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Knowledge About Enamel Defects Amongst Undergraduate Students A Cross-Sectional Survey

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ABSTRACT :

AIM: This study aims to evaluate the knowledge about enamel defects among dental students.
BACKGROUND: Enamel defects are disturbances in the quantity or quality of enamel caused by damage or disruption to the enamel organ during amelogenesis of calcified tissue that covers the whole anatomic crown of the tooth.
MATERIALS AND METHODS: This is a questionnaire based cross sectional study conducted among UG students in a private dental college. Random sampling is used to minimize the sampling bias . A questionnaire consisting of 10 questions about developmental enamel defects were circulated through the online survey mode undergraduates. The collected data were analysed using spss software version 23.
RESULTS: In this present study, first year undergraduate students were more aware of enamel defects than second, third, and fourth year students. According to this study, 43.14% of first year students were aware of enamel hypomineralization followed by 2.94% of second year students, 13.73% of third year students and 8.82% of final year students. The Pearson chi-square test used to determine the relationship between year of study and the number of respondents who were aware of hypomineralization enamel and the p value is 0.016, ($p < 0.05$), hence it is statistically significant.
CONCLUSION: The knowledge and awareness of enamel defects among undergraduate dental students were assessed in this study and it was found that first year undergraduate students were more aware of enamel defects than second, third, and fourth year students.

KEYWORDS : Enamel defects, amelogenesis imperfecta, enamel hypoplasia, innovative study .

INTRODUCTION:

Enamel is formed by ameloblasts and the process is called amelogenesis. Enamel is the most mineralized tissue of our body, forming a very hard, thin, translucent layer of calcified tissue that covers the complete anatomic crown of the tooth. It can differ in color commonly from yellowish to grayish white depending upon the thickness (1). It is composed primarily of inorganic minerals, roughly 95% to 98% of its calcium and phosphate ions that make up sturdy hydroxyapatite crystals.

Enamel defects are disturbances in the quantity or quality of enamel , due to disruption or damage to the enamel organ during amelogenesis. Developmental defects of the enamel might also be inherited as mutations in genes that code for enamel proteins or as a feature of generalized familial prerequisites (2). The enamel defects include - Hypoplasia - a reduction in quantity, presenting pits, grooves, thin or missing, enamel or Hypomineralization- reduced mileralization presenting soft reduced mineralization of enamel or Hypomaturation where there is a altered translucency affecting the entire tooth known as opacity (3).

The right diagnosis of enamel defects is vital as various management preferences should be required for different stipulations, difficulties in diagnosis can happen , due to the fact these defects can also have comparable clinical presentations(4). Also, our team has extensive knowledge and research experience that has translated into high quality publications (5-24). Thus, the aim of the study is to evaluate the knowledge about enamel defects among dental students.

MATERIALS & METHODS :

This is a questionnaire based cross sectional study conducted among pre clinical UG in a private dental college and simple random sampling were used to select the study participants. A questionnaire consisting of 10 questions about developmental enamel defects were circulated through the online survey mode among undergraduates. The collected data were analysed using spss software version 23 . The chi-square test was analysed to examine the difference between categorical variables in the same population. The chi square test was used to analyze and comparative bar graphs were plotted and it is statistically significant only if the p value is less than 0.05 .The results were represented in pie charts and bar graphs.

A questionnaire consisting of 10 questions about enamel defects are :

1. Are you aware of the following clinical picture ?
2. Do you know which of these clinical presentations represent amelogenesis imperfecta?
3. Do you know which defect causes enamel hypoplasia?
4. Are you aware of the types of amelogenesis imperfecta ?
5. Are you aware of which defect is caused by the formation of the teeth's enamel matrix?
6. Are you aware of which enamel defects refer to changes that occur in the last stages of the mineral accumulation?
7. Are you aware of which gene is involved in amelogenesis imperfecta?

8. Are you aware of the following clinical picture ?
9. Are you aware of the enamel defect that is caused by abnormality in the formation of ameloblast?
10. Are you aware of this defect manifested as pits, grooves, thin or missing enamel due to reduction in quantity ?

RESULTS:

