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Evaluation of Oral Health Status Based on Oral Hygiene Practices in Children-A Retrospective Study

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ABSTRACT

Good oral hygiene practices are recommended by the dentist to prevent oral diseases such as dental caries and periodontal diseases. Brushing twice daily with fluoridated toothpaste is the primary preventive method to maintain good oral hygiene and found to be the most effective hygiene practice. A retrospective study was conducted to assess the association between oral hygiene and the frequency of tooth brushing among children visiting a dental hospital. 531 participants between 7-12 years of age were selected randomly for this study. Data variables including socio-demographic data such as age and gender, oral hygiene practices including frequency of brushing and type of toothpaste used were recorded. Oral hygiene index-simplified (OHI-S) were also recorded. All the data were analyzed using the Chi-Square test. The study revealed that those who brushed twice daily had a lower OHI-S score which was statistically significant with $p<0.05$. A statistically significant difference was found between the type of toothpaste and OHI-S score with $p<0.05$. The children who brushed using fluoridated toothpaste had lower OHI-S scores. There was also a statistically significant difference between gender and frequency of brushing with $p<0.05$ in which females had good oral hygiene practice compared to males. Thus, it can be concluded that there was a significant association between oral hygiene and the frequency of tooth brushing. Brushing twice daily with fluoridated toothpaste is proven to improve oral health.

Keywords: Calculus score; Debris score; Duration; Frequency of toothbrushing; Fluoridated toothpaste; Oral hygiene.

INTRODUCTION

The oral cavity has been described as the window to general health which means there is an association between oral health and general health [(Alpert, 2017)]. Through maintaining a good oral hygiene practice, many oral diseases can be prevented. The most common oral diseases are dental caries and periodontal diseases [(Bodur, Yücesoy and Baloş, 2004; Gökalp*et al.*, 2007)]. Many studies had reported a high prevalence of dental caries in children [(Bodur, Yücesoy and Baloş, 2004; Gökalp*et al.*, 2007; Yildirim *et al.*, 2011)]. Poor oral hygiene habits may result in the progression of periodontal diseases due to plaque accumulation which initially causes gingival inflammation [(Sayegh *et al.*, 2005; Okolo *et al.*, 2006)]. If worsened, it may lead to a periodontal breakdown.

Good oral hygiene practices should be implemented from childhood and are recommended by the dentists for preventing oral diseases [(Blinkhorn*et al.*, 2003)]. Brushing twice daily with fluoridated toothpaste is important in preventing dental caries [(Gibson and Williams, 1999; Walsh *et al.*, 2010)]. Besides that, other oral hygiene practices are flossing, applying fluorides, minimal consumption of sweets and sugary foods, regular dental visits to the dentist and preventive dental procedures such as pit and fissure sealants [(Ewles and Simnett, 1985; Christabel and Gurunathan, 2015; Packiri, Gurunathan and Selvarasu, 2017)]. Adding fluorides

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in drinking water is also recommended by the World Health Organization in order to prevent dental caries [(Somasundaram *et al.*, 2015; Mahesh R, 2018)]. In children, tooth brushing should be started when the first primary tooth erupts with a smear size amount of toothpaste for children less than 3 years and a pea-size amount of toothpaste for children more than 3 years to improve the benefits of fluoride [(Creeth, Bosma and Govier, 2013)].

A study reported that children's oral health behavior was influenced by parents and family members [(Fisher-Owens *et al.*, 2007)]. In a study done by Trubey et al, habituation is an important factor that influences regular tooth brushing twice a day [(Trubey, Moore and Chestnutt, 2015)]. The parents should not miss brushing their children's teeth to ensure that the daily routines are stable from day to day. In a study done by David Avenetti et al, most children brushed at least once daily with toothpaste and very less brushed twice daily [(Avenetti*et al.*, 2020)].

