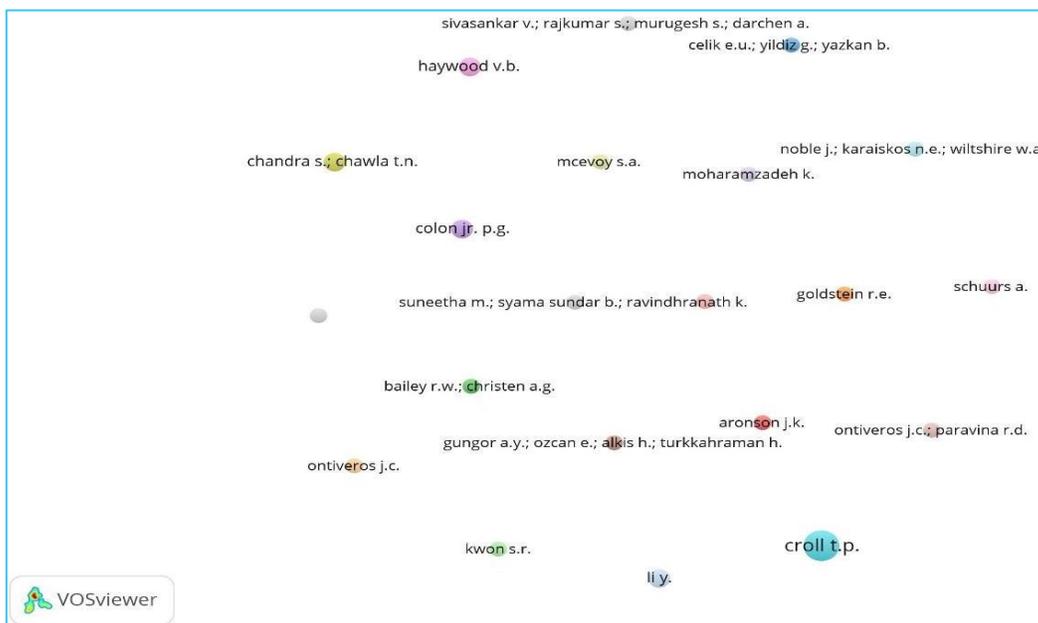


Figure 4: Citations of Various Authors included in the Study.

A total of 303 key words out of 1329 met the threshold of having 2 occurrences, the highest occurring keyword was Fluoride followed by Dental Fluorosis followed by Micro abrasion, Bleaching, post 2020 there was a high occurrence

of keywords pertaining to Caries infiltration, Orthodontics, Molar Incisor Hypo Mineralization Micro invasive, Visual assessment and Autofluorescence.

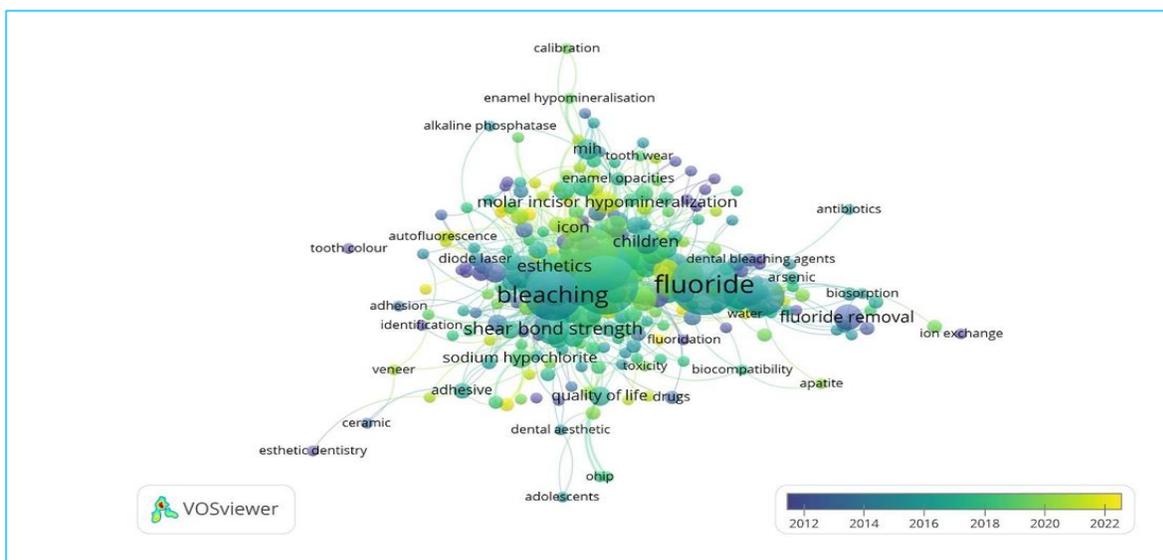


Figure 5: Various Keywords Used Over a Decade.