In the present study, most of the respondents were under the age of 18 (47.06 %) followed by 19 (35.29%) , 17 (11.76%) and 20 (5.88%). In our study 68.63% of the population were aware about dental fluorosis whereas 14.71% (enamel hypoplasia) , 13.73% (turner hypoplasia) and 2.94% (amelogenesis imperfecta) were unaware about the clinical picture of Dental fluorosis (**figure 1).** According to the study, 76.47 % of the population have knowledge about amelogenesis imperfecta (**figure 2)** whereas 15.69 % (dentinogenesis imperfecta) and 7.84% (dental fluorosis) were unaware of amelogenesis imperfecta. In our study, 76.47% of the population were aware about enamel hypoplasia **(figure 3)** and in the divisions of amelogenesis imperfecta **(figure 4).** As shown in this study, 78.43 % of the population were aware of enamel hypoplasia **(Figure 5)**. Following **(figure 6)** shows that 68.63 % of respondents were aware of hypomineralization enamel abnormalities, and 74.51% of respondents were aware that the DXS85 gene at XP22 is involved in amelogenesis imperfecta **(figure 7)**. In that same study, 73.53 % of the population were aware of mulberry molar teeth, whereas 17.65 % (screwdriver type incisors) and 8.82% (peg shaped) were unaware of the clinical presentation of mulberry molar teeth **(figure 8**)**.** Also, in this same study, 28.43 % of the population were aware about enamel hypoplasia affecting the formation of ameloblast **(figure 9)** and 76.47% of the population were aware about the clinical picture of enamel hypoplasia **(figure 10).** Finally, in this research, the Pearson chi-square test was used to determine the relationship between year of study and the number of respondents who were aware of genes involved in amelogenesis imperfecta , and the percentage was observed to be 41.18 percent of the first year students followed by 1.96% of second year , 18.63% of third and 9.80% of fourth year students were aware that DXS85 at XP22 is the gene involved in amelogenesis imperfecta and p value is 0.270 ($p > 0.05$) **(figure 11)** . The Pearson chi-square test was used to determine the relationship between year of study and the number of respondents who were aware that enamel hypoplasia is a quantitative defect, and percentage was observed to be 38.24 percent of first year students followed by 8.82 % of second year students, 19.61 % of third year students, and 9.80% of final year students were aware that enamel hypoplasia is a quantitative defect and p value is 0.458 ($p > 0.05$) **(figure 12)**, hence it is statistically insignificant and the Pearson chi-square test was used to determine the relationship between year of study and the number of respondents who were aware of enamel hypomineralization, and then the percentage was observed to be 43.14 percent of first year students followed by 2.94 % of second year students, 13.73 % of third year students, and 8.82 % of final year students were aware of enamel hypomineralization and the p value is 0.016 , ($p < 0.05$) hence it is statistically significant **(figure 13)** .

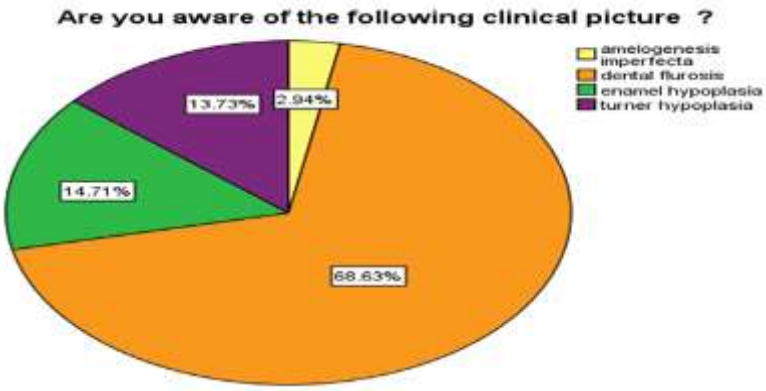

Figure 1 : The pie chart shows the students who were aware about the clinical picture of Dental fluorosis. Here yellow indicates amelogenesis imperfecta, orange indicates dental fluorosis, green indicates enamel hypoplasia and purple indicates turner's hypoplasia. Majority (68.63%) of the population were aware of clinical presentation of dental fluorosis whereas 14.71% (enamel hypoplasia) , 13.73% (turner hypoplasia) and 2.94% (amelogenesis imperfecta) were unaware about the clinical picture of Dental fluorosis.

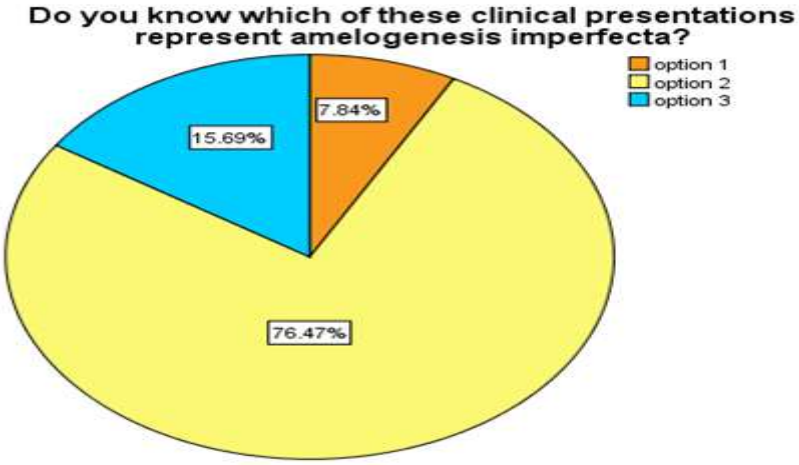

Figure 2. The pie chart shows students who were aware about the clinical picture of amelogenesis imperfecta. Majority (76.47%) of the participants were aware about clinical presentation of amelogenesis imperfecta whereas 15.69 % (dentinogenesis imperfecta) and 7.84% (dental fluorosis) were unaware of amelogenesis imperfecta.