Knowledge of oral health is important as it will increase the awareness of oral health and better oral hygiene practices [(Doğru*et al.*, 2012; Govindaraju, Jeevanandan and E. M. G. Subramanian, 2017a, 2017b; Jeevanandan, 2017)]. Parents should play an important role by showing good oral hygiene practice and educate their children about the importance of tooth brushing. It is parents' responsibility to ensure their children receive the necessary health related necessities [(Gurunathan and Shanmugaavel, 2016)]. Early childhood caries is a significant public health problem as it may impact the quality of life of young children [(Govindaraju, Jeevanandan and E. Subramanian, 2017; Jeevanandan and Govindaraju, 2018; Subramanyam *et al.*, 2018; Panchal *et al.*, 2019)]. Parents should receive education regarding this matter to reduce the risk of oral disease [(Ravikumar, Jeevanandan and Subramanian, 2017; Nair *et al.*, 2018)]. Furthermore, the first dental visit should be done months after the first tooth erupts. As there are fewer studies about oral hygiene in the Chennai population,

Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Subramanyam *et al.*, 2018)('Fluoride, fluoridated toothpaste efficacy and its safety in children - review', 2018; Ezhilarasan, 2018; Felicita, 2018; Kavarthapu and Thamaraiselvan, 2018; Krishnan *et al.*, 2018; Marimuthu*et al.*, 2018; Nair *et al.*, 2018; Padavala and Sukumaran, 2018; Pandian, Krishnan and Kumar, 2018; Rajeshkumar*et al.*, 2018; Rao and Kumar, 2018; VijayashreePriyadharsini, SmilineGirija and Paramasivam, 2018; Abhinav *et al.*, 2019; Ke*et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Ponnulakshmi*et al.*, 2019; Ramesh *et al.*, 2019; Sridharan *et al.*, 2019; Sweta, Abhinav and Ramesh, 2019; Wu *et al.*, 2019; Palati*et al.*, 2020; Paramasivam, VijayashreePriyadharsini and Raghunandhakumar, 2020).

this study was aimed to assess the association between oral health and frequency of tooth brushing among children in the Chennai population.

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MATERIALS AND METHODS

A retrospective study was conducted involving pediatrics patients visiting a dental hospital from July 2019 till March 2020. Ethical approval for this study was granted by the Institutional Ethics Committee with the following ethical approval number SDC/SIHEC/2020/DIASDATA/0619-0320. Written consent forms were obtained from the parents of all children.

Patients' case sheets were reviewed and analyzed. Patients who visited a dental hospital for the first time were included and children with special needs were excluded in the study. 531 participants irrespective of genders between 7 to 12 years were selected. To minimize bias, the data was verified by the second reviewer and cross-verification was done by contacting the parents.

Data variables including sociodemographic such as age and gender, oral hygiene practices such as frequency of brushing and type of toothpaste used were recorded. Oral hygiene status was assessed using oral hygiene index-simplified (OHI-S) of John C. Greene and Jack R. Vermillion. The interpretation of the OHI-S score was good (0-1.2), fair (1.3-3.0) and poor (3.0-6.0).

Data were analyzed using Statistical Package for Social Sciences SPSS Version 20. A Chi-Square test was used to determine the association and significant difference between the variables. P-value of less than 0.05 was considered significant.

RESULTS

A total of 531 participants out of which males (54.8%) and females (45.2%) between 7 to 12 year old children were shown in Graph 1. Based on Graph 2, the age was divided into 7 years (17.1%), 8 years (15.1%), 9 years (17.7%), 10 years (16.2%), 11 years (18.1%) and 12 years (15.8%).

Table 1 shows the association of gender with frequency of toothbrushing and OHIS-S score. In the present study, an increased frequency of brushing was seen in females as 53.4% brushed twice daily compared to males with 46.6% as shown in Graph 3. Meanwhile, 64.9% of males brushed only once daily compared to females with 35.1%. There was a statistically significant difference between gender and frequency of brushing ($p<0.05$). Present study revealed that there was a statistically significant difference between gender and OHI-S score ($p<0.05$). Good OHI-S score was higher in females (51%) than males (49%) as shown in Graph 4. Fair (78.6%) and poor (100%) OHI-S scores were higher in males than females.

Table 2 shows the association of OHI-S score with frequency of toothbrushing and toothpaste used. There was a statistically significant difference between the frequency of brushing and OHI-S score ($p<0.05$). Good OHI-S score was higher in those who brushed twice daily (64.3%) than once daily (35.7%) as shown in Graph 5. Meanwhile, fair OHI-S was higher in those who

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brushed once daily (85.7%) than twice daily (14.3%). An equal number of poor OHI-S scores was seen in those who brushed once daily and twice daily.

Present study also revealed that there was a statistically significant difference between the type of toothpaste used with the OHI-S score ($p<0.05$). The type of toothpaste was classified into fluoridated and non-fluoridated toothpaste as shown in Graph 6. Good (75.8%) and fair (53.1%) OHI-S scores were greater in those who used fluoridated toothpaste compared to non-fluoridated toothpaste. Poor (75%) OHI-S score was higher in those who used non-fluoridated toothpaste than fluoridated toothpaste.

