Deepak T.A. and Avinash Tejasvi M. L. (2023) Int. J. Appl. Sci. Biotechnol. Vol 11(4): 209-216.
DOI: 10.3126/ijasbt.v11i4.61163

ISSN (Online): 2091-2609
DOI Prefix: 10.3126/ijasbt

International Journal of Applied Sciences and Biotechnology (IJASBT)

Research Article

Correlation Between Teeth Alignment and Oral Diseases in New India

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Article Information

Received: 15 November 2023
Revised version received: 15 December 2023
Accepted: 18 December 2023
Published: 29 December 2023

Cite this article as:
Deepak T.A. and Avinash Tejasvi M. (2023) Int. J. Appl. Sci. Biotechnol. Vol 11(4): 209-216.
DOI: 10.3126/ijasbt.v11i4.61163

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Peer reviewed under authority of IJASBT

Keywords: Hygiene; cavities; pollinosis

Abstract

Systemic Health goes together with oral health. In India, Oral health remains a big challenge. It is connected tightly to overall individual's health. Basic oral hygiene such as brushing teeth twice a day is still foreign to most, while such practices are widely practiced in the west. In India, economic factors, coupled with normally accepted behavior and acceptance of poor oral hygiene, prevention of awareness contributed to vast populace with dental issues, like cavities, gum diseases, premature teeth loss, and oral cancers in some cases. With almost 60% of 1.4 billion living in rural areas, initiatives like oral hygiene awareness, preventative care, lifestyle changes and increased dental facilities including universities, colleges and dental care facilities are needed today.

We investigate whether there is an association between awareness of teeth alignment, good oral health to overall systemic health. We developed a questionnaire for dental patients falling between the age of 13 - 21 years. This range was selected as most of the patients are old enough to know their oral habits, and other health issues. The patient's data was collected over a range of 8 months (April 2023 to November 2023) between two states in southern India. The research had 191 patients who were from rural areas, and their awareness on oral hygiene activities were found to be far worse than their urban counterparts (both genders). Based on the data collected, we establish a close relationship between awareness of teeth alignment, to gum bleeding, caries, and pollinosis in young Indians.

Introduction

Oral health is often forgotten as being part of the overall 'well-being' of an individual. More so, in India and south Asia in general. The word, "well-being", means the state of mind, physical, social well-being, or lifestyle in totality (Johnson *et al*., 2006). A good oral health leads to good dental functionality and plays a vital role in the aesthetic part of an individual. A poor oral health on the other hand would result in diminished confidence, shyness, and a conscious awareness that certain activity is not well looked upon by others when an individual exercises it. E.g., Smiling with crooked teeth. Hence oral health plays a key role in both functional and social lifestyle.

Poor oral health is said to be the reason for increased risk of endocarditis and digestive problems in senior people. However, such inflammation and bacteria induced digestive problems are easily cured by medication today. Poor oral health is linked to pneumonia, strokes, brain haemorrhage and other diseases today (Nazir, 2017). (Nazir, 2017) has established that there are many risk factors for this periodontitis, they are smoking, poor oral hygiene,

hormonal changes in women, stress, hereditary, and medication. The direct correlation between cardiovascular diseases such as diabetes, respiratory diseases, preterm birth, kidney diseases, cancers, rheumatoid arthritis, stroke, coronary heart diseases, to oral infections has been reported and substantiated today with widely published articles (Nazir 2017; Meurman *et al*., 2004). Poor oral health does contribute to above diseases through microorganisms' bacteria formation and development in the endothelium, contributing to the above cardiovascular complications. There is a strong correlation of oral health to preterm birth, development of gestational diabetes, high blood pressure resulting in smaller gestational birth leading to further complications to the baby and mother. One of the interesting finds, is that maternal oral flora is transmitted to the child and this increased cariogenic flora in the mother increases the chances of the child to develop oral cavities much quicker according to (Boggess and Edelstein, 2006).

It is said that substantial number of diseases could be diagnosed by oral signs and its symptoms. These are oral cancers, osteoporosis, HIV, caries, residing jaws, and other endocrine anomalies. While HIV and oral cancers are not seen in great numbers in the age group between 13 - 21. This group oral problems are in some way correlated to school absentees, poor concentration, poor academic performance, leading to school dropouts (Rowan-Legg, 2013). Studies have found that poor oral health has some devastating effects on the children in this group.