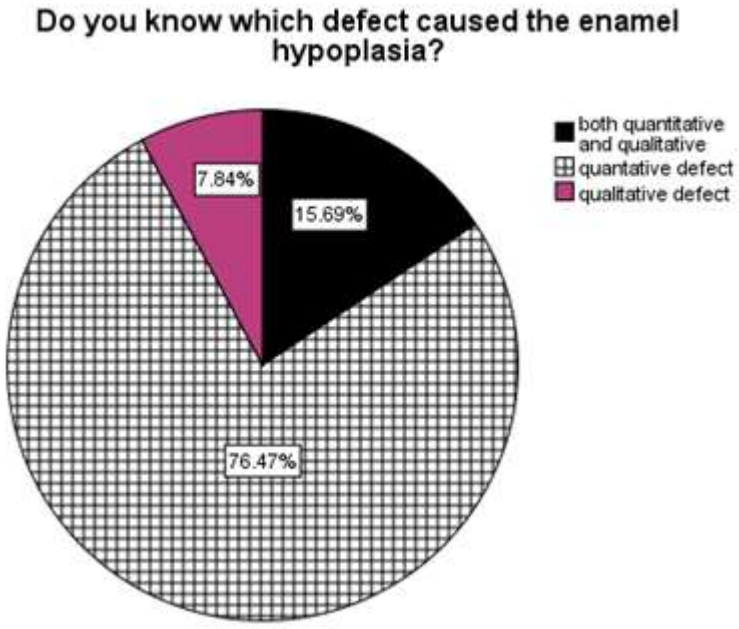

Figure 3 : The pie chart shows students who were aware that enamel hypoplasia is a quantitative defect. Here black indicates both quantitative and qualitative , white -patterned indicates quantitative defect , purple indicates qualitative defect. Majority (76.47%) of the population were aware that enamel hypoplasia is a quantitative defect whereas 7.84% (qualitative defect) and 15.69% (both quantitative and qualitative) were unaware that enamel hypoplasia is a quantitative defect .

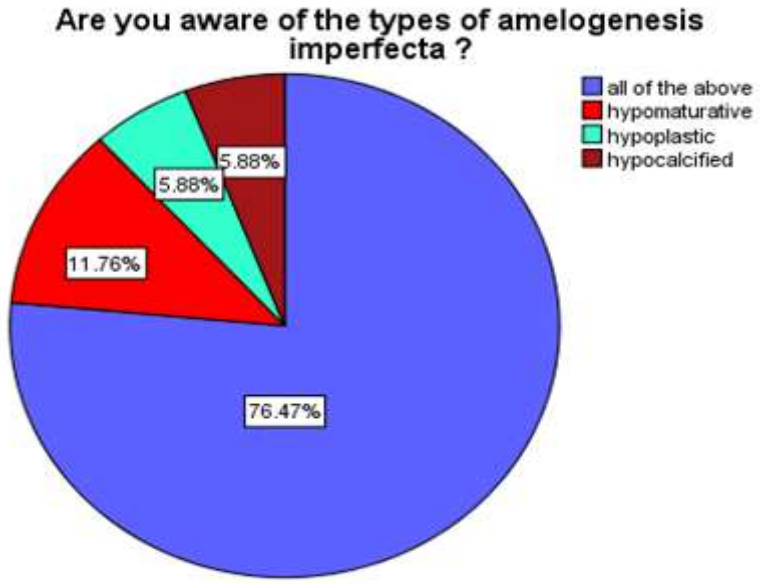

Figure 4 : The pie chart shows the percentage of response for types of amelogenesis imperfecta. Here blue indicates all of the above , red indicates hypomaturation, sea green indicates hypoplastic , brown indicates hypocalcified. Majority (76.47%) of the population were aware that amelogenesis imperfecta is divided into hypomaturation , hypoplastic and hypocalcified whereas 11.76%

(hypomaturation), 5.88% (hypoplastic and hypocalcified) were unaware about all the types of amelogenesis imperfecta.

