ORIGINAL ARTICLE

Knowledge and awareness about fibrodysplasia ossificans progressiva among dental students

L. Akshayaa, S. Kavitha, V. Vishnu Priya, R. Gayathri

Department of Biochemistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

J. Adv. Pharm. Technol. Res.

ABSTRACT

Fibrodysplasia ossificans progressiva (FOP) is a rare genetic disorder which is autosomal dominant distinguished by congenital malformations of large toes and flare ups, etc. It is a disorder of connective tissue, with heterotopic ossifications seen with skeletal muscles, tendons, and cartilages and also called as Stone man disease, myositis ossificans, and Munchmeyer disease. The main objective of the study is to assess and create the awareness about FOP among dental students. An online-based survey was conducted among 103 dental students, undergraduates and postgraduates. About 20 questionnaires were prepared and circulated among the students through the "Google forms" across Chennai. A survey questionnaire asked about the knowledge of fibrodysplasia, its causes, treatment, and diagnosis was enquired. Thus, the data obtained were analyzed statistically using the SPSS software. In our study, about 64% were undergraduates and 35% of them were postgraduates. About 66% of the participants were aware of fibrodysplasia and 32% of them were not aware. Most of the undergraduate students were more aware of fibrodysplasia (40%) when compared to postgraduates (29%). However, this is statistically not significant. Fibrodysplasia ossificans reported to have a high incidence in 1 in 2 million people worldwide. Hence, an early diagnosis of this disorder can prevent further complications. Although the survey has provided significant knowledge about fibrodysplasia, awareness still has to be created among dental students.

Key words: Awareness, dental students, fibrodysplasia ossificans, innovative technique, knowledge, novel method

INTRODUCTION

Fibrodysplasia ossificans progressiva (FOP) is a rare genetic disorder which is autosomal dominant and distinguished by congenital malformations of large toes and flare-ups.[1] This is a disorder of connective tissue, with heterotopic ossifications seen with skeletal muscles, tendons, and cartilages.[2] This disease condition is also called Stone man disease, myositis ossificans, and Munchmeyer disease. The prevalence of fibrodysplasia was about one among two million individuals irrespective of ethnic, racial, gender, or geographic factors.[3] The two definitive clinical symptoms of FOP incorporate distortions in big toes and development of heterotopic endochondral ossification in specific anatomic patterns.[4] It resembles a ribbon or plates

Address for correspondence:
Dr. S. Kavitha,
Department of Biochemistry, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600 077, Tamil Nadu, India.
E-mail: kavithas.sdc@saveetha.com

Submitted: 20-Apr-2022 **Revised:** 19-Nov-2022
Accepted: 21-Nov-2022 **Published:** 30-Dec-2022

Access this article online	
Quick Response Code:	Website: www.japtr.org
	DOI: 10.4103/japtr.japtr_165_22

How to cite this article: Akshayaa L, Kavitha S, Priya VV, Gayathri R. Knowledge and awareness about fibrodysplasia ossificans progressiva among dental students. J Adv Pharm Technol Res 2022;13:S554-8.

of heterotopic bony structures which replace connective tissue and skeletal muscles through endochondral ossification that promotes lifelong immobility of joints at the site involvements. This disease fundamentally affects the maxillofacial region, involving all the masticatory muscles.[5] The primary etiology of fibrodysplasia includes a mutation in ACVR1 gene (bone morphogenetic protein receptor). Other factors which predispose to fibrodysplasia include genetic mutations and hereditary causes of traumatic injuries.[6] A few clinical studies have provided evidence of significant abnormality in the regulation of BMP signaling pathway in patients with fibrodysplasia ossificans.[7]

