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Education is not merely an act of acquiring facts but also of values and integrity. These help enhance our personality and contribute to making the world a better place to live in. At D. Y. Patil University, School of Dentistry, we strive to bring together academic excellence and human values. Our learning model is grounded in its core values and fosters student’s development into knowledgeable and competent healthcare professionals who are critical thinkers, reflective and yet proactive. It has been our constant endeavour to create healthcare professionals who are committed to lifelong learning and imbued with a sense of good citizenship, leadership and ethical behaviour.

To add to our never ending list of world class initiatives, we have brought in a journal named Indian Journal of Oral Health and Research. This journal aims to include state of the art research and developments in all fields of dentistry. It will further endorse our commitment to excellence. I heartily congratulate the entire editorial team for their effort and may this journal become a truly comprehensive platform in the field of dentistry.

Dr. Vijay D. Patil
‘Intelligence plus character—that is the goal of true education.’

D. Y. Patil University, School of Dentistry has made this a way of life. It provides an environment that inculcates values, integrity and thirst for knowledge. It is because of this desire to excel and to tap that potential in every individual that D. Y. Patil University, School of Dentistry has created a niche for itself.

It is with great happiness and pride in my heart that I congratulate all our students and teachers for this achievement. Their pursuit of excellence, no matter how daunting, is the reason for us being where we are.

I want to acknowledge everybody associated with Indian Journal of Oral Health & Research for their efforts in making this a big success. This publication aims at chronicling outstanding work done in research and clinical cases of oral and maxillofacial regions. I am sure that the effort in this project will be of the same exacting standards our institution is synonymous with.

Dr. Sanjay Oak
It’s my immense pleasure to introduce the inaugural issue of Indian Journal of Oral Health and Research (IJOHR)

On behalf of IJOHR Editorial Team, I would like to extend a very warm welcome to the readership of IJOHR. IJOHR is dedicated to the rapid dissemination of high quality research papers to meet the challenges of the 21st century.

Research is the back bone of science. There is no dearth of innovative ideas or inquisitiveness among people in the dental fraternity. D.Y. Patil University encourages such scientific research. A critical aspect of the research process is the reporting of new results and findings in scientific journals in order to disseminate information to the larger community of researchers. This new journal was envisioned and founded to fulfill the growing needs of dentistry.

Over the years, conventional practice has been to publish in high impact factor journals, preferably well established ones with wide circulation. Despite this drawback, authors from overseas have shown interest in our journal by submitting their valuable contributions. I wish to assure all authors that the Editorial team shall make every effort possible within its capacity to get this journal indexed as well as achieve a good impact factor.

I take this opportunity to thank our management, editorial board, contributing authors, board of reviewers and the publication house and all the patients who have given their consent to publishing their data and for making this journal a reality. I hope this journal will serve as a platform for young researchers to envision the solutions to difficult problems in dentistry.

Finally, we wish to encourage more contributions from the scientific dental fraternity to ensure a continued success of the journal. We also welcome comments and suggestions that could improve the quality of the journal.

We look forward to welcoming your submissions.

Thank you. We hope you will find IJOHR informative.

Dr. Avinash Tamgadge
Editor In Chief
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INTRODUCTION

The use of tobacco and its products remains one of the most preventable causes of human morbidity and mortality globally.\textsuperscript{[1]} “Tobacco impoverishes entire nations, just as it does individual families.”\textsuperscript{[2]} Facing strong opposition and stringent regulations in rich and developed countries, the tobacco industry and manufacturers have slowed their expansion in rich countries and are now focusing on developing countries.\textsuperscript{[2]} Urgent action is required to prevent the inevitable health and social catastrophes linked to large scale tobacco consumption. Tobacco usage has a dual burden on the economy of the consumers: (a) Burden on the economy of the family from the money spent on tobacco products and (b) health burden or treatment costs which occur as a result of diseases attributed to tobacco usage.\textsuperscript{[1]} Government, nongovernmental organizations (NGO’s) and research groups are creating awareness among tobacco users about the ill-effects of tobacco usage through various strategies including, advocacy for an increase of taxes on tobacco products, ban on smoking in public places and mandatory printing of pictorial warning on packs of tobacco products.\textsuperscript{[1]}