DISCUSSION

This study provided information on oral health status based on oral hygiene simplified index (OHI-S). Previously, most of the studies used DMFT/DMFS and community periodontal index (CPI) to assess the oral health status [(Cheng *et al.*, 2014; Akhionbare and Ojehanon, 2016; Koyuncuoglu*et al.*, 2017)].

In this present study, a greater number of participants brushed twice daily (55%) when compared to those who brushed once daily (45%). A previous study reported that 50% of the children brushed twice daily and 40.6% brushed once daily [(Avenetti*et al.*, 2020)]. Another study reported that 58.3% of the participants brushed twice daily [(Akhionbare and Ojehanon, 2016)]. Meanwhile, in a study done by Zohoori et al, they were comparing a high socio-economic (HSE) with low socio-economic (LSE) status which revealed that 66% of LSE and 74% of HSE brushed twice daily and 34% of LSE and 26% of HSE brushed once daily [(Zohoori*et al.*, 2012)]. Studies that reported a higher proportion of those who brushed twice daily may be influenced by the location and socioeconomic status, which suggests that there is a high possibility that they have access to educational institutions to receive treatment and information regarding oral health [(Sofola, Shaba and Jeboda, 2003; Villalobos- Rodelo and Medina- Solís, 2007).

The results of this study also revealed that females had a higher number of those who brushed twice daily compared to males which were statistically significant. This was similar to a few studies which reported that females had an increase of brushing frequency than males [(Taani, al-Wahadni and al-Omari, 2003; Maes*et al.*, 2006; Al-Shammari*et al.*, 2007; Villalobos- Rodelo and Medina- Solís, 2007; Vallejos-Sánchez *et al.*, 2008; del Socorro Herrera *et al.*, 2009)]. However, a few studies also reported that males had a higher brushing frequency than females [(Almas, Albaker and Felembam, 2000; Akhionbare and Ojehanon, 2016)]. In contrast, in a study done by Casanova, there was no statistically significant difference between the frequency of brushing and gender [(Casanova-Rosado *et al.*, 2013)].

In the present study, good OHI-S score was higher in females as they had increased in frequency of toothbrushing which was statistically significant. This may be because girls received messages

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well in terms of oral health compared to boys [(Casanova-Rosado *et al.*, 2014)]. Nevertheless, a study reported that there was no significant difference between genders when it comes to oral health status as most of them should have adequate knowledge regarding oral health if they have the same educational level [(Quadri*et al.*, 2018)].

In the present study, good OHI-S score was higher in those who brushed twice daily and higher numbers of fair and poor OHI-S scores were seen in those who brushed once daily. In comparison to the other study, those who brushed irregularly were more prevalent for plaque accumulation and dental caries than those who brushed once or twice daily [(Quadri*et al.*, 2018)]. Meanwhile, in a study done by Chestnutt et al, an increase in the frequency of brushing will reduce the risk of dental caries [(Chestnutt*et al.*, 1998)]. As recommended by the dentist, brushing twice daily will reduce the risk of oral diseases [(Blinkhorn*et al.*, 2003)]. Besides that, the effectiveness of various brushing techniques also influences oral health status. The modified bass technique was found to be most effective followed by horizontal scrub and fones techniques for children [(Patil, Patil and Kashetty, 2014)].Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; VijayashreePriyadharsini, SmilineGirija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramaduraiet *al.*, 2019; Sridharan *et al.*, 2019; VijayashreePriyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

The results of this study revealed that 69% of the participants used fluoridated toothpaste and 31.5% used non-fluoridated toothpaste. Similarly, in the other study, there was a comparable percentage of those who used fluoridated toothpaste [(Lalithambigai*et al.*, 2019; Avenetti*et al.*, 2020)]. Those who used fluoridated toothpaste may get recommendations while visiting the dentists. Toothpaste generally consists of abrasive (aluminium hydroxide, calcium carbonate), fluoride (sodium fluoride, stannous fluoride), surfactant (sodium lauryl sulphate), antibacterial agents (triclosan, zinc chloride). Humectants (glycerol, xylitol), anti-sensitivity agent (strontium chloride, arginine) and anti calculus agent (polyphosphate, zinc citrate) [(Cury and Tenuta, 2014)]. The active ingredients tetrasodium pyrophosphate, Disodium pyrophosphate and Sodium hexametaphosphate present in the fluoridated toothpaste are responsible for the prevention of plaque. Hence in our study maximum children had good oral hygiene scores who used fluoridated toothpaste. Another study reported that 58% of the participants used non-fluoridated toothpaste in children [(Franzman*et al.*, 2004)]. They may not be aware of the importance of fluoride toothpaste in children. Therefore, it is important to create awareness among parents regarding the importance of oral hygiene maintenance since childhood. The invention of newer brushing devices can help to motivate the children in maintaining good oral hygiene [(Govindaraju and Gurunathan, 2017)]. The limitations of the study includes smaller sample size,hence extensive research is required considering the timing of brushing and method of brushing.