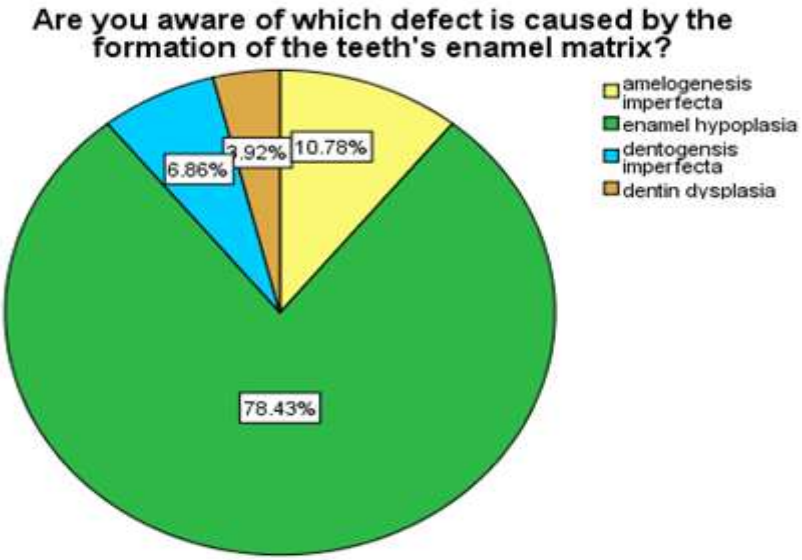

Figure 5: The pie chart shows students who were aware about enamel hypoplasia. Here yellow indicates amelogenesis imperfecta , green indicates enamel hypoplasia , sky blue indicates dentinogenesis imperfecta , sandal indicates dentin dysplasia. Majority (78.43%) of the population were aware of enamel hypoplasia whereas 6.86% (dentinogenesis imperfecta), 3.92% (dentin dysplasia) and 10.78% (amelogenesis imperfecta) were unaware of them.

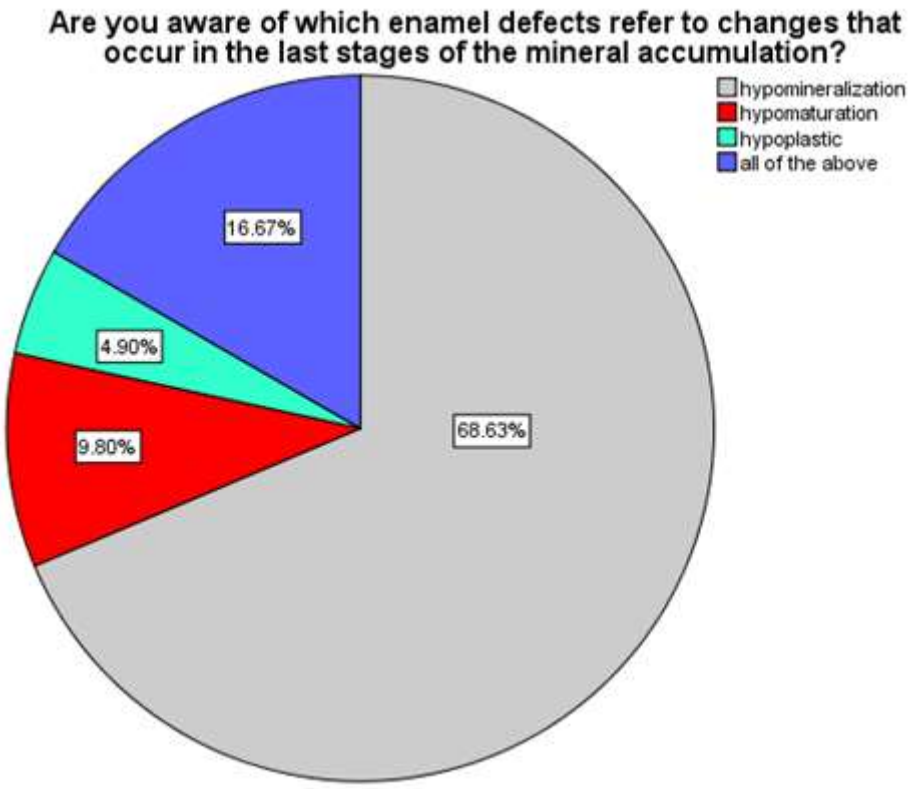

Figure 6: The pie chart shows students who were aware about hypomineralization of enamel. Here grey indicates hypomineralization, red indicates hypomaturation, sea green indicates hypoplastic , blue indicates all of the above. Majority (68.63%) of the population were aware of which enamel defect refers to the changes occurring in the last stages of the mineral accumulation whereas 9.80% (hypomaturation) 4.90% (hypoplastic) and 16.67% (all of the above) were unaware of them .