The Department of Health and Family Welfare, Government of India (GOI) has done a great deal toward fighting against usage of tobacco by introducing various fiscal and nonfiscal measures.\textsuperscript{[3]} One such nonfiscal measure is the introduction of health warnings on packages (both smoked and smokeless forms of tobacco).\textsuperscript{[3]} Health warning labels on tobacco products constitute the most cost-effective tool for educating smokers and nonsmokers alike about the health risks of tobacco use.\textsuperscript{[4]} There is definite evidence from studies in many developed countries such as Australia, Canada, UK and USA, where health warnings on cigarette packaging are effective for tobacco control. Changes to increase the severity of health warnings are associated with increased effectiveness and text-plus-graphic warning labels are more salient and potentially more effective than word-only labels.\textsuperscript{[5,6]} However, intervention measures may not always be as effective if directly transferred from one setting to another, without being tailored to the tobacco production and consumption context.

ADOPTION OF PICTORIAL WARNINGS

India is a signatory of the World Health Organization (WHO) framework convention on tobacco control (FCTC). As per the guidelines in the article 11 of FCTC,\textsuperscript{[7]} the Ministry of Health, GOI made pictorial warnings mandatory on smoked and smokeless forms of tobacco products effective from May 31, 2009.\textsuperscript{[8]} This move by the government was a major step toward creating awareness among both tobacco consumers and nonconsumers. This feat was achieved through concerted pressure on the GOI from NGOs, research agencies and international agencies.\textsuperscript{[9]} Studies in many countries have
shown that pictorial warnings, when used appropriately, have resulted in decreased use of tobacco among consumers.[10-12] The pictorial warnings on packs of tobacco products in India have been primarily that of a scorpion, skull, pictures of oral cancer or a picture of lungs [Figure 1].

However, the use of pictorial warnings in India would be better served by a stronger evidence base to inform the design of the campaign. Some key issues that need to be researched further arise from broader population issues of access to tobacco and purchasing and distribution patterns, as well as education and interpretation of warning images specifically.

FULL CIGARETTE AND BIDI PACKS VERSUS LOOSE CIGARETTES AND BIDIS

In India, cigarettes and bidis are purchased loose as well as in packs.[13,14] Ambika Srivastava, in her paper commissioned by the WHO, mentions that as much as 65% of cigarette sales in India occurs from single cigarettes sold by paan-bidi outlets and not in packs.[15] The reasons for purchasing loose cigarettes rather than packs range from “affordability” among low income smokers and students to the “fear of being caught” among school children if carrying cigarettes in large quantities.[16] There is also a perception among smokers that, if they buy too many cigarettes at a time, they smoke at a faster rate than if they had bought one or two.[16] So, even though purchase of loose or single cigarettes may be a strategy to cut down on the cigarette consumption, the pictorial warning on the pack remains with the vendor and the consumer is not exposed to the warning.

The Global Adult Tobacco Survey Report For India (2009–2010) states that 71% of cigarette smokers, 62% of bidi smokers and 63% of smokeless tobacco users noticed health warnings on packages of the respective products.[17] This reflects that not all smokers see the packaging and that even when they do, the impact is questionable. Authors argue that there is a need to strengthen and target the health messages in a better way to ensure that the warnings reach all smokers including those buying loose cigarettes/bidis. This will have more impact on those consumers who see the packaging. We also need to ensure that the health warnings reach those who buy loose cigarettes/bidis.

PICTORIAL WARNINGS

Although pictorial warnings are particularly useful in communicating health information to populations with low literacy rates, it is very important to ensure proper care is to be taken in the selection of pictures for use in low literacy populations.[4] As mentioned by Fong et al., “without supporting text, pictures of smoking could inadvertently suggest approval rather than warning of its harms. Although pictures may say 1000 words, it is critical to select those that say the correct 1000 words.”[4] This is especially true in India. Some degree of prior education on the causal links between the pictures shown (diseased lungs and oral cancer) and morbidity and mortality from smoking is needed for clear comprehension. More research on the comprehension of pictorial warnings on tobacco packaging is necessary.