These include poor health and growth, behaviour problems, sustained aggression, and other psychological problems (Boggess and Edelstein, 2006). Rowan-Legg reported that oral health affects the development of communication skills, and socialization, leading to low self-esteem. In India, the prevalence of cigarette smoking, betel leaf chewing, and today's new fad called 'Vaping', presents a unique yet major challenge to move a population of 1.4 billion into an oral hygiene and its best practices. In the age group this paper concentrates, clefts, receding jaws, malocclusion, legions (benign and malignant), poor diagnosis and poorly fitted dentures to overcome malocclusion are impairing the oral and overall health of the individual. These newfound challenges on the part of the patient, lead to poor chewing, snoring, predisposed gum diseases, tooth decay and premature caries. All these lead to anxiety, stress, embarrassment, and withdrawal hampering overall development of the youngster. In our research, we saw that even with dentures to correct malocclusion, the side effects on the behaviour, academic, confidence in taking up new challenges and self-esteem drops considerably, more so in females than in boys (Gil-Montoya *et al*., 2015).

Prevention of Oral Diseases

World health organization (WHO) recommends an integrated preventative strategies to prevent oral diseases depending on the risks factors that pose to an individual (Petersen and Ogawa, 2005). We have already mentioned the risk factors Indians face, like betel leaf chewing, smoking, vaping, economic factors coupled with lack of awareness. These risk factors come along with preexisting chronic health issues like Asthma, diabetes, high blood pressure (Bp), Pneumonia and others. Hence, WHO recommends that oral preventative measures be included in the preventative strategies of chronic diseases one is facing, to not burden the individual with any additional initiatives which would drive him / her away from the preventative measures already in place (Petersen and Ogawa, 2005).

Proper Brushing and Flossing

Proper brushing with the right material, equipment and discipline would solve majority of the oral diseases in India. India poses a paradoxical problem, as some still believe a neem plant branch chewing would solve majority of the oral diseases (Paul *et al*., 2014). This ignorance coupled with the economic factors are first line of challenge for an oral disease's reduction in India. Mouth cleaning, brushing with the right equipment and flossing would do wonders. With Indian government push lately, still half of the population still goes to sleep without brushing (Bhardwaj, 2014). Toothbrushes of different variety, manual brush and electronic brushes are available in India (Bhardwaj, 2014). Electrical or electronic brushes have demonstrated that they are efficient in reducing plaque (Bhardwaj, 2014).

Diet and Snacking

Diet plays an important role in preventing oral diseases. Poor diet leads to oral diseases and its rapid progression leading to other chronic diseases (Moynihan, 2005a). A good diet is very important for the growth and maintenance of good teeth, good teeth and oral cavity is very much essential for the consumption of varied healthy diet for the overall health (Moynihan, 2005b). This inter relationship importance cannot be stressed enough. In India, which is a land of cultural diversity, diet changes from one region to other. There is one study (Kavitha, 2020) which showed the importance of proper diet and found that there is not much difference in the prevalence of cavities based on one's dietary choice: Vegetarian or Mixed. On the other hand, Vitamin C deficiency to oral diseases has been found (Nishida *et al*., 2000). In their study sample of around 12000 patients, the research found that a healthy diet of vegetables, fruits, low fat, and sugar would prevent any oral diseases keeping the gum, teeth, and tissues in a healthy state. They also found out that a diet with low Vitamin C and E would lead to progressive plague build up, and limited response of the immune system to fight these bacteria (Nishida *et al*., 2000). Snacking between meals in another problem in modern India. With the advent of packaged food in abundance now, snacking is a common thing. Most resort to fried items and sodas, leading to the high calorie, high sugar

diet, causing inflammation and tissue damage (Branch-Mays *et al*., 2008).

Stannous Fluoride

Stannous fluoride is classified as a medication belonging to the group called cariostatic and antibacterial agents. Its main role is to give strength to the teeth and reducing the effects of acids and other bacteria on the oral cavities. It prevents mineralization around the teeth which lead to bacterial formation like gingivitis. Authors in (He at al., 2012), conducted a study to investigate the role of stannous fluoride in reducing gum inflammation, plaque buildup and gingivitis. The study established that Stannous fluoride does have good effects in the overall teeth maintenance and reduction of gingivitis and plague build up.