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CONCLUSION

Within the limitations of the study, it can be concluded that there was a strong association between oral hygiene and the frequency of brushing. Good oral hygiene maintenance was seen among females with increased brushing frequency and lower OHI-S score compared to males. Therefore, emphasis on the importance of twice daily brushing with a correct method along with the usage of fluoridated toothpaste is recommended to improve oral hygiene. Besides that, oral health promotions such as school health programs, preventive programs should be taken up for educating and creating awareness regarding oral hygiene maintenance.

AUTHOR CONTRIBUTIONS

All authors have equal contribution in bringing out the research work

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Nil

CONFLICT OF INTEREST

Nil

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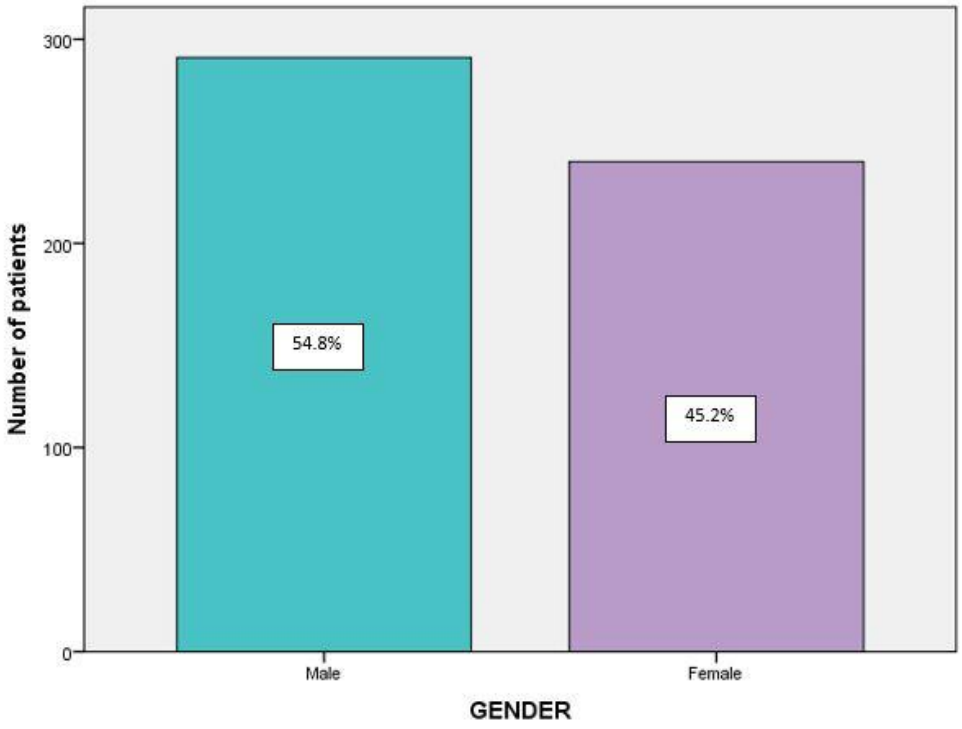
FIGURE AND TABLES



Graph 1: Bar graph represents the frequency distribution of gender. X-axis represents the gender and Y-axis represents the number of patients (blue-male and purple-female). In the study population, males (54.8%) were higher than females (45.2%).