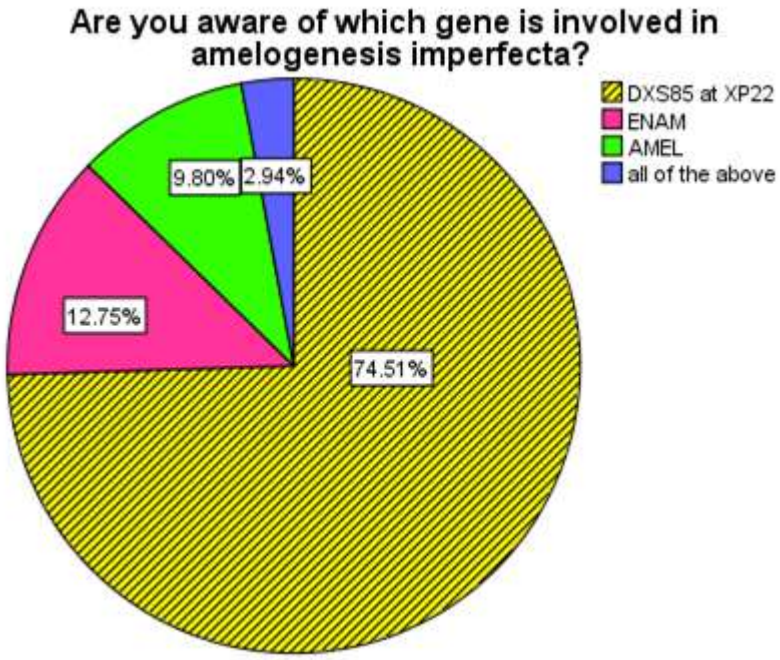

Figure7: The pie chart shows students who were aware of genes involved in amelogenesis imperfecta . Here, yellow -patterns indicate DXS85 at XP22 , pink indicates ENAM, light green indicates AMEL , blue indicates all of the above . Majority (74.51%) of the population were aware about the DXS85 at XP22 gene involved in amelogenesis imperfecta whereas 12.75% (ENAM) , 9.80% (AMEL) and 2.94% (all of the above) were unaware about the DXS85 at XP22 gene involved in amelogenesis imperfecta.

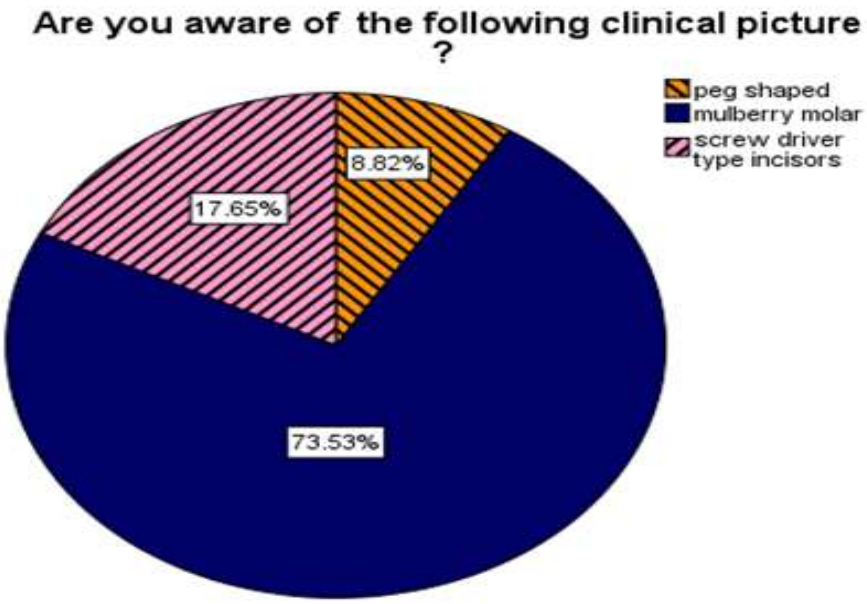

Figure 8: The pie chart shows students who were aware about the clinical picture of mulberry molar Here orange-patterns indicate peg shaped, navy blue indicates mulberry molar, pink patterned indicates screwdriver type incisors. Majority (73.53%) of the population were aware about clinical presentation of mulberry molar whereas 17.65% (screwdriver type incisors) and 8.82%(peg shaped) were unaware about clinical presentation of mulberry molar .

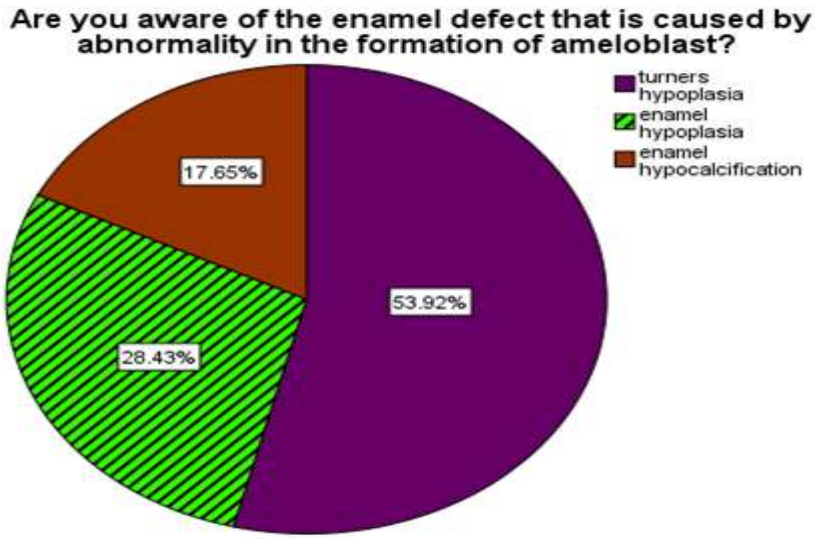

Figure 9: The pie chart shows students who were aware about enamel hypoplasia affecting formation of ameloblast. Here violet indicates turner's hypoplasia , green indicates enamel hypoplasia, brown indicates enamel hypocalcification .Majority (28.43%) of the population were aware about enamel hypoplasia affecting formation of ameloblast whereas 53.92% (Turner's hypoplasia) and 17.65% (enamel hypocalcification) were unaware of them .