People who are affected with FOP appear to be normal at birth, although there are malformations associated with great toes. Within 10 years of age, most of the children with FOP develop inflammatory, painful, and episodic inflammatory swelling of the soft tissue.[8] In later stages, it leads to ankylosis, chest stiffness, and respiratory infections.[9] Prior diagnosis of this disease is vital to prevent any further invasive examination such as biopsies as trauma, intramuscular injections which amplify the development of the disease.[10] The diagnostic approaches of FOP are X-rays, magnetic resonance imaging, and DNA genetic testing of the ACVR1 gene. FOP is also commonly misdiagnosed with juvenile lymphedema, fibromatosis, and soft-tissue sarcoma. Other blood routine investigation of fibrodysplasia shows the bone mineral metabolism, activity of serum alkaline phosphatase might be elevated, during disease flare-ups and the level of urinary basic fibroblast growth factor might also be increased which coincides with the angiogenic period of fibroproliferative lesions.[11] Studies have revealed that about 87% of patients with fibrodysplasia ossificans are wrongly diagnosed. There is no other conclusive treatment accommodated for fibrodysplasia. However drugs such as corticosteroids and NSAIDS can be administered.[12] Hence, the knowledge about the causes, diagnosis, and treatment required for fibrodysplasia is important for the clinicians to consult the patients.[13]Our research and knowledge have resulted in high-quality publications from our team.[14-28]

Thus, the main objective of our study is to assess the knowledge and awareness about FOP among the dental students.

MATERIALS AND METHODS

A cross-sectional study was conducted among 103 dental students, undergraduates and postgraduates. An online-based survey comprising 20 questionnaires was prepared and circulated among the students through the "Google forms" across Chennai. The demographic data of the participants consisting of name, gender, and qualification were asked. We framed a self-structured questionnaire with 20 questions and the validity of it was evaluated by external and internal experts. Random sampling method was selected to avoid the bias. A survey questionnaire enquired about the knowledge of fibrodysplasia, its causes, treatment, and the diagnosis was enquired. These questions assessed the knowledge and awareness about fibrodysplasia ossificans. About 103 responses were collected. Thus, the data obtained were analyzed statistically using SPSS software (IBM, India) and the Chi-square test was used.

RESULTS AND DISCUSSION

In our study, among n = 103 participants, 74% of them were female and 25% of them were male. In which, 64% of them were undergraduates and 35% were postgraduates were included in the study [Figure 1]. The percentage distribution of awareness about fibrodysplasia among the dental students was analyzed. 68.9% of the students chose as it is a connective tissue disorder, 21.3% of students chose congenital disease and 9.7% of them answered as it is a skeletal abnormality. This shows that 68% of them were aware and 30% of them were not aware [Figure 2]. The main predisposing factor for fibrodysplasia is genetic mutations. A gene involved in fibrodysplasia is the ACVR1 gene. The question regarding the causes and genes involved in fibrodysplasia was asked. About 66.9% of them know that it is caused by genetic mutations, 27.1% of them answered as hereditary and 5.8% of them have chosen as it is caused due to trauma [Figure 3]. We assess the awareness about oral manifestations of fibrodysplasia among dental students. 13.4% of the students answered as ankylosis of temporomandibular joint (TMJ), 6.7% of them chose tooth

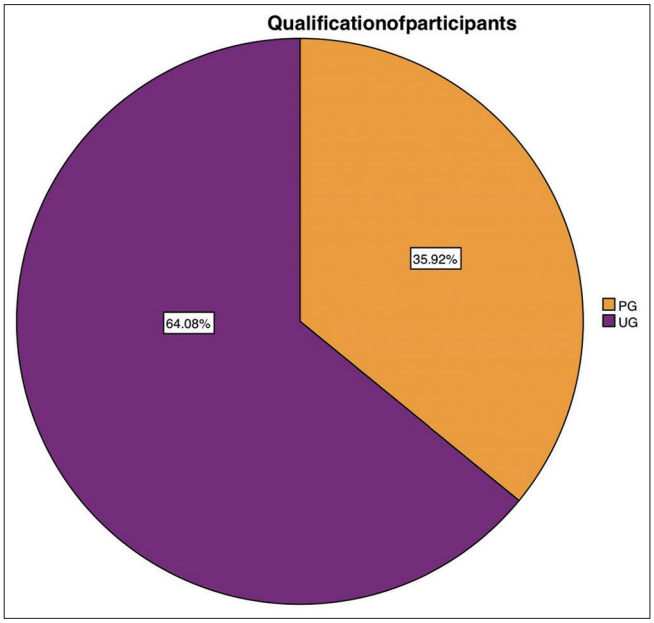

Figure 1: The pie chart shows the percentage distribution of the qualification of the students. Here, violet denotes undergraduate students (64%) and orange denotes postgraduate students (35.9%) who were included in the study