Effects of Antimicrobial agents in Toothpastes and Gels

Chlorhexidine, triclosan, oils, zinc in toothbrushes and toothpaste are generally used to control oral diseases like gingivitis and plaque build-up (Axelsson, 1993). Authors in (Puig et. al., 2008) contend that chlorhexidine reduced plaque by 55% and reduced gingivitis and associate inflammation by 30 - 45% in their study. The author attributes this reduction to the lowering inflammatory mediators to these plaques and gingivitis in their study find. Authors in (Gunsolley, 2010) made a comparative study with oral hygiene activities versus antiplaque / antigingivitic mouth rinses and found that these mouth rinses have greatly contributed to reduction in inflammation, plaque build-up and gingivitis. In India, a mouth rinse is done either consciously or unconsciously as one of the steps in individual meal step, a mouth rinse through products has never caught up and the study in (Paul *et al*., 2014; Bhardwaj, 2014) have shown that practices have lately shown up in urban areas.

Tobacco, Cigarette and Betel leaf Chewing

Tobacco chewing, cigarette smoking, betel leaf chewing, and alcoholism has adverse effect on oral health. Stopping these 4 activities would improve the overall health of the individual (Paul *et al*., 2014; Bhardwaj, 2014). Smoking, chewing tobacco and alcoholism increase the progression of the oral diseases, leading to tissue damage and in some cases, cancerous tumour in the oral cavity (Hodge and Binnie, 2009).

Preventative Screening

In India, preventative screening for cervical and breast cancer has come a long way (Paul *et al*., 2014; Bhardwaj, 2014) but preventative screening for oral diseases has not kept up with it (Deep, 2000). The reasons are many, economic factors, lack of awareness, people giving less importance to oral hygiene, pre-existing chronic diseases like diabetes and Bp taking majority of their time and money. There is need to establish and implement oral health promotion policies at the state and national level in India, to improve the quality of life and overall health. Recently, authors in (Chen, 2012) have noticed that oral scaling plays an important role in the prevention of oral diseases and have establish a direct correlation between oral scaling to other chronic disease. Because of this direct relationship, oral scaling has seen as a preventative measure to reduce other chronic diseases (Chen, 2012). With the advent of DNA sequencing algorithms, microbiology and bioinformatics have now the ability to find tumours and others quickly just by finding the anomalies in a DNA genome sequence (Reddy, 2009; Haque et at., 2009; Haque et at., 2008; Lipman and Pearson, 1985; AItschul *et al*., 1990; Altschul *et al*., 1997; Kent, 2002; Schwartz, 2003; Batzoglou, 2000; Brudno, 2002; Reddy and Fields, 2020a; Reddy and Fields, 2020b; Reddy and Fields, 2022a; Reddy, 2020; Reddy and Fields, 2022a; Reddy, B., & Fields, R, 2023) , on this topic we have extensive research done and are presenting the findings. The widely used and effective ones are BLAST, LAGAN and MASAA as they are faster and sensitive at the same time.

Study Setup and Methods Used

In this section, we are going to explain the research study which was conducted on 892 individuals from April 2023 - November 2023. The study was divided into two teams, one team from Narketpally and the second team in Bangalore, India. The patients were in the age group of 13 - 21 and were enrolled as they got into the hospital. Every patient was screened and had the equal enrollment chances and the data collected had equal weight in our study. As both the study groups were in well-known dental institutes, appropriate ethical conduct were observed. All the subjects under study had no preexisting systemic diseases and were not on any medications. Patients with preexisting conditions like teen diabetes, asthma and high BP were excluded. During this time frame, there were 141 patients with such preconditions and were excluded. The questionnaire was used to collect data. The questions were on demographic details, habits, oral hygiene, diet, and dentures if any. While this data was collected, a through dental examination was done by various dental experts using a probe and a mirror which is still the primary equipment in India to carry out manual examination. The examination of patients included the scan of all teeth from 1 - 32 going through each quarter. All the patients were examined for dental carries and all relevant data was recorded.

Questionnaire

The questionnaire (Table 1) was well received by majority of the patients, some were shy and were encouraged to come clean on their existing conditions when it came to certain oral disorders mentioned in the questionnaire. The self-awareness of the teeth- alignment disorder was assessed by different question at the very beginning " are you aware of your teeth alignment?". Some had incorrect diagnosis of their teeth alignment, the definition of correct alignment differed and was very subjective. When the patient was

examined and were asked different questions in the questionnaire and a teeth alignment disorder, patients were more forthcoming. Patients were aware of occlusal disorder and had medical history associated with it, they were excluded. After evaluating the results, the association between the awareness of teeth-alignment disorder to oral diseases/disorders were analyzed. Since we are trying to establish a correlation between two entities, $\chi 2$ test was used to analyze the data. We also used binomial logistical regression model. We used SAS software and a p-value < 0.05 was accepted as a major indicator.

