INTRODUCTION

Dental erosion is defined as an irreversible loss of dental hard tissue due to a chemical process without involvement of microorganisms [Imfeld 1996].\(^1\) It is a prevalent problem everywhere and seems to be a problem for the dental profession in this millennium.

There has been a clinical impression among dental practitioners, particularly those working with children that the problem of dental erosion is increasing. Is this really the case or are we aware of the problem. What is causing this increase, if it really exists? Perhaps more importantly what we can do about it?

Dental erosion may be caused by either extrinsic or intrinsic factors. Extrinsic erosion is the result of exogenous acids. Most of the extrinsic causes of dental erosion are excessive consumption of carbonated beverages, fruit juices, high energy drinks, vinegar conserves and candies. Majority of the carbonated drinks, non carbonated drinks, sports drinks and medicated syrups have a low pH rendering them acidic in nature and is considered one of the most important risk factor.

Consumption of these drinks has increased dramatically over the past 50 years. However, it is more worrying when this condition is found in an alarming proportion among children. The UK Child Dental Survey in 1993 found that there were over 50 per cent of five year old children with erosion in their primary incisors and 25 per cent of 12 to 14 year old children had their permanent dentition affected.\(^2\) If this condition is not controlled and stabilized, the child may suffer from severe tooth...
surface loss, tooth sensitivity, over closure, poor aesthetics, or even dental abscesses in the affected teeth.

The solubility of enamel is pH dependent process and saliva contains calcium and phosphate ions which exist in a supersaturated state at neutral pH with respect to enamel hydroxyapatite. As the pH of saliva decreases, it crosses the saturation line at a point known as the critical pH. Since the critical pH of enamel is approximately 5.5, any solution with a lower pH may cause erosion, particularly if the attack is lengthy and intermittent over time.

It has been accepted that titrable acidity which is a measurement of the total acid content, is a more important indicator than actual pH value in determining erosive potential of beverages.

The aim of this study was to measure the initial pH of various commonly used beverages, sports drink, and medicated syrup and to determine their titrable acidity (neutralizable acidity).

MATERIALS AND METHODS

This in vitro study was conducted in the Department of Pedodontics and Preventive Dentistry, Ahmedabad Dental College and Hospital, Gandhinagar. The measurement of pH and titrable acidity of the test media were conducted in laboratory of Department of Chemistry, Gujarat University, Ahmedabad. The Study was single blinded and observer was unknown for the reading of the test media.

Based on current drinking trends, following test media were selected;

- Carbonated Beverage (The Coca-Cola Company, India)
- Non Carbonated Beverage (Parle Agro Pvt. Ltd., India)
- High Energy Sports Drink (Rauch Fruchtsafte GmbH & Co OG, Red Bull Asia FZE, UAE)
- Medicated Cough Syrup (Johnson & Johnson, India)
- Distilled water as the control

Investigations were performed in 2 steps:

Step I: measurement of pH of the selected test media.

Step II: measurement of their titrable acidity (neutralizable acidity).

Measurement of pH

The initial pH of each drink was measured using a pH meter [Equip-Tronics pH Meter Model No EQ-615, India]. 100ml of freshly opened drink at room temperature was placed in a beaker and stirred using a non heating magnetic stirrer until a stable reading was obtained. The circuit of a simple pH meter usually consists of operational amplifiers in an inverting configuration, with a total voltage gain of about “17. The inverting amplifier converts the small voltage produced by the probe (+0.059 volt/pH) into pH units, which are then offset by seven volts to give a reading on the pH scale. After each single measurement, the probe was rinsed with distilled water to remove any traces of the solution being measured, blotted with a scientific wipe to absorb any remaining water which could dilute the sample and thus alter the reading. Three readings were taken of each drink from each group to give a mean measurement for that drink. For very precise work the pH meter was calibrated with buffer solution (sodium citrate) at pH 4 before each measurement. The reason for this was that the glass electrode does not give a reproducible electric and magnetic field over longer periods of time.

Measurement of Titrable acidity

100ml of each test media was titrated with 1M NaOH added in 0.2ml increments until the pH reached 7. This was done by using a non heating magnetic stirrer until a stable pH reading was obtained after each increment (0.2ml) of NaOH. This was done to measure the total titrable acidity. Titrations were repeated in triplicate for all drinks to check for reproducibility and to give a mean value for the test media. The amount of NaOH required to raise the pH to 7 was noted and the data was

The Journal of Ahmedabad Dental College and Hospital; 3(1), March 2012 - May 2012
subjected to statistical analysis using Mann Whitney test.

RESULTS

\textbf{pH measurements}

\begin{table}[h]
\centering
\caption{TITRABLE ACIDITY (NEUTRALIZABLE ACIDITY) OF VARIOUS BEVERAGES UP TO PH}
\begin{tabular}{|l|c|c|c|c|}
\hline
Test Media & Digital pH & Standard deviation & Neutralizable acidity ml & Standard deviation \\
\hline
Carbonated beverage-Thumbs up (G1) & 2.45 & 0.19 & 4.10 & 0.32 \\
Non carbonated beverage- Frooti(G2) & 3.10 & 0.18 & 8.50 & 0.69 \\
High energy drink- Red bull(G3) & 3.26 & 0.71 & 17.50 & 0.23 \\
Medicated syrup- Benadryl (G4) & 5.01 & 0.12 & 8.45 & 0.48 \\
Distilled water – Control (G5) & 6.90 & 0.11 & NA & 0.13 \\
\hline
\end{tabular}
\end{table}

Table 1 shows the mean pH and standard deviation values. The initial pH was lowest for carbonated beverages (2.45) followed by non carbonated beverage (3.10), high energy sports drink (3.26) and was highest for medicated syrup (5.01). According to this it can be stated that carbonated beverage was the most acidic among all the test media.