mobility, 7.6% as abscess and 42.3% of them have chosen all the above [Figure 4]. Other than this, questions regarding the most population group affected, abnormalities of fibrodysplasia were assessed. Moreover, gene mutations involved in disease were asked. 65.3% of them knew that the ACVR1 gene was involved in fibrodysplasia, 27.8% of them had chosen the RAS gene, and 5.7% as P53 gene. We found that 41% of the students know that females are the most common being affected with fibrodysplasia and 40% of the students also know about the abnormalities caused by fibrodysplasia.

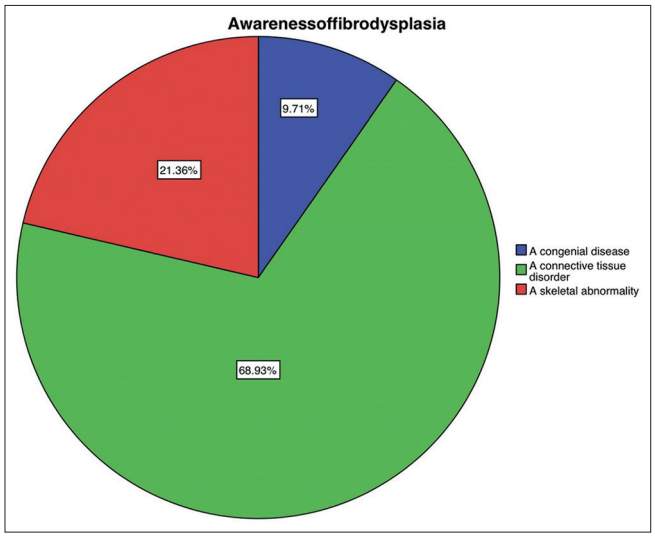

Figure 2: The pie chart shows the percentage distribution of awareness about fibrodysplasia among dental students. Here green denotes the percentage of students who answered as connective tissue disorder (68.9%), red denotes the option congenital disease (21.3%) and blue denotes the students who answered it as skeletal abnormality (9.7%)

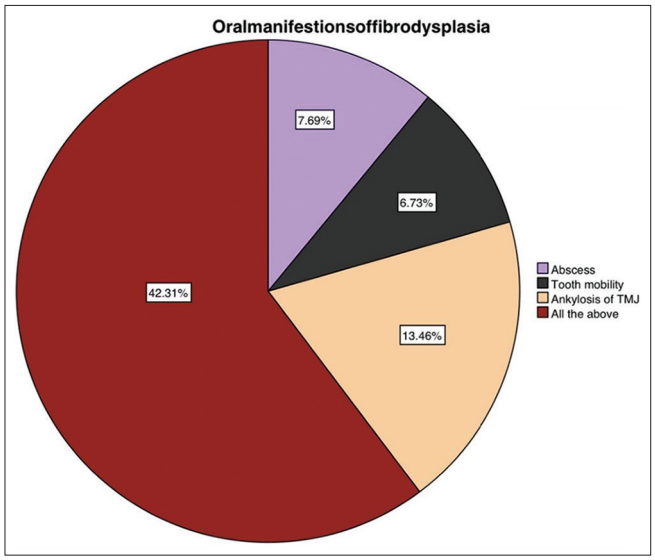

Figure 4: This pie chart depicts the percentage distribution of awareness about oral manifestations of fibrodysplasia asked among dental students. Here, brown colour denotes the percentage of students who have chosen all the above as option (42.3%), peach colour denotes the option ankylosis of TMJ, black denotes that of students answered as tooth mobility (6.7%) and purple denotes the option abscess as the oral manifestations of fibrodysplasia (7.6%). TMJ: Temporomandibular joint