Out of 837 documents, there were 582 documents which met the threshold of 2 citations of a document. The highest citation was obtained for a Document by Onyango MS et al which received a 555 citation titled, “Adsorption equilibrium modeling and solution chemistry dependence of fluoride removal from water by trivalent-cation-

exchanged zeolite F-9” which was followed by a Document published by Jagtap S et al titled “Fluoride in Drinking Water and Defluoridation of Water” which received 515 citations. However, it was observed that there was no link strength between any of the documents.

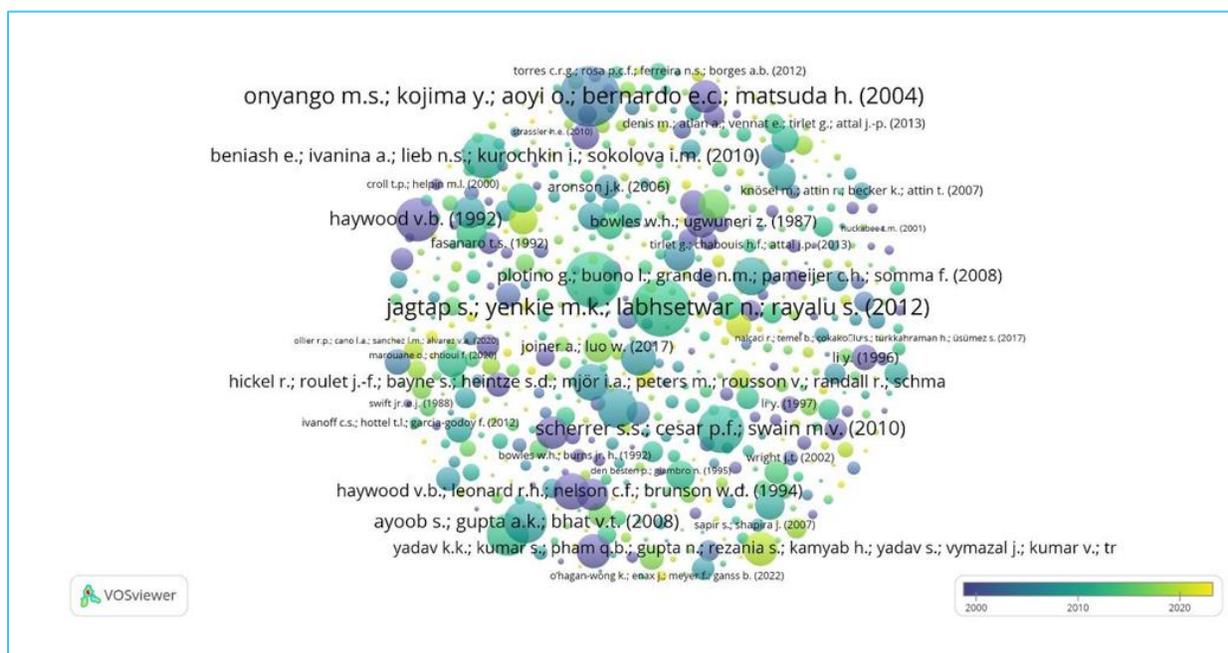


Figure 6: Citation for Distinguished Publications over a Vicennial.

Out of 837 documents of 582 depicted to have bibliographic coupling however only 439 exhibited to have bibliographic coupling amongst them.