\textbf{Titrable acidity measurements}

Table 1 shows amount of NaOH needed to raise the pH of beverages upto 7. The data were combined and the groups compared as a whole with one another. Maximum amount of NaOH i.e.17.50 ml was required to raise the pH of sports drink followed by 8.50 ml for non carbonated drink, 8.45 for medicated syrup and lastly 4.10 ml for carbonated drink (Graph 1).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{graph1.png}
\caption{DIGITAL PH AND NEUTRALIZABLE ACIDITY OF TEST MEDIA}
\end{figure}

The Journal of Ahmedabad Dental College and Hospital; 3(1), March 2012 - May 2012
TABLE-2: P VALUES FOR THE INDIVIDUAL COMPARISONS MADE BETWEEN EACH GROUP OF TEST MEDIA

<table>
<thead>
<tr>
<th>Test media</th>
<th>pH</th>
<th>Neutralizable acidity ml 0.1M Na(OH)2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonated beverage-Thumbs up : G1</td>
<td>G1 vs G2, G3, G4,G5</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Non carbonated beverage- Frooti: G2</td>
<td>G1 vs G2, G3, G4</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>High energy sports drink- Red bull: G3</td>
<td>G2 vs G3, G4,G5</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Medicated syrup- Benadryl: G4</td>
<td>G2 vs G3, G4</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Distilled water – Control: G5</td>
<td>G3 vs G4,G5</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>G4 vs G5</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>G5</td>
<td></td>
</tr>
</tbody>
</table>

P<0.001 significant

P values (Table 2) for the individual comparisons made between each group of beverages for the number of ml of NaOH required raising the pH to 7 using one way ANOVA with multi comparison Tukey test. In this study P<0.001 was considered as significant. There was a significant difference between the sports drinks, non carbonated drink, medicated syrup, carbonated drink in relation to distilled water, initially there were no significant differences between non carbonated drink and medicated syrup at pH 7 although the initial pH was different for both.

DISCUSSION

Black in 1908 stated: “Though erosion is rare compared to caries, once a practitioner is aware of dental erosion, he will actually see it in many more patients”.[5] This philosophy is not out of place today.

Dental erosion is defined as an irreversible loss of dental hard tissue by a chemical process without the involvement of microorganisms and is due to either extrinsic or intrinsic sources. [1][6][7] Enamel, in spite of being the hardest tissue, has been reported to suffer from the devastating effects of soft drinks.

Changing lifestyle and dietary patterns have played a major role in the increase of dental erosion in recent years. Dietary erosion may result from food or drinks containing a variety of acidic ingredients. [6] Frequent consumption of these easily and widely available beverages showed erosion of the enamel in both in vitro and in-vivo studies. Children and adolescents consume significant amounts of these mostly erosive beverages and therefore their risk of developing dental erosion is high. It can be stated that dietary factors represent the most important external risk factor for children and adolescents to develop dental erosion.[7][8]

The present study was undertaken to evaluate the pH and neutralizable acidity (titratable acidity) of three different beverages, medicated syrup and control (distilled water).

The acidogenicity is described as the production of oral acids from sugars or refined carbohydrates found in soft drinks. Consequently, the ability of a soft drink to foster caries is referred to as cariogenicity. [9] Two ways to quantify the acid content of a food stuff or beverage include pH and total or neutralizable acidity (titratable acidity). The pH or actual acidity is the negative logarithm of the hydrogen ion concentration (actual hydrogen ion concentration) and is measured on a scale of 0 to 14 with a reading below 7 indicating an acid content or environment. The neutralizable acidity level may be a more realistic and accurate method for measuring
Neutralizable acidity is the total number of acid molecules, both protonated and non-protonated and determines the actual hydrogen ion availability for interaction with the tooth surface.

Generally, the more the titration required, the higher the buffering capacity, with a corresponding increase of erosion potential on dental enamel. The total acid level (titratable acid) of acidic drinks is considered to be more important than pH alone as this determines the concentration of damaging hydrogen ions available to interact with the tooth surface.

pH of all test media is as follows: Carbonated beverage (2.45) < Non carbonated beverage (3.10) <High energy sports drink (3.26) < Medicated syrup (5.01) < Distilled water (6.90). The buffering capacity of beverages can be ranked as follows: High energy sports drink (17.50 ml) > Non carbonated beverage (8.50 ml)> Medicated syrup (8.45 ml) > Carbonated Beverage (4.10 ml) > Distilled water (NA).

The results of the present study indicate that pH and titratable acidity were indeed predisposing factors responsible for the erosion of enamel. These test media have a low pH, are sweetened by highly refined carbohydrates (sugar and/or sugar substitute components) that are metabolized by plaque microorganisms forming organic acids, and also contain additional additives, all of which can contribute to the demineralization effect and erosive potential of dental hard tissues (enamel). Thus the refined carbohydrates/concentration and additives which modify the properties of the test media used, contribute to pH and titratable acidity.

The carbonated beverage despite having the lowest pH on opening was easy to neutralize than the high energy sports drink, non carbonated beverage and medicated syrup, i.e. it required only 4.10 ml of NaOH to raise pH to 7. This finding was similar to a study done by Kitchens & Owens, 2007 and Wongkhantee et al., 2005. Carbonated beverages contain carbonic acid formed by carbon dioxide in solution and inorganic acids such as phosphoric acid to stimulate taste and counteract sweetness. Edward et al., 1999 reported that even when the carbon dioxide has been blown off and the drinks have become “flat” still the pH remains low. This indicates that soft drinks have inherent acidity due to other acids that are added to stimulate taste and counter sweetness.