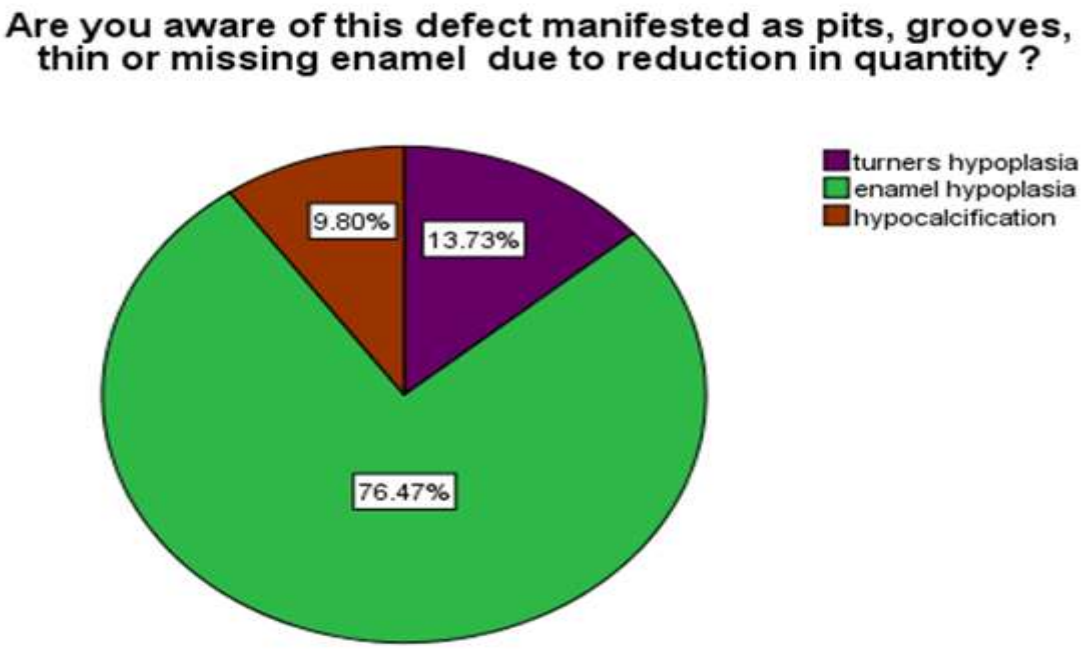

Figure 10 : The pie chart shows students who were aware about enamel hypoplasia which causes reduction in quantity , manifested as pits, grooves,thin or missing enamel. . Here violet indicates turner's hypoplasia , green indicates enamel hypoplasia, brown indicates enamel hypocalcification .Majority (76.47%) of the population were aware about enamel hypoplasia which causes reduction in quantity , manifested as pits, grooves,thin or missing enamel whereas 9.80% (enamel hypocalcification) and 13.73% (turner's hypoplasia) were unaware about them.

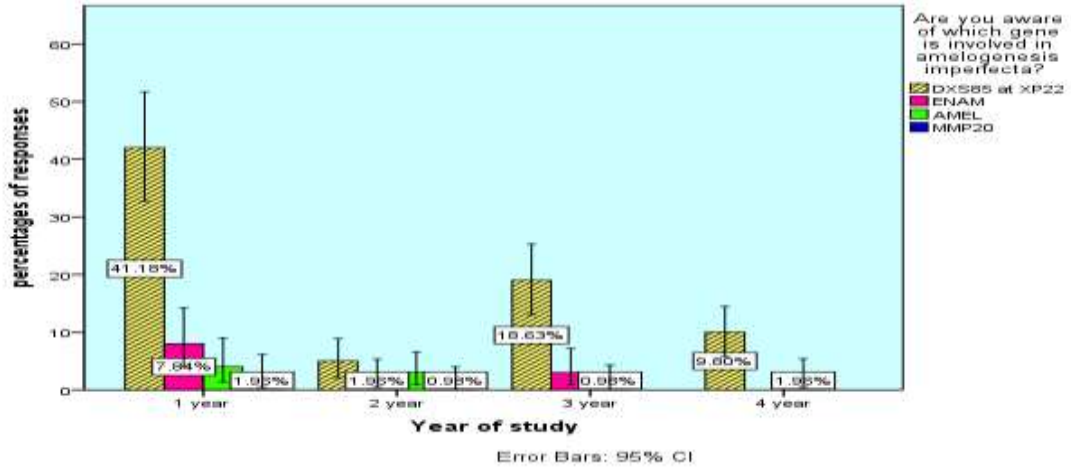

Figure 11 : The bar graph represents the association between year of study and who were aware of genes involved in amelogenesis imperfecta . X axis represents the age of the respondents and Y axis represents the percentage of the responses overall . Here, yellow -patterns indicate DXS85 at XP22 , pink indicates ENAM, light green indicates AMEL , blue indicates all of the above . Majority (41.18%) of the first year students were more aware about the DXS85 at XP22 gene involved in amelogenesis imperfecta than second (1.96%), third (18.63%) and fourth (9.80%) year students. Pearson chi - square test shows p value is 0.270 (p >0.05) . Hence it is statistically insignificant.