STATUTORY WARNINGS

The sign “not for sale to minors” on the cigarette packs is written on the sides of the foldable top of the cigarette packs and is not immediately visible to the consumers and can only be read by those who are literate. Although the literacy rate in India (which is defined as the ability to read, write and understand in any language for a person who is older than 7 years of age) is around 65%,[18] the literacy rate for English language is likely to be much lower and needs to be quantified. A 2005 report claims that the English literate population in India is just 5%.[19] Current written statutory warnings are printed predominantly only in English or English and Hindi (India’s National Language) [Figure 1]. In many states in India, the majority of people only know the local dialect and cannot read or write in either English or Hindi.

CONCLUSIONS AND RECOMMENDATIONS

In reviewing the implementation of tobacco warnings in India, we have identified some possible ways to further strengthen the campaign and ensure maximum impact of anti-tobacco messaging on tobacco products:

- Printing pictorial warnings on both front and back surfaces of the packaging along with relevant text material
- Printing the warning in English and Hindi or even better, in the local language (dialect) of the state where the packs are marketed (i.e. if a cigarette is being marketed in Tamil Nadu state, the warning should also be in Tamil)
- Evaluation of pictorial warnings (scorpion, lungs etc.,)
to ensure that the message from the pictures is clearly understandable by the whole population, regardless of literacy levels

- Investigate whether the statutory warning “smoking injures health” could be printed on the paper wrap of the cigarettes or the filter area and hence that, even if people buy a single cigarette, they have a chance to see the warning.

Urgent action is required in order to put a stop to the inevitable health and social catastrophes linked to large scale tobacco consumption in the developing world. Measures to make anti-tobacco messages on packaging of tobacco products meaningful in the Indian context will be a small, but significant additional step in the fight against tobacco.

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INTRODUCTION

Noninsulin dependent diabetes mellitus (DM) is rapidly becoming a common chronic disease among the urban population. At the same time, the morbidity and mortality associated with oral cancer is increasing despite exhaustive research. Are they related? Is impaired glucose tolerance (IGT) a risk factor or a predisposing factor for oral cancer? There are studies on the inflammatory lesions of the periodontal tissues and oral mucosa in patients with DM,[1] these oral alterations are more serious in untreated or inadequately treated diabetic patients,[2] but there are hardly any studies on DM and its association with oral cancer.

Studies state that altered metabolism as in DM leads to breakdown in oxidation equilibrium leading to elevated glucose concentration, excessive formation of free radicals, leading to reduced activities of the antioxidant scavengers bringing out serious damages in the biological structures even at a molecular level.[3,4]

Diabetes mellitus is associated with increased risk, as well as the worse outcome, of various malignancies, including endometrial, colon and pancreatic cancers.[5] The present study proposes a novel hypothesis for an etiological association between prediabetes, diabetes as a risk for cancers of the oral cavity. A large population of India is habituated to vices like tobacco and alcohol; hence we would also like to throw light on the relation between alcohol and tobacco in the causation of oral cancer.

There are similar studies reported in the west but very few among Asians,[6] since there is considerable heterogeneity in the genetic background and lifestyle between Asian and Western populations, it is of value to review the influence of prediabetes on the risk of oral cancer.

MATERIALS AND METHODS

Study population

Oral cancer subjects who visited for treatment to any of these three tertiary care hospitals of Manipal Hospital between October and December 2013. Expected sample size was calculated using following figures: Expected proportion of IGT in control group = 15%, anticipated odds ratio = 3,
Calculated proportion of IGT among cancer patients = 35% and accordingly the power of study was calculated as 80%. The number of subjects recruited for the study was 45 subjects and 45 controls, the controls were people from the general population who were not known to be suffering from any illness. Ethics committee approval was obtained from Institutional Ethics Committee, and informed consents were taken from study participants.