The present study showed that high energy sports drink needed the most base (17.50 ml) to neutralize it thereby having greater erosive potential than the carbonated and the other non carbonated beverage (Chart 1). This was quite similar to the findings of other studies by Jendsdottir & Bardow, 2006; Bamaise et al., 2007; Touyz 1994. In high energy drink sucrose, glucose, sodium citrate, inositol, niacinamide, calcium-pantothenate, pyridoxine HCL, calcium and phosphate are used as ingredients. The sucrose and glucose compounds have been shown to cause a substantial reduction in plaque pH, production of acids, and in turn increase the neutralizable acidity. The most common type of acid used in sports drinks is citric acid which has greater erosive potential.Actually citric acids and/or citrates are added as buffering and flavouring agents, but they can concurrently bind to calcium and phosphorus thereby promoting increased titratable acidity levels. Other ingredients like inositol & pyridoxine HCL may contribute towards its high titrable acidity by interfering with buffering capacity of saliva leading to increase in the titrable acidity.

Non carbonated beverage had initial pH of 3.10, which was higher than carbonated beverage but required more amount of NaOH to raise pH up to 7. This finding highlights the role of fruit-based acids in determining the buffering capacity of non carbonated beverage. These results are in agreement with results of some studies. Edwards et al., 1999; Grenby et al.,1989; Saeed & Al Tinawi 2010. Non carbonated beverage in the present study, contain mango pulp, sugar, citric acid, ascorbic acid, salts, anti oxidants. Among them citric acid, ascorbic acid and sugar are the substances that contributes towards its low pH & high neutralizable acidity. Different non carbonated beverages & high energy sports drinks contain acids in different concentrations & dilutions that could be the reason for difference in neutralizable acidity.

For medicated syrup initially pH (5.01) was higher.
than carbonated beverage, but required the same amount of base to raise pH up to 7 as did for non carbonated beverage. The medicated syrup contains diphenhydramine hydrochloride, ammonium chloride, sodium citrate, menthol & ethanol. As mentioned by Maguire, 2007 that larger quantity of citric acid is added in form of sodium citrate to mask unpleasant taste of medication which adversely affects medicine. Also diphenhydramine hydrochloride & ethanol may also contribute for its increased neutralizable acidity. Similarly different concentration of acid may be the reason for different neutralizable acidity in high energy sports drink & medicated syrup.

Erosion depends upon several intrinsic as well as extrinsic factors. Intrinsic dental erosion is known as perimolysis, whereby gastric acid from the stomach comes into contact with the teeth. People with diseases such as anorexia nervosa, bulimia and gastro oesophageal reflux disease often suffer from this.

Extrinsic erosion is related to acidity of foods and drinks what we eat or drink. Extrinsic factors like increased consumption of soft drinks, sports drink and indiscriminate use of medicated syrup (with added sweeteners) has been linked to an increase in dental erosion. These acidic drinks tends to lower the pH level of saliva below critical pH (5.2- 5.5) and cause the tooth to demineralised. Even though initial pH is used to measure acidic potential but it is the titrable acidity which truly indicates the potential of a particular beverage to erode the tooth surface.

The results of this in vitro study indicate that the drinks within any one group behave in a similar fashion due to their acid content. The titrable acidity of beverages tested in vitro can therefore be ranked as follows: high energy sports drink juices >non carbonated drinks > medicated syrup >carbonated drink> water. The fruit-based drink, sports drink and medicated syrup were significantly different from carbonated drink.

It was also interesting to note that initial pH value gave no indication of the underlying buffering capacity and, therefore the erosive potential of the drink. Generally non carbonated drink, medicated syrup had a higher initial pH than the carbonated drinks but required much more NaOH to raise the pH close to neutrality. This study agrees broadly with those already found in the literature that fruit juices have greater erosive potential. This could be due to the addition of preservatives and flavouring agents which have a marked effect on the total acidity. Further investigation is being conducted to measure the effect of these beverages on enamel surface roughness of extracted teeth.

Modification by adding calcium and phosphate to the drinks may be a helpful measure to reduce the erosive potential of the drinks. In the oral cavity, any drink or foodstuff will be instantaneously mixed with saliva with a subsequent rise in its pH. After consuming a low pH drink, the pH on the tongue stays low only for a short duration. In addition, acidic drinks have also been shown to stimulate salivary secretion, which in turn facilitates the buffering systems.

Further in vivo studies should be carried out to ascertain whether the increased buffering properties of these test media have a greater potential to lower the pH at the tooth surface. Many factors will be involved in the oral cavity, not least the ability of a drink to promote increased salivary flow due to gustatory stimulation. In oral cavity saliva is important factor to maintain equilibrium for pH, use of the artificial saliva for in vitro experiment can also increase more accurate results.

Based on the results obtained in the study, the definite erosive potential of commonly used beverages and medicated syrup, dentist should plan appropriate preventive treatment modalities for their patients.

**CONCLUSIONS**

Under the limitations of this study it can be concluded that:

- Initial pH was least in carbonated drink followed by non carbonated drink then sports drink and highest was seen for medicated syrup.
- Titrable acidity ie amount of NaOH solution required to neutralize the pH was highest for
sports drink and least carbonated drink.

- There was direct relation between titrable acidity and erosion instead of initial pH values of drinks and erosion.
- There is no correlation between the initial pH of the drink and their erosive potential.
- High energy sports drink had the most erosive potential whereas carbonated drink had the least.

REFERENCES


Source of support : Nil, Conflict of interest : None declared
INTRODUCTION

The number of patients seeking orthodontic treatment is increasing mainly for esthetic improvement. Orthodontic treatment can improve mastication, speech and appearance, as well as overall health, comfort, and self-esteem. However, like many other interventions, orthodontic treatment has inherent risks and complications like decalcification of enamel, enamel fracture, pulpitis, root resorption, gingivitis, periodontitis, alveolar bone resorption, occlusion trauma, TMJ dysfunction, systemic endocarditis.