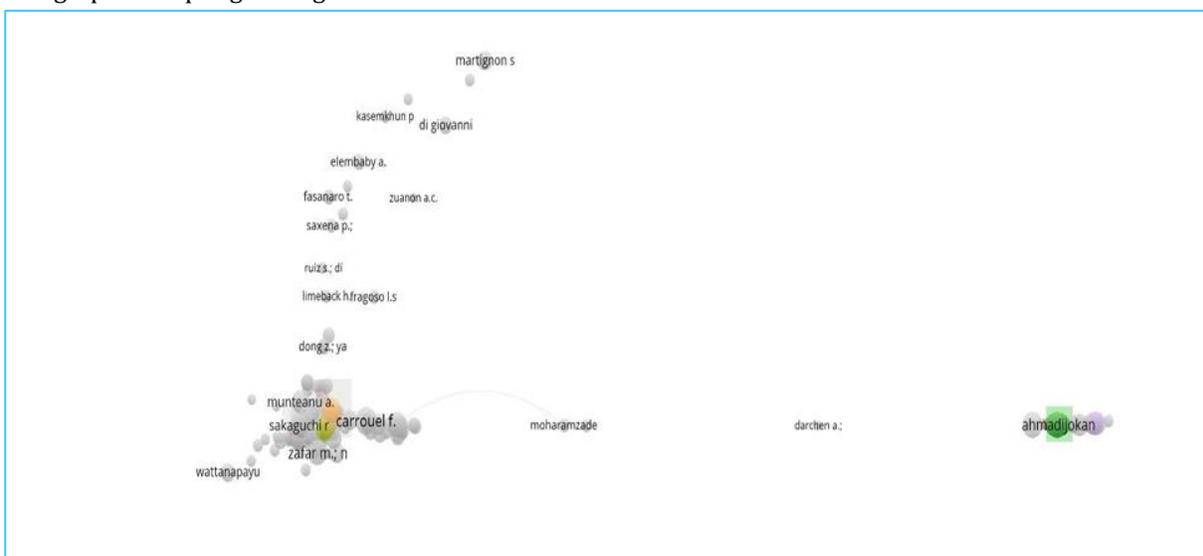


Figure 7: Bibliographic Coupling among the authors.

Discussion

Dental fluorosis leads to enamel mottling which is considered to be a developmental disturbance of the tooth. The cause of dental fluorosis is the exceeded optimal levels causing enamel hypoplasia or the formation of porosities in the enamel structure with a decreased level of mineral content in the tooth structure.³ The toxicity of fluoride leads to defects in the production and progression of the enamel matrix due to disturbance in the metabolic process, thus affecting the enamel-forming cells (ameloblasts) during tooth development.³

According to the data by Schoppmeier (2018), dental fluorosis has affected almost 7.5% to 8.3% of the population group from the age 6-18 years.⁸ Clinically dental fluorosis, appears as narrow opaque linear striations on the teeth, snowcapped teeth with flakes which have unclear edges with sound enamel structure in cases of mild fluorosis.⁴ However in the case of severe dental fluorosis, there are roughened, pitted surfaces which is discolored and range from yellow to brown and the tooth is fragile leading to loss of structure.⁴ Discolouration of teeth psychologically affects the quality of life in patients and is aesthetically unpleasant. H. T. Dean in 1942 introduced the classification based on severity and degree of dental fluorosis.² The classification has 6 scores which ranges from 0, 0.5,1,2,3,4 according to the clinical signs of the affected tooth structure. The other classification like Thylstrup and Fejerskov index is also commonly used.² The grading of this dental defect guides the clinician to implement the necessary treatment options accordingly.

The systematic review designed by Sharoom in the year 2018 included a total of 304 papers with a mean age of 17.7 years from August 1998 to August 2019 for articles in the management of dental fluorosis. The wide spectrum of the population in these papers had been treated with microabrasion, bleaching, resin infiltration, or a combination of microabrasion with bleaching, and resin infiltration with bleaching out of which

microabrasion resulted in less esthetic improvement compared with bleaching. Meanwhile, resin infiltration showed a greater improvement in esthetics in comparison to bleaching. Resin infiltration with additional infiltration time and a combination of resin infiltration with bleaching are the best treatment options which is by the present study as revealing the increased trends in the year 2020 justifying the advancement of treatment.¹¹

A parallel randomized controlled trial carried out by Castro in the year 2013 in Brazil evaluated the efficacy of two treatments for removing fluorosis stains which involved 70 fluorosis endemic area residents randomizing them into two treatment groups with 35 in each group where micro-abrading using 37% phosphoric acid and pumice and, at-home tooth bleaching was performed with 10% carbamide peroxide where allocated treatments respectively to each group. This study concluded the superiority of home bleaching in people satisfaction which is one among the 77.3 percent of the articles contributing to the present study.¹²

A systematic review by Papageorgiou in the year 2018 used a systematic review design to assess the comparative effectiveness of the various interventions for the treatment of fluorosed enamel at Zurich, Switzerland by the documents chosen in the present study by the criteria of country.¹³

A study conducted by Srisakthi in the year 2020 at Chennai revealed that patients with dental fluorosis had appreciable oral hygiene status and less dental caries prevalence which was published in the International Journal of Dentistry and Oral Sciences justifying the higher amount of literature the journal contains as given in the present study.¹⁴

Limitations

No access to Databases like MEDLINE, WEB OF SCIENCE, etc.

Limited studies on microabrasion compared with resin infiltration, as resin infiltration is costly and technique-sensitive.

Limited studies on primary dentition compare microabrasion, bleaching, and resin infiltration.