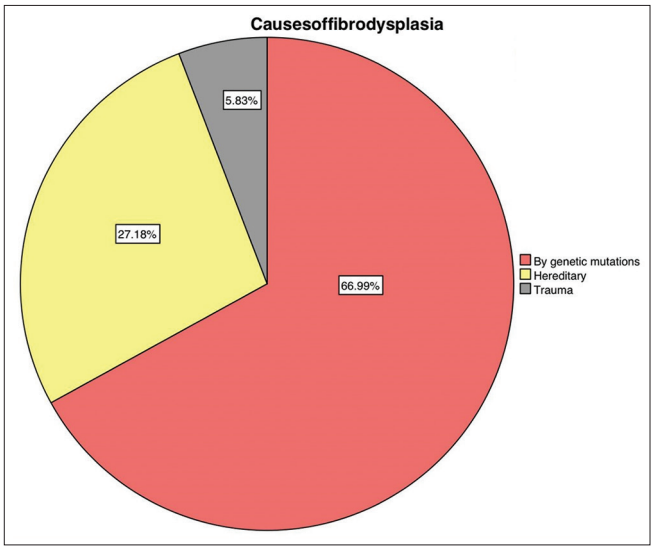

Figure 3: Pie chart depicts the percentage distribution of the knowledge about causes of fibrodysplasia known by the students. Here, pink denotes the percentage of students who answered as genetic mutations (66.9%), yellow denotes that students who had chosen hereditary (27.1%) and grey denotes the percentage of students (5.8%) who have answered as trauma

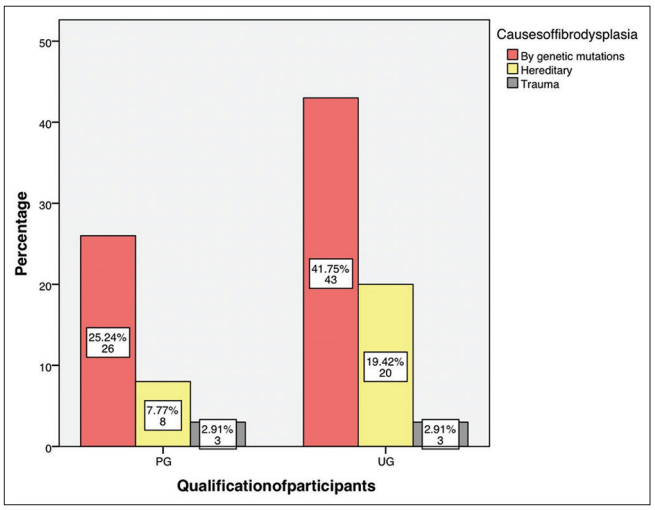

Figure 5: Bar graph represents the association between the qualification of participants and their knowledge on causes of fibrodysplasia. The X-axis indicates the degree of the dental students, Y-axis indicates the percentage of participants knowing causes of fibrodysplasia ossificans. Here, pink denotes the participants who had chosen genetic mutations, yellow denotes the students who had chosen as hereditary and gray denotes the students who had chosen trauma as the cause for fibrodysplasia. It shows that the majority of undergraduate students (41%) have known that fibrodysplasia is caused by genetic mutations when compared to postgraduates (25%). However, this is not significant statistically ($\chi^2 = 0.53$; $P > 0.005$)

Figure 5 shows the correlation between the qualification of the participants and awareness of fibrodysplasia. It shows that the undergraduate students were more aware of fibrodysplasia (40%) when compared to postgraduates (29%). As they know fibrodysplasia is a type of connective tissue disorder. Although postgraduates also have equal knowledge and awareness about fibrodysplasia, this is not statistically significant. As Chi-square test $P = 0.27$; $P > 0.005$, hence, it shows not significant [Figure 6]. Then we also assessed the correlation between the degree of students and causes of fibrodysplasia. It shows that the majority of undergraduate students (41%) have known that fibrodysplasia is caused by genetic mutations when compared to postgraduates (25%). However, this correlation is not found to be statistically significant as the Chi-square test $P = 0.53$; $P > 0.005$; hence, it shows no significance [Figure 5].