There is a symbiotic inter-relationship between Orthodontics and Periodontics. This relationship is considered a challenge, especially periodontal health during and after orthodontic treatment. There are some malocclusions that harm the periodontium, such as an anterior deep bite, which strips the gingiva on the maxillary incisors, or an anterior crossbite that results in recession and mobility of a lower incisor. Correcting these malocclusions with orthodontic treatment is most likely to be beneficial for periodontal health.

Fixed orthodontic appliances have been cited as a predisposing cause of gingival disease. This is because of their mechanical irritant effect or because of their increased plaque retention potential. The most common argument for biological plausibility is that dental alignment obtained with orthodontic therapy facilitates plaque removal and reduces the occlusal trauma.

The scientific evidences regarding risk factors for periodontal conditions potentially modifiable through orthodontic treatment are weak and inconsistent. For instance, the reported relationships between crowding and periodontal...

COMPARATIVE EVALUATION OF PLAQUE AND GINGIVAL STATUS AMONG DENTAL STUDENTS UNDERGOING ORTHODONTIC TREATMENT AND NON-ORTHODONTIC TREATMENT

SUKAL PARKAR*, NIYATI TRIVEDI**, RAHUL THAKKAR***

ABSTRACT

Objective: The purpose of the study is to assess and compare the plaque and gingival status among dental students undergoing orthodontic treatment with that of non-orthodontic treatment.

Materials and Methods: A comparative cross sectional study was conducted among 64 dental students. The 64 students were divided into three groups, Group 1 subjects undergoing orthodontic treatment, Group 2 subjects having malocclusion but not having orthodontic treatment and Group 3 subjects having ideal occlusion. The details of oral hygiene measures were obtained through direct personal interview. The plaque and gingival status was assessed by using Silness and Loe Plaque index and Loe and Silness Gingival index respectively. The results were analyzed statistically at 5% level of significance.

Results: The oral hygiene practices among all the groups were satisfactory. The plaque status varies from mild to moderate level, while all the subjects have mild gingivitis. There was a highly significant difference (p<0.001) when the mean plaque and gingival scores among the groups were compared. The mean plaque and gingival score were low in the subjects belonging to Group 3.

Conclusion: Plaque retention and gingivitis were significantly higher in the subjects undergoing orthodontic treatment. Hence proper plaque control measures are strongly recommended to all the orthodontic patients before, during and following orthodontic treatment, to ensure the best possible results.

Key words: dental plaque, gingivitis, malocclusion, orthodontic treatment

Received: 23-08-2011 ; Review Completed: 25-11-2011 ; Accepted: 23-01-2012
status have ranged from no relationship to a weak relationship to a relationship limited to the maxilla. Only few studies utilizing index system to classify the degree of gingival inflammation have been made, hence very little attention has been focused on the relationship of orthodontic treatment to gingivitis. Hence the purpose of this study is to assess the effect of fixed orthodontic appliances and plaque accumulation upon the health status of the gingival tissues.

**MATERIALS AND METHODS**

A cross sectional comparative study was conducted among dental students of Ahmedabad Dental College and Hospital. The study population was divided into three groups.

Group 1 includes the dental students undergoing the orthodontic treatment having fixed orthodontic appliances.

Group 2 includes dental students with malocclusion without fixed orthodontic appliances.

Group 3 includes dental students with ideal occlusion.

A total of 20 students having fixed orthodontic appliances were included in the study. 22 students in each group (Group 2 and Group 3) were selected as control group after having matched with age and gender with that of Group 1. Hence, the sample size comprise of 64 students. These students were the classmates of the students undergoing orthodontic treatment. Students having fixed orthodontic appliances for minimum of 12 months were included and those students who had undergone oral prophylactic treatment during last 3 months were excluded.

Before conducting the clinical examination the purpose of the study was explained to all the participants (students) and if the students were willing to participate in the study, informed consent for participation was obtained for the oral examination. The clinical examination was done by two investigators (TK and TR) who were trained and calibrated by PSM. The inter examiner variability was checked by using κ statistics, showing a strong agreement (κ=0.87).

The subjects were asked regarding their own oral hygiene practices including both mechanical and chemical plaque control measures through the personal interview. The clinical examination includes assessment of plaque and gingival status. The plaque status was assessed by using Silness and Loe Plaque Index (1964) and the gingival status was assessed by using Loe & Silness Gingival Index (1963).

**Statistical analysis**

The data obtained was entered into a Microsoft Excel 2007. The data was analyzed using SPSS statistical package version 17. The difference in the proportions among the various groups was tested statistically by using chi-square test. The mean values among the various groups were compared by using one way ANOVA test. The multiple comparisons among the groups were carried out by applying Post Hoc Tukey test. All analysis was made at the 0.05 level of significance.

**RESULTS**

Out of 64 subjects 22 were male and 42 were female subjects. 14 (70%) out of 20 subjects were female undergoing orthodontic treatment with fixed orthodontic appliances. The mean age of Group 1, Group 2 and Group 3 were $20.7 \pm 0.92$, $20.32 \pm 1.29$ and $20.55 \pm 1.22$ years respectively.