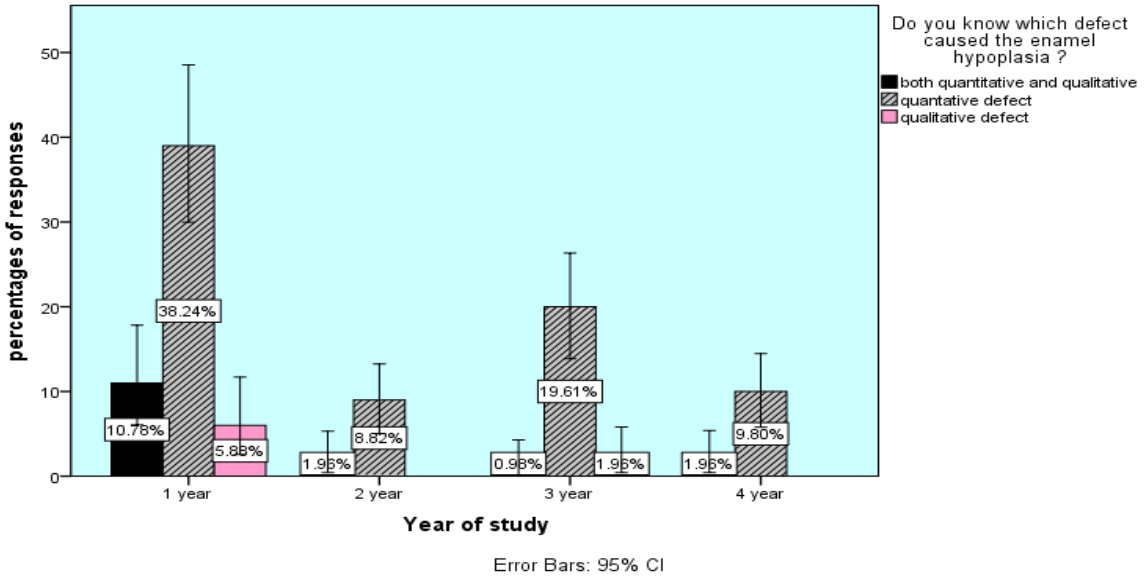

Figure 12 : The bar graph represents the association between year of study and the percentage of responses for the type of defect of enamel hypoplasia. X axis represents the age of the respondents and Y axis represents the percentage of the responses overall . Here black indicates both quantitative and qualitative , white-patterned indicates quantitative defect , purple indicates qualitative defect. Majority (38.24%) of the first year students were more aware that enamel hypoplasia is a quantitative defect than than second (8.82%), third (19.61%) and fourth (9.80%) year students Pearson chi - square test shows p value is 0.458 (p >0.05) . Hence it is statistically insignificant .

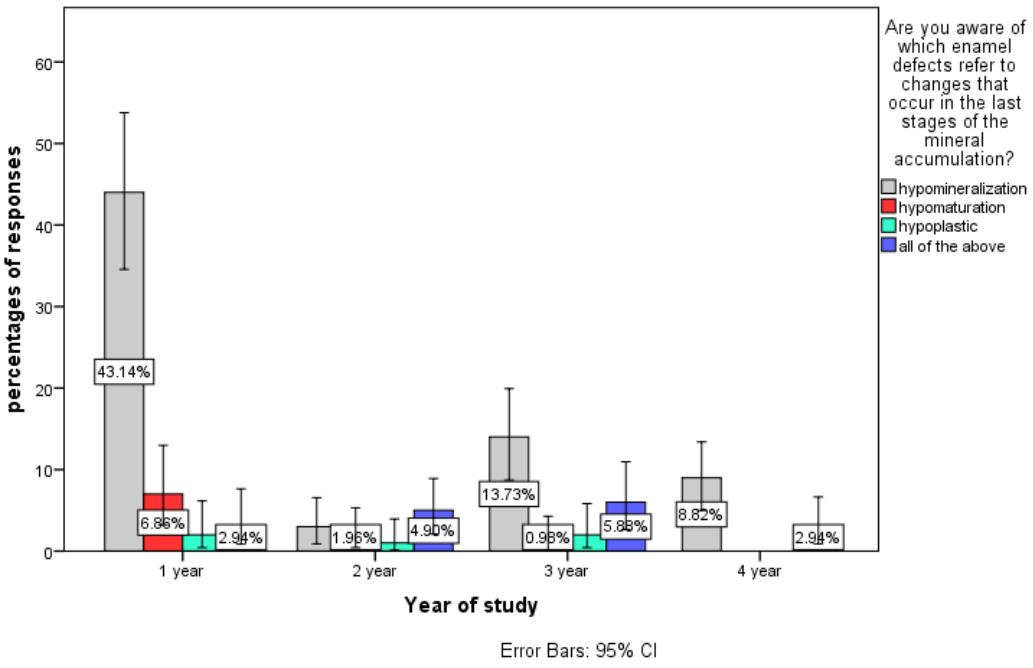

Figure 13: The bar graph represents the association between year and the percentage of responses for hypomineralization enamel. X axis represents the year of the respondents and Y axis represents the percentage of the responses. Here grey indicates hypomineralization, green indicates hypomaturation, sea green indicates hypoplastic , blue indicates all of the above . Majority (43.14%)

of the first year students were more aware of hypomineralization of enamel than second (2.94%), third (13.37%) and fourth (8.82%) year students . Pearson chi - square test shows p value is 0.016 , ($p < 0.05$), hence it is statistically significant .