DISCUSSION

From the results obtained from our study, it was found that the majority of the participants know about fibrodysplasia ossificans and its features. Only a few of them were unaware. Our present study observed that the majority of dental students knew that fibrodysplasia is a connective tissue disorder. A similar study conducted among 50 orthopedic surgeons have reported that only 6% of the clinicians were aware of diagnosis and prevention for fibrodysplasia ossificans.[29] A similar study done among the physicians on iatrogenic harm caused by fibrodysplasia was reported that about 87% of patients were incorrectly diagnosed due to the lack of awareness among the medical students.[30] Thus, our study findings confirmed that students in dental colleges have some knowledge and idea about FOP. In our study, we observed that undergraduate and postgraduate students have significant knowledge about the causes, abnormalities of fibrodysplasia. One case report study has revealed that almost all physicians had known that fibrodysplasia is caused by genetic mutations.[31] Our study findings also infer the diagnosis and treatment approaches like X-rays, genetic testing needed for fibrodysplasia. A previous study had discussed the importance of X-rays, radiological features useful for the diagnosis of fibrodysplasia.[32]

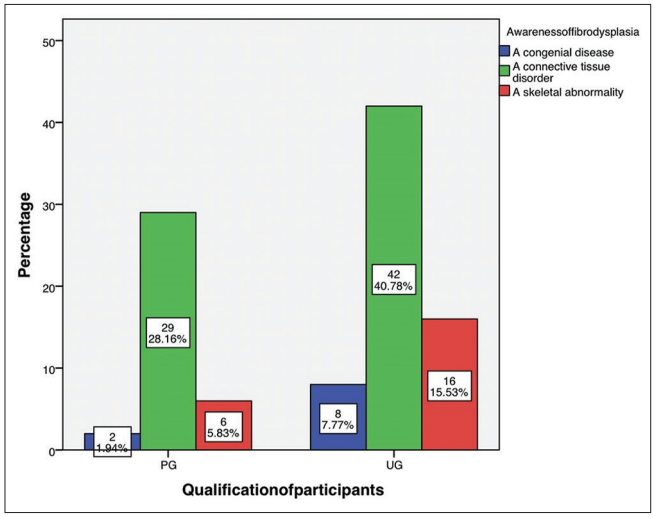

Figure 6: Bar graph shows the association between the qualification of the participants and awareness of fibrodysplasia. The X-axis indicates the degree of the dental students, Y-axis indicates the percentage of participants having awareness about fibrodysplasia ossificans. Green denotes the students who have chosen connective tissue disorder, red denotes the students who have selected congenital disease, blue denotes the students who considered fibrodysplasia as a skeletal abnormality. It shows that the undergraduate students were aware of fibrodysplasia (40%) when compared to postgraduates (29%). However, this is not significant statistically ($\chi^2 = 0.27$; $P > 0.005$)

Although classic FOP involves genetic mutations, studies have been still going on to elucidate the exact molecular pathway which prompts the intricate illness aggregate of skeletal formation.[33] In addition, few studies have reported that diagnostic errors and inappropriate medical procedures in patients can cause harm which likely results from a lack of awareness and misdiagnosis of fibrodysplasia.[34] Although several studies have inferred the importance of fibrodysplasia and its diagnosis, an early diagnosis of this disorder can prevent further complications. Our present study had certain limitations, which involves less sample size and a short period. Thus, the future extent of our study can include newer information and therapeutic approaches related to fibrodysplasia ossificans. Although the survey has provided significant knowledge about fibrodysplasia, awareness still has to be created among dental college students.

CONCLUSION

The fibrodysplasia ossificans has been reported to have incidence in 1 in 2 million people. Diagnosing the disease earlier is most important as it can avoid further complications. Hence, knowledge about this disease plays a vital role for all physicians leading to the correct diagnosis of diseases. Hence, this survey would have created significant knowledge and awareness about the fibrodysplasia ossificans among the dental students.

Acknowledgments

The authors are thankful to Saveetha Dental College for providing a platform to express our knowledge.