**Table-1 Various oral hygiene aids used among the study groups**

<table>
<thead>
<tr>
<th>Oral hygiene aids</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual tooth brush</td>
<td>11 (55)</td>
<td>19 (86.4)</td>
<td>20 (90.9)</td>
<td>50 (78.1)</td>
</tr>
<tr>
<td>Manual Tooth brush &amp; Mouth wash</td>
<td>0</td>
<td>0</td>
<td>1 (4.5)</td>
<td>1 (1.6)</td>
</tr>
<tr>
<td>Manual Tooth brush &amp; dental floss</td>
<td>0</td>
<td>2 (9.1)</td>
<td>1 (4.5)</td>
<td>3 (4.7)</td>
</tr>
<tr>
<td>Orthodontic tooth brush</td>
<td>7 (35)</td>
<td>1 (4.5)</td>
<td>0</td>
<td>8 (12.5)</td>
</tr>
<tr>
<td>Orthodontic tooth brush &amp; dental floss</td>
<td>2 (10)</td>
<td>0</td>
<td>0</td>
<td>2 (3.1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 (100)</td>
<td>22 (100)</td>
<td>22 (100)</td>
<td>64 (100)</td>
</tr>
</tbody>
</table>

$\chi^2 = 22.14$, df=8, p= 0.005 (S)
Table 1 shows the cross tabulation between various oral hygiene aids used among different study groups. Majority of the subjects 50 (78.1%) in all the three groups uses manual tooth brush. 4 (6.25%) subjects out of 64 used the mouth wash and dental floss as an adjuvant to tooth brush. Out of 20 subjects of Group 1, only 7 (35%) subjects use orthodontic tooth brush. The results shows statistically significant difference (p<0.05) for various oral hygiene practices.

Those subjects belonging to Group 1 and 2 had moderate plaque status as compared to students of Group 3 having mild plaque status. There was highly significant difference (p < 0.001) among the three groups when the mean plaque scores were compared Table 2. The mean plaque score (0.95 ± 0.22) was least for the Group 3. The post hoc tukey analysis was further applied for multiple comparisons (Table 3) showing the significant

** Highly significant at p<0.001

(35%) subjects use orthodontic tooth brush. The results shows statistically significant difference (p<0.05) for various oral hygiene practices.

All the subjects have mild gingivitis. There was highly significant difference (p < 0.001) between the three groups when the mean gingival scores were compared Table 2. The mean gingival score (0.41 ± 0.13) was least for the Group 3. The post hoc tukey analysis was further applied for multiple comparisons (Table 3) showing the highly significant differences between Group 1 and Group 3 and between Group 2 and Group 3.

** Highly Significant at p<0.001

* Significant at p<0.05

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean Plaque Score Mean ± SD</th>
<th>Mean Gingival Score Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (n=20)</td>
<td>1.31 ± 0.17</td>
<td>0.65 ± 0.18</td>
</tr>
<tr>
<td>Group 2 (n=22)</td>
<td>1.38 ± 0.52</td>
<td>0.59 ± 0.18</td>
</tr>
<tr>
<td>Group 3 (n=22)</td>
<td>0.95 ± 0.22</td>
<td>0.41 ± 0.13</td>
</tr>
<tr>
<td>F= 9.53, p&lt;0.001**</td>
<td>F= 12.52, p&lt;0.001**</td>
<td></td>
</tr>
</tbody>
</table>

** Post hoc tukey analysis among the study groups for mean Plaque and Gingival score**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Plaque Status p value</th>
<th>Gingival Status p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 Vs Group 2</td>
<td>0.80</td>
<td>0.53</td>
</tr>
<tr>
<td>Group 2 Vs Group 3</td>
<td>&lt;0.001**</td>
<td>0.001*</td>
</tr>
<tr>
<td>Group 3 Vs Group 1</td>
<td>0.004*</td>
<td>&lt;0.001**</td>
</tr>
</tbody>
</table>

** DISCUSSION **

To know the effects of the fixed orthodontic appliances on the accumulation and the retention of plaque on tooth surfaces and its effect on the gingival tissue the present cross-sectional study was conducted to among 64 dental students of Ahmedabad Dental College and Hospital.

In the present study population comprised a sample of dental students. It is generally accepted that this population shows a higher pattern of a supra gingival plaque control, thus reducing selection bias and misinterpretations. All the dental students
having fixed orthodontic appliances were selected. There were total 20 such students (Group 1), out of which 14 (70%) were female students this results shows that the female are more conscious regarding cosmetic care related to improvement in oral hygiene as compared to their male counterparts. The age of the study groups ranges from 18- 23 years, this is the age were the plaque retention increases and the incidence of gingival inflammation is most severe due to the hormonal changes and unfortunately and co-incidentally this happens to be the time when orthodontic treatment is mostly started.\textsuperscript{13,15}

Methodological rinsing plus regular attention stimulated the good oral hygiene to great extent. Almost 76.6% of the subjects show moderate plaque accumulation, however no severe plaque accumulation was observed. The results of present study shows the low plaque scores reflecting that the oral hygiene measures of the subjects were satisfactory. The plaque score is minimum in the control group having ideal occlusion (Group 3) this shows that the subjects belonging to this group have better oral hygiene as they have easy accessibility for brushing their teeth when compared to other two groups where brushing is difficult due to orthodontic appliances and maligned teeth. The orthodontic bands and arch wires are the result of inherent irregularities; it is quite conceivable that these appliances provide additional surface for the collection and retention of food and debris. The appliances also protect the plaque from the actions of brushing, mastication, and salivary flow.\textsuperscript{16}

Mild gingival alternations occurred in spite of satisfactory oral hygiene maintenance in the present study. Contradictory results appear in literature stating whether the crowding of the teeth or any other aspects of mal-occlusion initiates or accelerates inflammation. The prevailing view is that malalignment of teeth does not itself enhance tissue degradation, but that it decrease the efficacy of mechanical tooth cleansing. Some authors have reported a positive increase in plaque and gingivitis levels during orthodontic treatment (Boyd RL and Baumrind S,\textsuperscript{15} Alexander SA,\textsuperscript{17} Sallum EJ et al\textsuperscript{18}) probably due to the plaque retentive conditions related to the appliances (Huser M et al\textsuperscript{19}). In the present study, an effort was made to investigate an important clinical question without conscious bias and usually a reasonably well design comparative study. However, there are certain limitations of this study which are indicate here in an attempt to create improved conditions for further research in this area. First, the sample size included in this study was relatively small, this may be not large enough to represent for whole population. Although the sample size in this study have sufficient for detection of most clinically relevant between group differences. Secondly, the partial mouth recordings protocol was used for the estimation of clinical criteria, which may be accurate and efficient in estimating the mean measures but could severely under and/or over-estimate the prevalence of gingivitis. The third problem is that the measurement of clinical parameters was made by an investigator whose familiarity with the aim of the study made “blind” measurement impossible. Thus, although the single measurer made strong attempts to maintain impartiality, it is necessary to note that investigator’s personal biases or the inadvertent overcorrection for those biases may have influenced the reported values.