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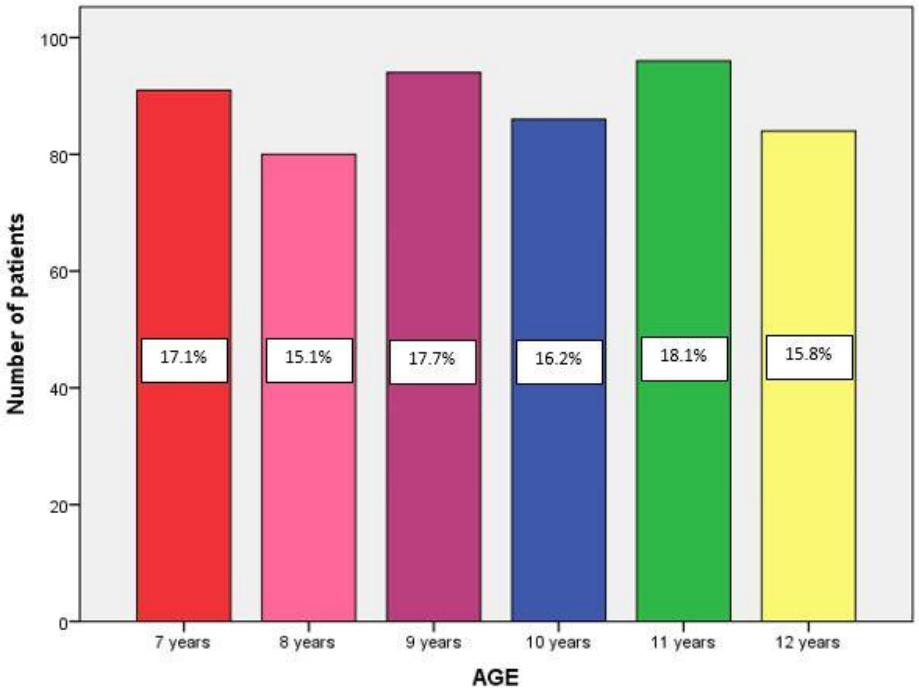

Graph 2: Bar chart represents the frequency distribution of gender. X-axis represents the age and Y-axis represents the number of patients (red-7 years, pink-8 years, purple-9 years, blue-10 years, green-11 years and yellow-12 years). 11 years (18.1%) were the highest compared to other age groups.

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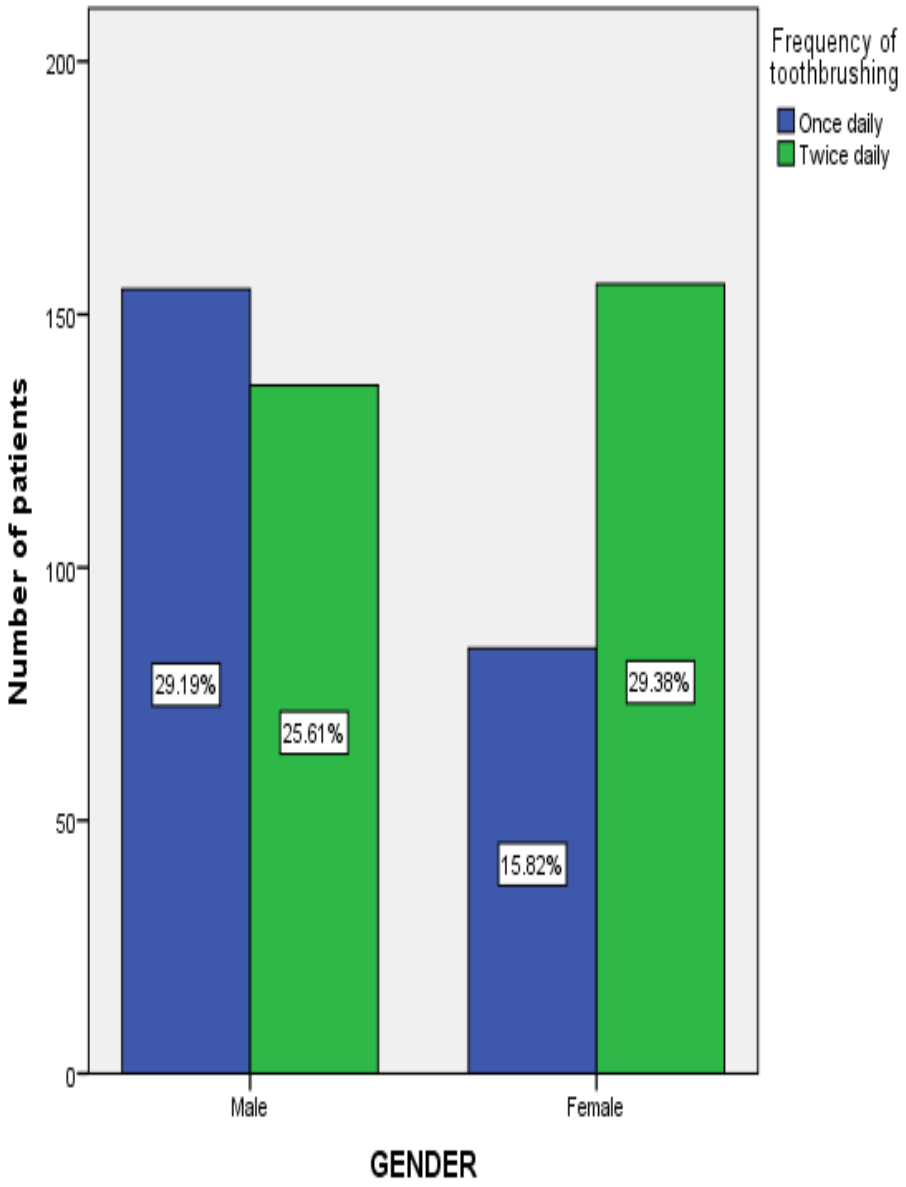