Financial support and sponsorship

The present project is supported by

- Saveetha Dental College
- Saveetha Institute of Medical and Technical Science, Saveetha University
- Lingam Stores.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Connor JM, Evans DA. Fibrodysplasia ossificans progressiva. The clinical features and natural history of 34 patients. J Bone Joint Surg Br 1982;64:76-83.
2. Stanley A, Tichy ED, Kocan J, Roberts DW, Shore EM, Mourkioti F. Dynamics of skeletal muscle-resident stem cells during myogenesis in fibrodysplasia ossificans progressiva. NPJ Regen Med 2022;7:5.
3. Moriatis JM, Gannon FH, Shore EM, Bilker W, Zasloff MA, Kaplan FS. Limb swelling in patients who have fibrodysplasia ossificans progressiva. Clin Orthop Relat Res 1997;336:247-53.
4. Shore EM, Rogers JG, Smith R, Gannon FH, Delatycki M, Andoni Urtizberea J, *et al*. Fibrodysplasia Ossificans Progressiva. The Genetics of Osteoporosis and Metabolic Bone Disease. Humana Press: Totowa, NJ; 2000. p. 211-36.
5. Kaplan FS, Shore EM, Gupta R, Billings PC, Glaser DL, Pignolo RJ, *et al*. Immunological features of fibrodysplasia ossificans progressiva and the dysregulated BMP4 Pathway. Clin Rev Bone Miner Metabol 2005;3:189-94.
6. Kaplan FS, Glaser DL. Thoracic insufficiency syndrome in patients with fibrodysplasia ossificans progressiva. Clin Rev Bone Miner Metabol 2005;3:213-6.
7. Shafritz AB, Shore EM, Gannon FH, Zasloff MA, Taub R, Muenke M, *et al*. Overexpression of an osteogenic morphogen in fibrodysplasia ossificans progressiva. N Engl J Med 1996;335:555-61.
8. Raees-Karami SR, Jafarieh H, Ziyayi V, Shekarriz Foumani R, Aghighi Y. Evaluation of 20 years experience of fibrodysplasia ossificans progressiva in Iran: Lessons for early diagnosis and prevention. Clin Rheumatol 2012;31:1133-7.
9. Debeney-Bruyerre C, Chikhani L, Lockhart R, Favre-Dauvergne E, Weschler B, Bertrand JC, *et al*. Myositis ossificans progressiva: Five generations where the disease was exclusively limited to the maxillofacial region. A case report. Int J Oral Maxillofac Surg 1998;27:299-302.
10. Smilde BJ, Botman E, de Ruiter RD, Smit JM, Teunissen BP, Lubbers WD, *et al*. Monitoring and management of fibrodysplasia ossificans progressiva: Current perspectives. Orthop Res Rev 2022;14:113-20.
11. Sleem H. Fibrodysplasia ossificans progressiva: TMJ involvement and feeding dilemma. Oral Health Dent Sci 2019;3:1-3. [doi. org/10.33425/2639-9490.1037].
12. Schaffer AA, Kaplan FS, Tracy MR, O'Brien ML, Dormans JP, Shore EM, *et al*. Developmental anomalies of the cervical spine in patients with fibrodysplasia ossificans progressiva are distinctly different from those in patients with Klippel-Feil syndrome: Clues from the BMP signaling pathway. Spine (Phila Pa 1976) 2005;30:1379-85.
13. Rosenstirn J. A contribution to the study of Myositis Ossificans Progressiva. Ann Surg 1918;68:591-637.
14. Murugan MA, Arul Murugan M, Jayaseelan V, Jayabalakrishnan D, Maridurai T, Selva Kumar S, *et al*. Low velocity impact and mechanical behaviour of shot blasted SiC wire-mesh and Silane-treated *Aloevera*/*Hemp*/Flax-reinforced SiC whisker modified epoxy resin composites. Silicon 2020;12:1847-56.
15. Rajagopal R, Padmanabhan S, Gnanamani J. A comparison of shear bond strength and debonding characteristics of conventional, moisture-insensitive, and self-etching primers in vitro. Angle Orthod 2004;74:264-8.
16. Muthukrishnan S, Krishnaswamy H, Thanikodi S, Sundaresan D, Venkatraman V. Support vector machine for modelling and simulation of heat exchangers. Therm Sci 2020;24 1 Part B: 499-503.