Table 1: Questionnaire Structure

Are you aware of your teeth alignment? Yes /No			
Oral Diseases present during examination			
Oral_Diseases	Yes	No	Explain
Tooth Ache			
Stained Teeth			
Cavities			
Chipped tooth			
Impacted Teeth			
Cracked Teeth			
Sensitive to Cold			
Hyperdontia			
Crooked Teeth			
Gaps between Teeth			
Gum Problems			
Grinding Teeth			
Wisdom Teeth			
Not Enough Teeth			
Bleed during Brushing			
Hard to Floss			
Need Cosmetics			
Bad Breadth			
Oral Cancer			

Results

Tooth-Alignment Disorder

We analysed data from 1119 patients whose age ranged from 13 - 21, they are received the questionnaire. Of these, we excluded some students who were aware of their teeth-alignment disorder but had some pre-existing conditions which were excluded predominately because, the analysed results would otherwise skew the results one way. The final population was 892 patients, which included 601 young men and 291 young women. The rate of awareness of teeth-alignment disorder was 30.15 (which is 269 patients, out of these 269, 146 were young women). The number of patients who were aware of their teeth-alignment disorder was much higher in young women than young men. We attribute this to the self-awareness psych of young women who are self-aware of their aesthetic appearance than young male who hardly care of their appearance until they are in their early twenties (Paul *et al*., 2014; Bhardwaj, 2014).

Table 2: Numbers of Teeth Disorder

Teeth Alignment Disorder	Total	Male	Female
Present	269	123	146
Absent	623	478	145

Associations of Awareness of Teeth-Alignment Disorder with Oral Diseases

The correlation between the teeth-alignment disorder to oral diseases were analysed. The disorders we looked at are as follows: 19 oral diseases, (Tooth Ache, Stained Teeth, Cavities, Chipped tooth, Impacted Teeth, Cracked Teeth, Sensitive to Cold, Hypodontia, Crooked Teeth, Gaps between Teeth, Gum Problems, Grinding Teeth, Wisdom Teeth, Not Enough Teeth, Bleed during Brushing, Hard to Floss, Need Cosmetics, Bad Breadth, Oral Cancer). All are shown in table 2.

One of the most common teeth-alignment disorder to oral diseases we found was in teeth ache, teeth decay which is one we did not foresee as one of the objective diseases in this age group, and lastly gum bleeding. The awareness of teeth-alignment to crooked teeth, gaps between teeth, gum problems and gum bleeding was associated with greater incidence ($P < 0.001$).

Table 3: Awareness of Tooth Alignment Disorder to Oral Disease

Oral_Diseases	Total	Male	Female
Tooth Ache	547	335	212
Stained Teeth	320	192	128
Cavities	298	203	95
Chipped tooth	14	9	6
Impacted Teeth	31	26	5
Cracked Teeth	1	1	0
Sensitive to Cold	97	77	20
Hyperdontia	29	26	1
Crooked Teeth	148	127	21
Gaps between Teeth	446	301	145
Gum Problems	321	198	123
Grinding Teeth	117	87	30
Wisdom Teeth	802	459	343
Not Enough Teeth	0	0	0
Bleed during Brushing	224	187	37
Hard to Floss	65	61	4
Need Cosmetics	728	150	578
Bad Breadth	233	187	46
Oral Cancer	0	0	0

The incidence of tooth ache, stained teeth, gaps between teeth and bad breadth. One other " need for cosmetics" was abnormally high as almost all the patients wanted a clean set of perfectly aligned teeth. One of the surprises in this study is an abnormally high incidence of gaps between

teeth, by gaps, we mean, anywhere between the teeth. To see a certain high proportion of patients suffering from gap teeth is surprising and one of the reasons is high salt intake, fast food, snacking, and lifestyle change in youngsters. From 20 - 30 years ago, Sedentary life coupled with electronic device addiction. There was bad breadth incidence, out of which only a smaller proportion were females, this study tells that females are more inclined to better oral hygiene in India.

The binomial logistical regression model with teeth-alignment disorder to oral diseases and the above mentioned 19 oral disorders with both female and male population as the only variables revealed the following among the patients. Tooth ache, stained teeth, Cavities Gaps, gum diseases, bleeding during brushing, and breadth pointed at an odds ratio of 1.56, with 84% Confidence interval (CI). The need for cosmetics was much higher as the number of the people who wanted cosmetics were closer to whole data sample. The female gender performed much better with OR 1.14 and confidence interval of 95% with $p = 0.045$.