Graph 3: The bar chart depicting the association of gender with the frequency of toothbrushing. X-axis represents the gender and Y-axis represents the number of patients based on frequency of toothbrushing (blue - once daily and green - twice daily). Chi-square test shows that there is a significant association between gender and frequency of toothbrushing, $p=0.000$ ($p<0.05$) which denotes statistically significant. There is a significant increase in the frequency of toothbrushing in females (29.38%) compared to males.

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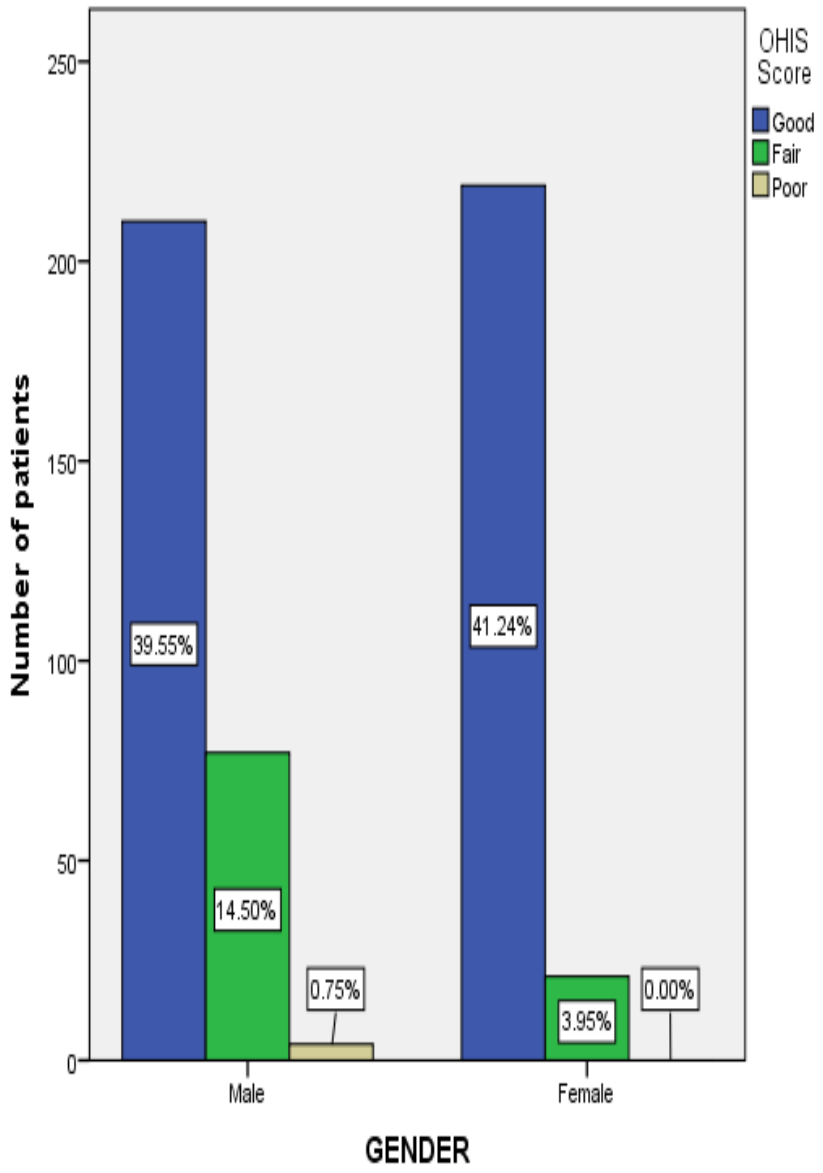

raph 4: The bar chart depicting the association of gender with the OHI-S score. X-axis represents the gender and Y-axis represents the number of patients based on OHI-S score (blue - good, green - fair and light yellow - poor). Chi-square test shows that there is a significant association between gender and OHI-S score, $p=0.000$ ($p<0.05$) which denotes statistically significant. There was an increase in OHI-S score in males (0.75% poor score) compared to females.