**CONCLUSION**

Within the limitation of this present study, the results of the present study reinforce the importance of susceptibility to gingivitis independent of the presence of a well-known retentive plaque factor, i.e. orthodontic appliances and/or bands. Subjects with a malocclusion have worse gingival health than subjects without a malocclusion. Hence, good clinical practice, careful patient selection, and good patient’s cooperation are prerequisites to minimizing tissue damage. Oral hygiene is a paramount factor in successful orthodontic treatment. Any negligence in maintaining oral hygiene may have a negative impact on orthodontic treatment results which to dental caries, gingivitis, periodontitis and other sequellae.
REFERENCES


Source of support: Nil, Conflict of interest: None declared
INTRODUCTION

Ankylosis is a Greek terminology meaning 'stiff joint'. It can be defined as "inability to open mouth due to either a fibrous or bony union between the head of the condyle and the glenoid fossa".

Ankylosis of the temporomandibular joint is a serious and disabling condition. Impairment of speech, difficulty with mastication, rampant caries, poor oral hygiene, disturbances of facial and mandibular growth, and acute compromise of the airway invariably result in physical and psychological disability. This is particularly true of young children who are completely unable to open their mouth.¹

It is most commonly associated with trauma (13% to 100%), local or systemic infection (0% to 53%), or systemic disease, such as ankylosing spondylitis, rheumatoid arthritis, or psoriasis.

TMJ ankylosis may be classified by a combination of location (intra- or extra-articular), type of tissue involved (bony, fibrous, or fibro-osseous) and extent of fusion (complete, incomplete). Literature classifies ankylosis as true and false. Any condition that gives rise to osseous or fibrous adhesion between the surfaces of the temporomandibular joint is a true ankylosis. False ankylosis results from pathologic conditions not directly related to the joint.²

Due to better understanding of the management of condylar fractures, and also due to the decreased incidence of middle ear infections following the introduction of antibiotics, the incidence of temporomandibular joint (TMJ) ankylosis is decreasing in the west. However, in India the incidence of TMJ ankylosis is still high, and the onset is believed to be before the age of 10.

When it occurs in a child, it can have devastating effects on the future growth and development of the jaws and teeth. Furthermore, in many cases it has a profoundly negative influence on the psychosocial development of the patient, because of the obvious
facial deformity, which worsens with growth.³

CASE REPORT

A 16 year old patient reported to ADCH with the chief complaint of inability to open his mouth. History revealed that he had an episode of trauma to his chin due to a trivial fall during play time before 3 years. He was otherwise healthy. He developed swelling in front of both his ears subsequent to the trauma, which resolved in due course of time. After the resolution of swelling, his mouth opening started reducing gradually, for which he consulted a local doctor who seemingly missed the diagnosis and could only prescribe some pain-killing medications. When he was examined at our centre, his mouth opening was nil (0 mm) (fig 1.2). He spotted an old scar on his chin. The initial clinical examination revealed an obviously hypoplastic mandible with a class II dental relationship and a budding bird-face deformity (fig 1.1). There was no palpable movement over the both TMJs and they were non-tender on palpation. Furthermore, abnormally prominent antegonal notching was present on both sides.

Radiographic evaluation comprised of an orthopantomogram and a 3-dimensional computed tomographic reconstruction which revealed obliteration of the joint space by large bony ankylosic mass in both right and left temporomandibular joint region with elongation of coronoid process on both sides. (fig 2.1 & 2.2)

Based on all these findings, a diagnosis of bilateral, true, post traumatic bony TMJ ankylosis was confirmed.

After complete evaluation a bilateral Gap arthroplasty was planned under general anaesthesia on both right and left side. The patient was intubated using a fibre-optic bronchoscope, which is the recent technique of choice in patients who present with difficulty in mouth opening. Alkayat and Bramley's preauricular incision was employed in gaining access to the both temporomandibular joints (fig 3.1 & 3.2).

After exposing the joint space, an arthrotomy cuts were given on both sides to remove ankylosic mass and bilateral coronoidectomy done (fig 4.1 & 4.2).

A mouth opening of >36 mm was achieved immediate postoperatively. Short-term
maxillomandibular fixation given for 3 days followed by elastic traction to prevent anterior open bite. Patient was discharged from hospital 4 days after surgery with good range of motion.

Patient then received oral physiotherapy to maintain the optimum results. At his most recent follow-up, 2 months after the initial surgery, he has stable occlusion with good range of motion (fig 5). He has now regained his beaming smile and is relishing his favourite dishes with enthusiasm.

DISCUSSION

The causes and treatment of TMJ ankylosis have been well documented, with trauma and infection identified as the 2 leading causes.

If the cause is trauma, it is hypothesized that intra-articular hematoma, along with scarring and formation of excessive bone, leads to the hypomobility.

The administration of anesthesia to patients with TMJ ankylosis is a challenging. It requires considerable expertise and adequate monitoring facilities. The safest technique for securing the airway would be a nasal fiberoptic assisted intubation with the patient awake and under local anesthesia.

A variety of techniques for the treatment of TMJ ankylosis have been described, including intraoral coronoidectomy, ramus osteotomy, high condylectomy, forceful opening of the jaw under general anesthesia, lysis of adhesions of the pterygoid space during exploration for a foreign body, autogenous Costochondral grafting and free vascularized whole-joint transplants. In addition, several prosthetic options for TMJ reconstruction exist, including Silastic sheeting material, the TMJ condylar prosthesis, custom glenoid fossa implants, articular eminence implants and mandibular reconstruction plates with condylar heads.