Conclusion

In conclusion, there is a significant difference in the efficacy of bleaching and microabrasion as there is no difference between bleaching and resin infiltration in the treatment of dental fluorosis. The results from this systematic review show that enamel microabrasion may be considered a better treatment option alongside resin infiltration for treating dental fluorosis. Even though, resin infiltration has a better outcome in terms of aesthetics but is less likely to be opted for due to technique sensitivity and cost-effectiveness.

References

1. Celik EU, Yıldız G, Yazkan B. Comparison of enamel microabrasion with a combined approach to the esthetic management of fluorosed teeth. *Oper Dent* 2013;38(5):134-43. doi: <https://doi.org/10.2341/12-317-c>
2. Saxena P, Grewal MS, Agarwal P, Kaur G, Verma J, Chhikara V. Clinical efficacy of resin infiltration technique alone or in combination with micro abrasion and in-office bleaching in adults with mild-to-moderate fluorosis stains. *J Pharm Bioallied Sci* 2021;13(1):301. doi: <https://doi.org/10.4103/jpbs.jpbs.795.20>
3. Gupta A, Dhingra R, Chaudhuri P, Gupta A. A comparison of various minimally invasive techniques for the removal of dental fluorosis stains in children. *J Indian Soc Pedod Prev Dent* 2017;35(3):260. doi: <https://doi.org/10.4103/jisppd.jisppd.13816>
4. Gugnani N, Pandit IK, Gupta M, Gugnani S, Soni S, Goyal V. Comparative evaluation of esthetic changes in nonpitted fluorosis stains when treated with resin infiltration, in-office bleaching, and combination therapies. *J Esthet Restor Dent* 2017;29(5):317-24. doi: <https://doi.org/10.1111/jerd.12312>
5. Pini NI, Sundfeld-Neto D, Aguiar FH, Sundfeld RH, Martins LR, Lovadino JR, Lima DA. Enamel microabrasion: An overview of clinical and scientific considerations. *World J Clin Cases* 2015;3(1):34. doi: <https://doi.org/10.12998/wjcc.v3.i1.34>
6. Bharath KP, Subba Reddy VV, Poornima P, Revathy V, Kambalimath HV, Karthik B. Comparison of relative efficacy of two techniques of enamel stain removal on fluorosed teeth. An in vivo study. *J Clin Pediatr Dent* 2014;38(3):207-14. doi: <https://doi.org/10.17796/jcpd.38.3.0h120nkl8852p568>
7. Index M. Treatment of White Spot Lesions With Resin Infiltration Drs. Nathaniel Lawson and Bushra Nizami October 25, 2021 9 Mins read 6.4 k Views. <https://www.dentistrytoday.com/treatment-of-white-spot-lesions-with-resin-infiltration/>
8. Schoppmeier CM, Derman SH, Noack MJ, Wicht MJ. Power bleaching enhances resin infiltration masking effect of dental fluorosis. A randomized clinical trial. *J Dent* 2018;79:77-84. doi: <https://doi.org/10.1016/j.jdent.2018.10.005>
9. Borges AB, Caneppele TM, Masterson D, Maia LC. Is resin infiltration an effective esthetic treatment for enamel development defects and white spot lesions? A systematic review. *J Dent* 2017;56:11-8. doi: <https://doi.org/10.1016/j.jdent.2016.10.010>
10. Meireles SS, Goettens ML, Castro KS, Sampaio FC, Demarco FF. Dental fluorosis treatment can improve the individuals' OHRQoL? Results from a randomized clinical trial. *Braz Dent J*

- 2018;29:109-16. doi: <https://doi.org/10.1016/j.ident.2014.01.011>
- <https://doi.org/10.1590/0103-6440201801733>
11. Shahroom NSB, Mani G, Ramakrishnan M. Interventions in management of dental fluorosis, an endemic disease: A systematic review. J Family Med Prim Care. 2019 Oct 31;8(10):3108-3113. doi: https://doi.org/10.4103/jfmprc.jfmprc_648_19
12. Castro KS, et al. Acceptability, efficacy and safety of two treatment protocols for dental fluorosis: A randomized clinical trial. Journal of Dentistry (2014). doi:
13. Di Giovanni T, Eliades T, Papageorgiou SN. Interventions for dental fluorosis: A systematic review. J Esthet Restor Dent. 2018 Nov;30(6):502-508. doi: <https://doi.org/10.1111/jerd.12408>
14. D, Sri. (2020). Oral Hygiene Status and Dental Caries Experience in Patients with Dental Fluorosis Visiting A Private Dental Institution in Chennai. International Journal of Dentistry and Oral Science. 955-959. doi: <http://dx.doi.org/10.19070/2377-8075-20000189>

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