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Table 1 shows the association of gender with frequency of toothbrushing and OHIS scores.(*statistically significant)

					Statistical Value	
		%)	(%)		Chi-Square	
ency of hing	y	%)	%)			
	ily	%)	%)			
ore		%)	%)			
		%)	%)			

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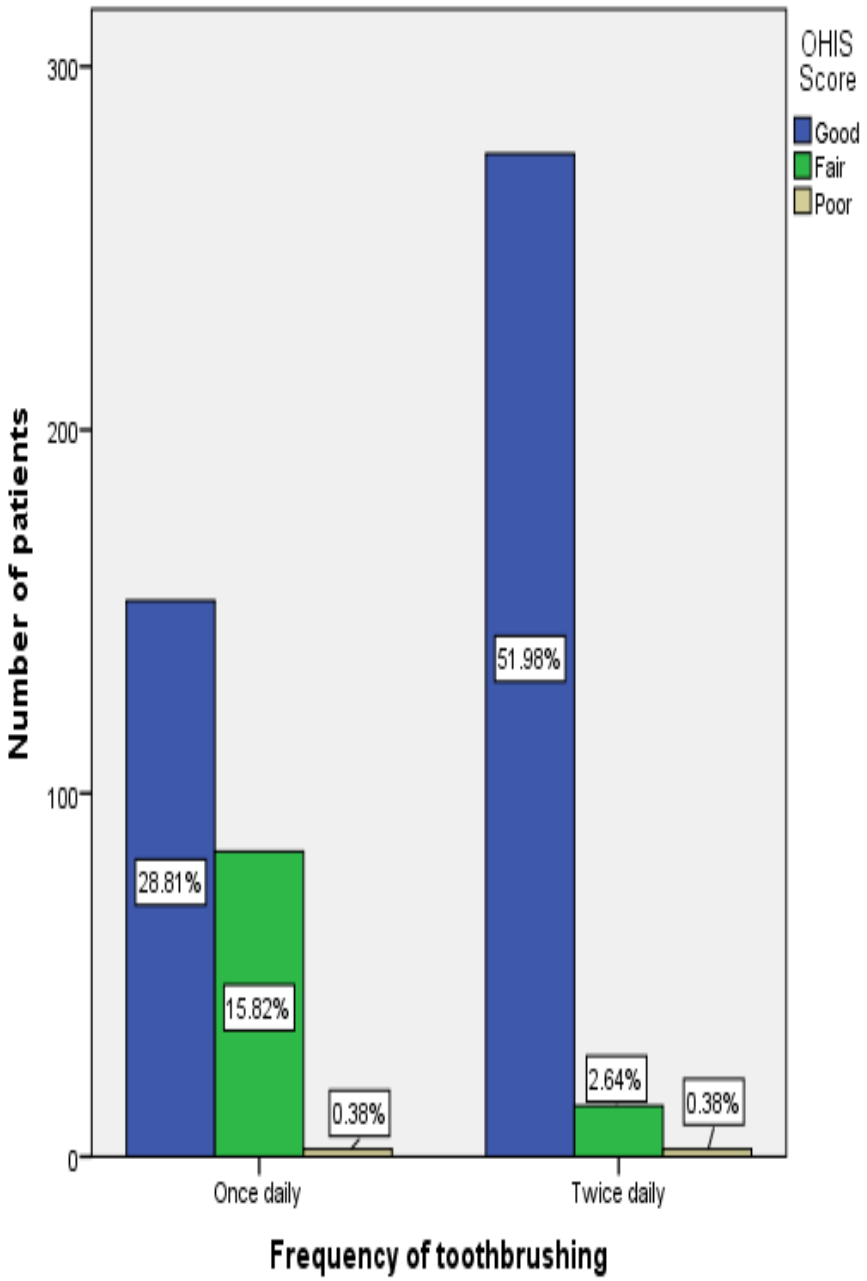

Graph 5: The bar chart depicting the association of frequency of toothbrushing with OHI-S score. X-axis represents the frequency of toothbrushing and Y-axis represents the number of patients based on OHI-S score (blue - good, green - fair and light yellow - poor). Chi-square test shows that there is a significant association between frequency of toothbrushing and OHI-S score, $p=0.000$ ($p<0.05$) which denotes statistically significant. There was a decrease in OHI-S score (51.9% good score) as frequency of toothbrushing increased.