Each participant completed a self-administered questionnaire covering medical history, family history of cancer, antidiabetic treatment, smoking habits, alcohol intake, and leisure-time physical activity. Smoking and alcohol intake were classified as either current use or not. At the baseline examination, we performed a 75-g oral glucose tolerance test between 8:00 am and 10:30 am after at least 8-h overnight fast. Plasma glucose levels were measured by means of the glucose oxidase method. Glucose tolerance was classified according to American Diabetes Association (ADA) diagnostic criteria 2002.[7]

Statistical analysis
The collected data were fed in the computer in MS excel and the analysis was performed using the statistical package SPSS version 11.5. The quantitative variables were analyzed using Student’s t-test and ANOVA. The qualitative variables were analyzed using Chi-square test. A P < 0.05 was taken as statistically significant. The statistical significance of differences in the mean values and frequencies of risk factors was estimated by means of analysis of covariance and logistic regression analysis, respectively.

RESULTS
Our study subjects and controls were age and gender matched. More than a third of the cases (36%) were in the fifth decade of their life, about 24% of them were in their 60’s. 20% of the cases were between 40 and 50 years. Only 4% of the cases were in their 70’s. 46% of our study subjects were diabetic, 54% of the cases were hyperglycemic as compared to 31% of the controls [Tables 1 and 2]. 71% of them were males. Majority of the cases (75.6%) did not have any family history of oral cancer. More than half of the cases (58%) consumed tobacco in the study population and among controls, 64% did not consume tobacco. Among those with habits in the study group, 65.3% of them were smokers, 34% of them were paan chewers, and 23% of them were paan chewers as well as smokers. Among the study population, half of the cases (53.3%) had a history of alcohol consumption, whereas 51% of controls did not consume alcohol.

DISCUSSION
The present study clearly demonstrated that higher fasting plasma glucose and 2-h postprandial glucose levels were significantly associated with increased risks of oral cancer. These associations remained robust even after adjustment for other confounding factors, like consumption of tobacco and alcohol. Interestingly, we found that the risk of cancer death was increased significantly not only in diabetic subjects but also in subjects with IGT as compared with subjects with normal glucose tolerance. These findings highlight the clinical value of early management of hyperglycemia, even in the prediabetic range, to prevent cancer death.

Abnormal glucose was found in nearly half of the cases with oral cancer in comparison with control, while nearly quarter of the controls had abnormal glucose tolerance. This can be due to associated insulin resistance in type II DM. Chronically increased levels of insulin resulting in hyperinsulinemia, have been associated with colon cancer and cancer of breast, pancreas and endometrium. These tumourogenic effects of insulin could be directly mediated by insulin receptors in the preneoplastic target cells or might be due to related changes in endogenous hormone metabolism.[8] Recent studies say that insulin promotes the synthesis and biological activity of insulin like growth factors-1 (IGF-1), which act as a growth factor that promote cell proliferation and inhibits apoptosis. There is evidence that the effect of IGF-1 might be related to p53 mutations, which are quite common in head and neck malignancies.[9,10]

Several prospective population-based studies have assessed the association between diabetes and cancer death, but laboratory parameters used were fasting plasma glucose levels[11,12] or postprandial glucose levels.[13,14]

More than half of our study subjects were regular abusers of tobacco either in smoking form or smokeless form. Nearly half of them had a history of alcohol usage, this is consistent with the study done in Kerala.[15]

<p>| Table 1: Glycemic parameters of cases and controls |</p>
<table>
<thead>
<tr>
<th>Cases (%)</th>
<th>Controls (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normoglycemic</td>
<td>21 (46)</td>
</tr>
<tr>
<td>Hyperglycemia (IFG+IGT+DM)</td>
<td>24 (54)</td>
</tr>
<tr>
<td>IFG</td>
<td>7 (29)</td>
</tr>
<tr>
<td>IGT</td>
<td>6 (25)</td>
</tr>
<tr>
<td>DM</td>
<td>11 (46)</td>
</tr>
<tr>
<td>Mean FBS (mg/dl)</td>
<td>96±12</td>
</tr>
<tr>
<td>Mean 2 h OGTT (mg/dl)</td>
<td>108±22</td>
</tr>
</tbody>
</table>

IFG: Impaired fasting glucose, IGT: Impaired glucose tolerance, DM: Diabetes mellitus, FBS: Fasting blood sugar, OGTT: Oral glucose tolerance test