17. Ezhilarasan D. Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective. Arab J Gastroenterol 2018;19:56-64.
18. Neelakantan P, Sharma S, Shemesh H, Wesselink PR. Influence of irrigation sequence on the adhesion of root canal sealers to dentin: A fourier transform infrared spectroscopy and push-out bond strength analysis. J Endod 2015;41:1108-11.
19. Jose J, Ajitha P, Subbaiyan H. Different treatment modalities followed by dental practitioners for Ellis class 2 fracture – A questionnaire-based survey. Open Dent J 2020;14:59-65.
20. Sahu D, Kannan GM, Vijayaraghavan R. Carbon black particle exhibits size dependent toxicity in human monocytes. Int J Inflam 2014;2014:827019.
21. Nandhini NT, Rajeshkumar S, Mythili S. The possible mechanism of eco-friendly synthesized nanoparticles on hazardous dyes degradation. Biocatal Agric Biotechnol 2019;19:101138.
22. Wu F, Zhu J, Li G, Wang J, Veeraraghavan VP, Krishna Mohan S, *et al*. Biologically synthesized green gold nanoparticles from *Siberian ginseng* induce growth-inhibitory effect on melanoma cells (B16). Artif Cells Nanomed Biotechnol 2019;47:3297-305.
23. Patil SB, Durairaj D, Suresh Kumar G, Karthikeyan D, Pradeep D. Comparison of extended nasolabial flap versus buccal fat pad graft in the surgical management of oral submucous fibrosis: A prospective pilot study. J Maxillofac Oral Surg 2017;16:312-21.
24. Uthrakumar R, Vesta C, Raj CJ, Krishnan S, Das SJ. Bulk crystal growth and characterization of non-linear optical bisthiourea zinc chloride single crystal by unidirectional growth method. Curr Appl Phys 2010;10:548-52.
25. Vijayakumar Jain S, Muthusekhar MR, Baig MF, Senthilnathan P, Loganathan S, Abdul Wahab PU, *et al*. Evaluation of three-dimensional changes in pharyngeal airway following isolated lefort one osteotomy for the correction of vertical maxillary excess: A prospective study. J Maxillofac Oral Surg 2019;18:139-46.
26. Vishnu Prasad S, Kumar M, Ramakrishnan M, Ravikumar D. Report on oral health status and treatment needs of 5-15 years old children with sensory deficits in Chennai, India. Spec Care Dentist 2018;38:58-9.
27. Eapen BV, Baig MF, Avinash S. An assessment of the incidence of prolonged postoperative bleeding after dental extraction among patients on uninterrupted low dose aspirin therapy and to evaluate the need to stop such medication prior to dental extractions. J Maxillofac Oral Surg 2017;16:48-52.
28. Krishnamurthy A, Sherlin HJ, Ramalingam K, Natesan A, Premkumar P, Ramani P, *et al*. Glandular odontogenic cyst: Report of two cases and review of literature. Head Neck Pathol 2009;3:153-8.
29. Smith R. Fibrodysplasia (myositis) ossificans progressiva. Clinical lessons from a rare disease. Clin Orthop Relat Res 1998;346:7-14.
30. Kitterman JA, Kantanie S, Rocke DM, Kaplan FS. Iatrogenic harm caused by diagnostic errors in fibrodysplasia ossificans progressiva. Pediatrics 2005;116:e654-61.
31. Verma AK, Aga P, Singh SK, Singh R. The stone man disease: Fibrodysplasia ossificans progressiva: Imaging revisited. BMJ Case Rep 2012;2012:bcr2012006422.
32. Shah ZA, Rausch S, Arif U, El Yafawi B. Fibrodysplasia ossificans progressiva (stone man syndrome): A case report. J Med Case Rep 2019;13:364.
33. Wang Z, Wang X, Liu B, Hou Y. Fibrodysplasia ossificans progressiva in a young adult with genetic mutation: Case report. Medicine (Baltimore) 2021;100:e24620.
34. Akyuz G, Gencer-Atalay K, Ata P. Fibrodysplasia ossificans progressiva: Lessons learned from a rare disease. Curr Opin Pediatr 2019;31:716-22.