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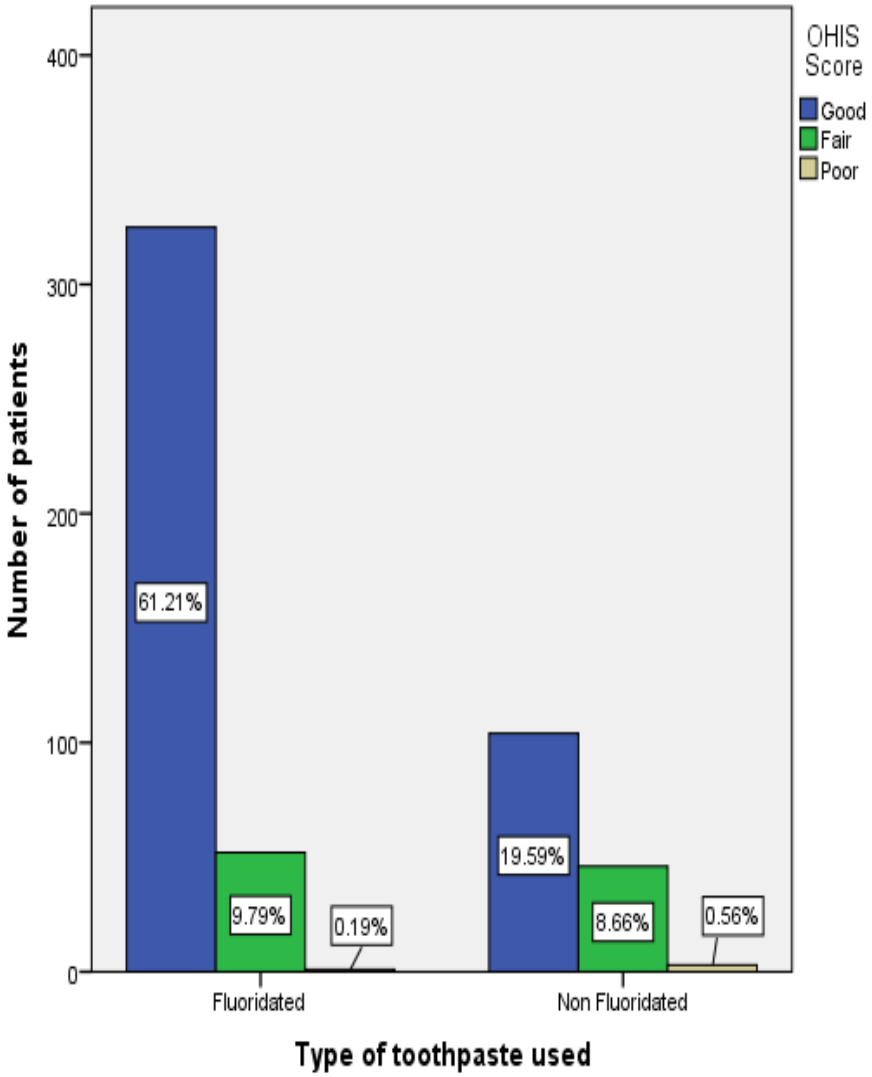

Graph 6: The bar chart depicting the association of type of toothpaste used with OHI-S score. X-axis represents the type of toothpaste used and Y-axis represents the number of patients based on OHI-S score (blue - good, green - fair and light yellow - poor). Chi-square test shows that there is a significant association between gender and OHI-S score, $p=0.000$ ($p<0.05$) which denotes statistically significant. There was a decrease in OHI-S score (61.21% good score) when using fluoridated toothpaste compared to non fluoridated toothpaste.

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Table 2 shows the association of OHIS score with frequency of toothbrushing and toothpaste used.

		ore				Statistical Value	
		od N (%)	)	%)		Chi-Square	
y of hing	y	%)	)				
	ily	%)	)				
te used	ed	%)	)				
	Non d	%)	)				