<p>| Table 2: Glucose tolerance among cases and controls |</p>
<table>
<thead>
<tr>
<th>Cases</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal OGTT</td>
<td>21</td>
</tr>
<tr>
<td>Impaired OGTT</td>
<td>6</td>
</tr>
<tr>
<td>IGT</td>
<td>7</td>
</tr>
<tr>
<td>DM</td>
<td>11</td>
</tr>
</tbody>
</table>

IGT: Impaired glucose tolerance, DM: Diabetes mellitus, OGTT: Oral glucose tolerance test
November 2019

Majority of the cases were males, and there is a statistically significant association in men for the development of oral cancer. It is possible that males and females reported history of diabetes differently and due to social reasons females report to doctors quite late. Men are likely to represent patients with poorer metabolic control, leading to higher levels of insulin, and probably more oxidative damage to DNA. It has been proposed that poor diabetic control is associated with an increased cancer risk due to enhanced oxidative damage to DNA.[16,17]

CONCLUSIONS

The following conclusions were drawn, hyperglycemia (which includes impaired fasting glucose, IGT and diabetes) increase the risk of oral cancer two-folds, and however IGT alone as defined by ADA does not appear to play a role. Several potential confounders of the association between DM and cancer incidence were accounted for in the analysis, although the possibility of residual confounding factors cannot be denied. However, numerous potential confounders were controlled in the present study. We did not obtain information about the use of some antidiabetic drugs that could improve insulin resistance and reduce the risk of cancer.

In summary, the current study suggests preexisting DM is positively associated with the incidence of oral cancer. Given the increasing epidemic of DM in recent years, it is time to be on the move and start preventive programs aimed at those with DM, so as to prevent cancer.

Strength

The strength of the present study is its prospective design, which prevents recall bias.

Limitations

In our study, serum insulin level estimation was not done, which is the most appropriate test to determine the insulin resistance, this was due to financial constraints.

REFERENCES


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ASSOCIATION OF ORAL LESIONS AND IMMUNOSUPPRESSION IN HUMAN IMMUNODEFICIENCY VIRUS/ACQUIRED IMMUNE DEFICIENCY SYNDROME PATIENTS NOT TAKING ANTIRETROVIRAL THERAPY IN PAKISTAN

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ABSTRACT

Background: Oral lesions, especially oral candidiasis, oral hairy leukoplakia, necrotizing periodontal conditions and variety of other viral and bacterial infections are essentially presented in human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) patients due to low CD4+ count. Aims: This study was designed to determine various oral clinical and cytological mucosal changes seen in HIV/AIDS patients not taking antiretroviral therapy (ART) in Pakistan and their relation to CD4+ lymphocyte count as no study has been reported yet in our country. Materials and Methods: Patients were clinically examined and staged according to World Health Organization (WHO) staging system. Oral smears, from \( n = 25 \) patients not taking ART, were prepared and examined microscopically using hematoxylin and eosin, periodic acid–Schiff and Papanicolaou stains. The CD4+ lymphocyte count was determined using flow cytometry. Result: Oral lesions were present in 36% of the patients with chronic periodontitis in 20%, oral candidiasis in 12%, oral pigmentation in 8% and oral ulcers in 4% patients. On cytological examination, fungi were detected in 56% smears. Inflammation was seen in 60% smears, micronuclei in 72%, nuclear atypia in 44% and dysplastic changes in 16% (grade 1 in 12% and grade 2 in 4%) smears. The mean CD4+ lymphocyte count was 338.12 ± 127 cells/mm\(^3\). The CD4+ lymphocyte count was grouped as < 350 cells/mm\(^3\) (Group 1) and > 350 cells/mm\(^3\) (Group 2). Group 1 comprised of \( n = 15 \) while Group 2 had \( n = 10 \) patients. Most of the oral lesions were seen in CD4+ Group 1 having low CD4+ count. When the cytopathological variables were compared with WHO clinical stages, a statistically significant association (\( P < 0.05 \)) was observed in the case of pseudomembranous candidiasis clinically and dysplasia and presence of fungi cytologically. Conclusion: This study highlights the importance of oral lesions as a marker of HIV/AIDS progression and immunosuppression as oral lesions were frequent with low CD4+ count especially < 350 cells/mm\(^3\).