According to Kaban et al. the advantages of gap arthroplasty are its simplicity and short operating time and the disadvantages include creation of a pseudo articulation and a short ramus, failure to remove all the bony pathology, and increased risk of reankylosis. Patients with bilateral involvement showed more frequent anterior open bite. This complication can be treated with physiotherapy and the use of elastic traction.

To prevent surgical recurrence in cases afflicted with ankylosis, radical removal of the bony or fibrous ankylotic segment is essential. However the unfavourable anatomic configuration and the proximity of vital structures make the surgical procedure particularly difficult.

Roychoudhury et al. recommended a gap of at least 15 mm between the recountoured glenoid fossa and the mandible and subjected this gap to extensive active jaw opening exercises to prevent reankylosis when using gap arthroplasty.

Many studies have shown that the choice of interposition material is important in preventing recurrence. Interposition of autogenous or alloplastic material at the ostectomy site is a mechanism to prevent recurrence; however, there are possible disadvantages, such as morbidity at the donor site and unpredictable resorption when autogenous material is used, and the risk of a foreign body reaction when alloplastic material is used.

CONCLUSION

There is no consensus in the existing literature of the best treatment for TMJ ankylosis. Several authors studied and developed different techniques, but
recurrence still remains the major problem when treating TMJ ankylosis. Inadequate exposure of the TMJ region for not to know on the adjacent structures (facial nerve, carotid, jugular and maxillary vessels) often leads to insufficient removal of the ankylotic bone, thus leading to a recurrence of the problem.

Optimal results can be achieved only after a complete assessment and development of a long-term treatment plan. A careful surgical technique and subsequent meticulous attention to long-term physiotherapy are both considered essential to achieve a satisfactory result.

REFERENCES


Source of support : Nil, Conflict of interest : None declared
INTRODUCTION

Cutaneous sinus tract is a rare entity. Because of its cutaneous location, it is generally misdiagnosed and confused with traumatic injuries, furuncles, bacterial infections, carcinomas, osteomyelitis, pyogenic granulomas, foreign objects and congenital fistula. The patient often undergoes multiple antibiotic regimens, surgical excisions, biopsies and even radiotherapy. Delay in diagnosis and unnecessary treatment leads to unaesthetic facial scarring and dimpling.

A sinus tract of endodontic origin is caused by pulp necrosis followed by invasion of micro organisms causing an inflammatory lesion in the periapical area of the affected tooth. The inflammatory process may penetrate the alveolar bone, spreads along the path of least resistance; reaching the soft tissues and forming a path of drainage.

The site of an extra oral drainage depends on which tooth is diseased and on specific factors such as the virulence of the micro organism and the relation between anatomy and facial muscle attachments to determine the trajectory of the fistula.

CASE REPORTS

CASE: I

A 30 year old female patient, was referred to department of Conservative Dentistry and Endodontics with the chief complaint of pus discharge from lower right border of mandible. History taking revealed that the patient had been to a dermatologist for a surgical removal of a cutaneous lesion with recurrence of lesion after some period.

Extra oral examination revealed a crusted cutaneous lesion at the right lower border of mandible approximately 1.5mm x 2mm in size. (figure 1) Intra orally, tooth 46 was found to be...
grossly carious which did not respond to electric pulp testing. Radiographically, the tooth showed diffuse radiolucency around both the roots. (figure2) 

Root canal treatment of tooth 46 was initiated. After access opening, biomechanical preparation was carried out using 1.25% sodium hypochlorite as an irrigant. Calcium hydroxide powder was placed as an intracanal medicament for 20 days. After which the pus discharge had stopped and sinus was progressively healing. Due to the alleviation of symptoms, obturation by lateral condensation technique was followed.

A recall after 6 months showed healing of the extraoral sinus. (figure 3) Radiographs also showed healing of periapical lesion. (figure 4)

CASE: II

A 19 year old female patient reported to the department of Conservative Dentistry and Endodontics with the chief complaint of pus discharge from the chin region since 7 months. The patient gave history of getting root canal therapy done in her lower anterior teeth around 3 years back.

Clinically, mental region showed a cutaneous lesion approximately 3mm in diameter. (figure 5) Intra oral examination showed discoloured mandibular incisors. Radiograph showed improper root canal filling in 31, 41, 42 and periapical radiolucency in relation with both 31 and 41. (figure 6)
Retreatment by non surgical means was attempted in all three incisors. Gutta percha was removed from the canals using H- files, necessary biomechanical preparation was done using 1.25% Sodium Hypochlorite and 2% Chlorhexidine Gluconate as irrigant. Calcium hydroxide powder was placed as an intracanal medicament for 1 month. On recall, the sinus was healed (figure 7) and pus discharge had stopped completely. This was followed by obturation of canals by lateral condensation technique. Post operative radiograph showed that periapical tissues had healed. (figure 8)

The cases characteristically present lesions as an erythematous, smooth, symmetrical nodule, 1-20 mm in diameter. There is periodic drainage and crusting in some cases. A cord-like tract can be felt attached to the underlying bone. Histopathologically, the lesion is a chronic abscess and tract is characterized as fragments of granulation tissue focally lined by stratified squamous epithelium.

For the correct diagnosis the clinicians should give special attention to presence of caries, deficient restorations, periodontal conditions or any discoloured tooth adjacent to the area of cutaneous lesion. As the tooth with necrotic pulp may or may not show any discolouration, radiographic analysis is must which shows periapical bone loss of infected teeth. Only when accurate diagnosis is not possible by this way, etiologic teeth can be confirmed by tracing the sinus tract to its origin with gutta percha or a similar radiopaque material during a radiographic examination. Pulp vitality test of involved teeth generally gives negative results.