Discussion

Good teeth alignment is important not only from the aesthetic point of view but also improves functional, self cleaning and effective over all health. The equipment both manual and motorized brushes can only be effective when they reach every corner of the mouth. From this research, we can see that stained teeth is the one the major issue found in young kids, we think this is due to diet, especially the beverages and snacking dyed packaged foods which has changed the eating habits in India. We also found that, vast majority indicated that they need orthotic help or braces, this orthodontic help could possibly also help in reducing the compromised oral health (Bock *et al*., 2018) and their prevalence (Sim *et al*., 2017). To solve gaps in teeth, we found quite a big number of young kids with gaps and gum ailment, we think, fixed orthodontic appliances or newer transparent removable dental (aligners) could be used. We also find that the fixed appliances or fixed braces is quite painful during checkups retuning, and quite difficult to maintain oral hygiene to numerous surfaces (Ren *et al*., 2014; Kim *et al*., 2016; Kramer and Splieth, 2022).

Most of the stains caused by either tobacco smoking or carbonated beverage consumption can be removed by scaling and polishing the teeth. The use of Hydrogen peroxide for teeth whitening. Micro abrasion (Ambalavanan, 2019), a technique associated with leaching is clinical method of establishing the esthetics of some severely discolored teeth. Other methods, like Veneering, a treatment for some deeply discolored teeth is another technique, which is used when tooth is damaged like cracks and splits (Akpata, 2014). Other solution is placement of crowns, which is seen as best solution. Placement of porcelain crowns when there are many badly discolored teeth. These crowns are made up of porcelain and are more suitable when patients do not want to see their teeth / tooth clipped off.

Many studies have established that tooth-alignment disorder leads to oral diseases this paper has investigated (Javali *et al*., 2020; Bernhardt *et al*., 2019; Alsulaiman *et al*., 2018). In this study, we found that there is large correlation between headaches, gum diseases, bleeding gums to tooth-alignment disorder, and bleeding gums sticks out to be primary cause of bad breadth, which was caused by either plaque build up and Gingivitis.

For all these snowballing oral diseases, orthodontic treatment would improve the oral condition after an initial oral cleanup of plaque to remove and maintain gingivitis (Macey *et al*., 2020). This must be followed with a disciplined twice a day brushing followed by flossing (Abe *et al*., 2020).

During our study, we have found Hyperdontia, not only in this age group but in adults above 21 years and due to economic reasons, adults have not been able to avail any help in India. The prevalence of this condition might vary in other parts of India, but we found quite a number (26) in teens and young adults this paper concentrated on. The first correction is awareness that one is having this disorder and taking help from dental professionals. Since the condition is quite unique, the correction methods involve many techniques already discussed, ranging from teeth removal, orthodontics, braces or aligners, good oral care, and discipline.

In this paper, we have analyzed close to 1000 young patients ranging from 13 - 21 and have made pointed inferences between teeth alignment disorder and oral diseases ranging from a simple headache to gum bleeding to oral cancer. The findings provide a foundation of what young Indian population is facing when it comes to oral diseases and teeth alignment disorder. It can be said, that while there is a marginal awareness when it comes oral care, lot more needs to be done both on the private as well as government fronts to establish certain policies in governing and administering oral care to general population. From this study, we think that orthodontic therapy can contribute, along with oral screening to clean and remove plaque, gingivitis, and others to improve the overall health of the individual.

Conclusion

In this paper, we established a close relationship between teeth-alignment disorder and 19 other oral diseases in young Indians whose age varied from 13 to 21. These diseases were either partly because of tooth alignment or could be vice versa. The oral diseases solution might vary depending on the economic conditions of the individual. However, we have established that oral care belongs first in the hands of the individual and simple brushing twice a day along with flossing goes a long way in maintaining the oral flora and fauna for a healthy body. Further study is warranted to

confirm the association we have established in this study, where our study suggests that pre-screening, oral cleans ups and orthodontic therapy along with oral discipline goes a long way in removing the teeth-alignment disorder along with its associated oral diseases which we have mentioned in this paper.

Authors' Contribution

Dr. Deepak T.A is the initiator of the study. The data was collected and analysed by both Dr. Deepak T.A and Dr. Avinash Tejaswi M.L. The manuscript was revised by Dr. Avinash. The work was proofread by Suchindra and other staff from V.S Dental College and Kamineni Institute of Dental Science.

Conflict of interest

The authors have no conflicts of interest in this research.

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