Key words: Human immunodeficiency virus/acquired immune deficiency syndrome, immunosuppression, oral lesions, Pakistan

INTRODUCTION

Numbers of human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) patients are increasing in Pakistan especially due to high risk groups including sex workers and injecting drug users along with their spouses and children, which are becoming a bridging population in the society.[1] Oral lesions including oral candidiasis, oral hairy leukoplakia, recurrent ulcerative conditions, severe periodontal diseases, different viral infections (including human papilloma virus and herpes simplex) and variety of oral cancers, especially Kaposi sarcomas are essentially related to the entire HIV/AIDS disease course.[2] These oral lesions are considered to be the reliable predictors of severe immunosuppression and disease progression along with low CD4+ lymphocyte count in HIV/AIDS patients.[3] No study has been reported from Pakistan that describes oral lesions present in HIV/AIDS population. Hence, this study was designed to find out clinical as well as cytological changes in the oral mucosa of these patients and their relation to CD4+ lymphocyte count.

MATERIALS AND METHODS

This study was approved by the Ethical Review Board of the University of Health Sciences Lahore. A total of 25 HIV/AIDS positive patients reporting to HIV Voluntary Counseling and Testing Centers working under Punjab AIDS Control
Programme (PACP) Pakistan from April to September, 2013, were selected after taking written informed consent. All the patients were carefully examined for oral mucosal changes and relevant selected clinical history was recorded. Patients were staged according to World Health Organization (WHO) clinical staging system. The oral lesions were diagnosed according to the criteria by Oral HIV/AIDS Research Alliance.[2] After oral examination, normal saline was given according to the criteria by Oral HIV/AIDS Research Alliance.[2] After oral examination, normal saline was given to the patients to rinse the oral cavity, and oral smears were taken by scraping the buccal mucosa. All the slides were fixed in 95% ethanol and then stained with hematoxylin and eosin, Papanicolaou stain by the recommended procedures. Periodic acid–Schiff and Grocott’s methenamine silver stains were applied where fungal infection was suspected. Blood samples were taken from all patients, and CD4+Cell Count was determined through flow cytometry at the Department of Immunology, UHS Lahore, Pakistan.

Statistical analysis

Results were analyzed using Statistical Package for Social Sciences Software Version 18. Chi-square tests were used to find out the associations between different variables. $P \leq 0.05$ was considered as statistically significant.

RESULTS

Mean age of the patients was 33.08 ± 8.3 (range: 21–52) years. About 88% ($n = 22$) of the patients were males, 8% ($n = 2$) were females while 4% ($n = 1$) were transgender (Hijra). Male:female ratio was 7.3:1. After a careful history taking and examination of oral mucosal changes, the patients were classified according to WHO clinical staging system.[4] It was observed that about 84% ($n = 21$) patients were in clinical stage 1, 8% ($n = 2$) each in clinical stages 2 and 3 while none of the patients in the clinical stage 4 was seen. Oral lesions were found in 36% ($n = 9$) of the patients while 64% ($n = 16$) had no lesion. Clinical and cytological changes found in the oral cavity of HIV/AIDS patients are summarized in Table 1.

CD4+ lymphocyte count was quantitatively grouped as Group 1 with CD4+ lymphocyte count < 350 cells/mm$^3$ and Group 2 having CD4+ lymphocyte count > 350 cells/mm$^3$. This cut point of 350 cells/mm$^3$ was used because it is considered as the level of advanced immunosuppression according to WHO immunological classification.[6] Mean CD4+ lymphocyte count was 338.12 ± 127 cells/mm$^3$.

Clinical and cytological variables were compared to CD4+ lymphocyte groups by applying Chi-square tests [Table 2]. Inflammation was significantly associated ($P = 0.03$) with CD4+ lymphocyte Group 1 while all other variables yielded insignificant associations but most of them were present in Group 1 with < 350 cells/mm$^3$.