Nonsurgical endodontic therapy is the treatment of choice if the tooth is restorable. While for non-restorable tooth, extraction is indicated. Calcium hydroxide is the preferred intracanal medicament. A cutaneous sinus tract is a localized entity and not an indication for antibiotics. Antibiotics may actually be misleading as drainage may stop temporarily. Systemic antibiotic therapy is not recommended in patients with cutaneous sinus tract who have competent immune system, no signs and symptoms of systemic involvement and no other systemic condition requiring prophylactic antibiotic cover.

Most authors believe that once the primary odontogenic cause is removed, the sinus tract and cutaneous lesion heal without treatment. As healing...
occurs by secondary intention leaving scar in most cases, cosmetic surgical treatment may be required at a later date if the healing results in cutaneous retraction or dimpling.

If nonsurgical approach fails (rarely), surgical removal of the dental pathology should be carried out.

CONCLUSION

Any cutaneous sinus on face or neck needs to be examined for a dental origin. Clinical and radiographic analysis can help in localization of the infected teeth and avoid any antibiotic therapy or surgical procedure. In the above mentioned cases, the sinus tracts were eliminated and periapical healing was promoted by nonsurgical root canal therapy.

REFERENCES


How to cite this article : Patel P, Chokshi P, Vaidys R, Atrey A. Non Surgical management of odontogenic cutaneous sinus tract : J Ahm Dent Coll Hos 2012;3(1):34-37.
Source of support : Nil. Conflict of interest : None declared
REVIEW COMMITTEE

Dr. Balaji Manohar
Professor & Head, Dep. of Periodontology,
Pacific Dental College & Hospital, Rajasthan

Dr. Pravin Kudva
Professor & Head, Dep. of Periodontology,
Jaipur Dental College & Hospital, Rajasthan

Dr. Sunita Garg
Professor, Dept. of Conservative Dentistry,
GDCH, Ahmedabad, Gujarat

Dr. Sunilkumar M. V.
Professor & Head, Dept. of Prosthodontics,
Jaipur Dental College & Hospital, Rajasthan

Dr. F. R. Karjodkar
Professor & Head, Dept. of Oral Medicine & Radiology,
Nair Dental College & Hospital, Maharashtra

Dr. Raksha Shah
Ex. Professor & Head, Dept. of Oral Pathology,
GDCH, Ahmedabad, Gujarat

Dr. B. Sivapathasundra
Professor & Head, Dept. of Oral Pathology,
Minaxi ammal Dental College, Tamilnadu

Dr. A. F. Bhatia
Professor & Head, Dept. of Orthodontia,
K. M. Shah Dental College, Gujarat

Dr. Bhagavandas Rai
Professor & Head, Dept. of Oral Surgery,
Pacific Dental College & Hospital, Rajasthan

Dr. Anisha Maria
Professor & Head, Dept. of Oral Surgery,
Morden Dental College, Madhya Pradesh

Dr. Rashmin Naik
Professor, Dept. of Pedodontics,
Manipal College of Dental Science, Karnataka

Dr. Vaishali Nandini prasad
Professor, Dept. of Pedodontics,
Nagpur Dental College, Maharashtra

Mr. P. K. Kulkarni
Ex. Deputy Director, Senior Grade Ststastician,
National Institute of Occupational Health, Gujarat
REVIEW COMMITTEE

Dr. Ajith Krishnan
Professor & head,
Dept. of Public Health Dentistry,
K.M. Shah Dental College & Hospital,
Vadodara, Gujarat.

Dr. Jigna Shah
Professor & Head,
Dept. of Oral Medicine & Radiology,
GDCH, Ahmedabad, Gujarat.

Dr. Megha Jain
Ex. Reader,
Dept. of Conservative Dentistry,
College of Dental Science, GITHARI,
Songadh (Amargadh), Ta.: Sihor,
Dist. : Bhavnagar, Gujarat.
ETHICS COMMITTEE

CHAIRPERSON
Dr. Mahendra K. Joshi
Advocate & Medico Legal Advisor
DEPUTY CHAIRPERSON
Dr. Mahadev Desai
Professor & Head,
Dept of General Medicine, ADCH.

MEMBER SECRETARY
Dr. Rupal Vaidya
Professor & H.O.D,
Conservative Dentistry & Endodontics, ADCH.

COMMITTEE MEMBERS
Dr. Darshana Shah
Professor & H.O.D
Dept of Prosthodontics & Crown & Bridge, ADCH

Dr. Vijay Bhaskar
Professor & H.O.D,
Paedodontics & Preventive Dentistry, ADCH.

Dr. Neha Vyas
Professor & H.O.D,
Oral & Maxillofacial Surgery, ADCH.

Dr. Dolly Patel
Professor & H.O.D,
Orthodontics & Dentofacial Orthopedics, GDCH.

Dr. Chetana Desai
Professor
Dept of Pharmacology
BJMC, Ahmedabad.

Dr. Archana Dalal
Associate Professor
Department of General Surgery
NHL Municipal Medical College

Dr. Sujal Parkar
Sr. Lecturer
Department of Public Health Dentistry, ADCH.

Dr. Archita Kikani
Professor
Department of Periodontology
ADCH.

Dr. Bhavin Dudhia
Professor
Department of Oral Medicine & Radiology, ADCH.
ETHICS COMMITTEE

Dr. Dilip Zaveri
Director
Biocare Research (India) Pvt. Ltd.
Paldi, Ahmedabad

Dr. M.Ganesh
Reader,
Paedodontics & Preventive Dentistry   ADCH.

Dr. Keval Shah
Professor
Prosthodontics & Crown &Bridge, ADCH

COMMUNITY REPRESENTATIVE/SOCIAL WORKER
Mr. Ashish Shah