DISCUSSION :

In our present survey, the majority of students' responses were from their first year (54.9 %), pursued by their second (10.78 %), third (22.55 %), and fourth year (11.75 %). This study found that 43.14% of first-year students were aware of enamel hypomineralization, followed by 2.94 % of second-year students, 13.73 % of third-year students, and 8.82 % of final-year students. As a result of the current study, it is evident that first-year students are more aware of enamel defects.

Amelogenesis imperfecta is a group of inherited disorders of enamel .Even it is transmitted in the family as a mendelian dominant trait which affects enamel of all the teeth , deciduous as well as permanent. Amelogenesis imperfecta can be clinically classified into hypoplastic, hypocalcified or hypo mature types depending on the stage of enamel formation that is affected by a genetic defect. Each main clinical group of AI may be further divided into several subgroups depending on mode of inheritance or clinical appearance of defective enamel. The prevalence of the rates varies approximately between 1.4:1000 and 1.1:6000 in different populations(25). Hypoplastic AI represents 60-73% of all cases , hypomaturation AI represents 20-40% and hypocalcification AI represents 7% (26). The hypomineralized and hypomaturation types are characterized by the presence of normal amounts of enamel matrix that is deficiently mineralized. DXS85 at XP22 is the gene involved in amelogenesis imperfecta(27) . In the present study, 76.46 % of the population have knowledge about amelogenesis imperfecta and 74.51% of the population are aware that the DXS85 at XP22 is the gene involved in amelogenesis imperfecta.

Enamel hypoplasia is a surface defect of the tooth crown that is caused by a disturbance of enamel matrix secretion , defective calcification ,or defective maturation (28). Even though enamel hypoplasia or hypomineralization may be caused by hereditary factors and environmental factors, many experimental and clinical studies have been conducted in an attempt to determine the cause and nature of environmental enamel hypoplasia (29). Enamel hypoplasia is impacted from both hereditary and environmental factors, which may include systemic factors such as nutritional factors , exanthematous diseases like measles ,chicken pox, hypocalcemia , birth injury , fluoride ingestion and local factors such as infection or trauma from deciduous tooth. Hypoplasia is a quantitative defect associated with reduced thickness of enamel (30) . In our study, 78.43 % of the population were aware about the pathogenesis of enamel hypoplasia. Even 76.47% of the population are more aware about the clinical picture of enamel hypoplasia and it is a quantitative defect. On the other hand, 28.43% of the participants were aware of ameloblasts getting affected in Enamel hypoplasia.

Excess fluoride intake causes multiple changes in the developing enamel, which is known as enamel fluorosis (31). Changes range from chalky white opaque areas resulting in subsurface hypomineralization to pits and grooves and with increased severity, post-eruption staining (32). Fluoride's effects on enamel formation imply that fluoride affects the enamel-forming cells, the ameloblasts. Although fluoride has different effects at different stages of enamel formation, it has the greatest effect when exposed through all stages of formation (33). An accurate diagnosis of fluorosis necessitates an examination of clean and dry dental surfaces under a good light source (34). In our

study 68.63% of the students were aware of clinical presentation of dental fluorosis. In the clinical presentation of dental fluorosis, there are four forms of dental fluorosis based on the severity of the fluorosis: very mild, mild, moderate, and severe. The four forms of dental fluorosis clinical appearance is characterized by, Very mild : small opaque paper -white areas scattered over the tooth surface (do not involve as much as 25% of the surface) , Mild : white opaque areas on the surface are more extensive (do not involve as much as 50% of the surface) Moderate : white opaque areas affect more than 50% of the enamel surface and Severe : all enamel surfaces are affected (presence of discrete or confluent pitting) (35). Therefore it is observed that the age group of 18 were more aware about the enamel defects. They also have adequate knowledge and information about the developmental enamel defects. One of the limitations included in this survey was it was conducted among only 100 participants and a simple random sampling method was used to select the participants. Hence the same study has to be conducted with more participants as study was conducted on a small number of participants. In the future, such research should be conducted on a larger number of people; the results may be accurate, and new findings may be discovered.

CONCLUSION :

Although the clinical significance of enamel defects is well understood, the pathogenesis of the defects is still under investigation. Furthermore, enamel defects are currently managed by treating the symptoms, future research should focus on the development of appropriate techniques and aesthetic restorative materials that can bond effectively to enamel defects. It is important for the students to know about enamel defects for the proper diagnosis and appropriate treatment . This study concludes that first year students have adequate knowledge regarding enamel defects.

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CONFLICTS OF INTEREST:

The authors declare that there are no conflicts of interest in the present study

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