When the cytopathological variables were compared to WHO clinical stages [Table 3], a statistically significant association ($P < 0.05$) was observed in the case of pseudomembranous candidiasis clinically and dysplasia and presence of fungi cytologically. Frequencies of many clinico-cytological variables were increased with

| Table 1: Oral clinical and cytological mucosal changes in HIV/AIDS patients not taking ART |
|-------------------------------------------------|----------------|-----------------|----------------|-------------|----------------|
| Periodontitis | Oral candidiasis | Oral pigmentation | Oral ulcers | Micronuclei | Inflammation |
| 20% ($n=5$) | 12% ($n=3$) | 8% ($n=2$) | 4% ($n=1$) | 72% ($n=18$) | 60% ($n=15$) |
| Acute=44% | Chronic=12% ($n=3$) | Mixed=4% ($n=1$) |
| Fungi | Nuclear atypia | Dysplasia |
| 56% ($n=14$) | 44% ($n=11$) | 16% ($n=4$) |
| G1=12%, G2=4% |


| Table 2: Association between clinical-cytological variables and CD4+groups |
|-------------------------------------------------|----------------|-----------------|-------------|----------------|
| Clinical and cytological variables | Group 1 | Group 2 | Total (%) | $P$ |
| <350 cells/mm$^3$ CD4+ lymphocyte count ($n=15$) (%) | >350 cells/mm$^3$ CD4+ lymphocyte count ($n=10$) (%) |
| Oral ulcers | $n=1$, 4 | 0 | $n=1$, 4, 0 | 1.0 |
| Pseudomembranous candidiasis | $n=3$, 12 | 0 | $n=3$, 12 | 0.25 |
| Chronic periodontitis | $n=3$, 12 | $n=2$, 8 | $n=5$, 20 | 1.0 |
| Oral pigmentation | 0 | $n=2$, 8 | $n=9$, 36 | 1.0 |
| At least one clinical lesion* | $n=5$, 20 | $n=4$, 16 | $n=9$, 36 | 1.0 |
| Inflammation | $n=12$, 48 | $n=3$, 12 | $n=15$, 60 | 0.03 |
| Dysplasia | $n=4$, 16 | 0 | $n=4$, 16 | 0.12 |
| Fungi | $n=11$, 44 | $n=3$, 12 | $n=14$, 56 | 0.11 |
| Micronuclei | $n=13$, 52 | $n=5$, 20 | $n=18$, 72 | 0.11 |
| Nuclear atypia | $n=9$, 36 | $n=2$, 8 | $n=11$, 44 | 0.09 |

*Number of patients with at least one oral lesion as many patients had more than one lesion.
increase in clinical stage, which shows an increase in oral mucosal pathological changes with increased immunosuppression (low CD4+ count).

DISCUSSION

Oral lesions in the present study are found in 36% patients which is in accordance to the results of Noce et al. when he reported the oral lesions in 37% patients in his study. Chronic periodontitis (presence of periodontal pockets > 4 mm) was seen in 20% of the patients in this study but Rath and Raj from India have reported a higher prevalence (29%) than this study. Pseudomembranous candidiasis (scrapable white plaque revealing an erythematous base) was observed in 12% of the patients in the present study while Shiboski et al. have reported it up to 6% patients, which is about half of the results of the present study. Oral pigmentation (asymmetrical oral mucosal hyperpigmentation of > 1 cm) was seen in 8% of the patients in this study, but Bravo et al. had reported a higher frequency (38%) than the present study. Oral ulcers are observed in 4% of the patients in the present study, which is the same reported by Greenspan et al. No study has been carried out that describes the cytological changes in the oral mucosa of HIV/AIDS patients hence the results of the cytological changes cannot be compared to other studies.

In this study, most common cytological change observed was the presence of micronuclei found in 72% smears. Micronucleus is an extra small nucleus that has well defined nuclear membrane and is present in the vicinity of the main nucleus or may be united with it. Micronucleus has the same color intensity as that of the main nucleus. Shimura et al. reported that Vpr an accessory gene of HIV may be involved in micronucleation while Casartelli et al. reported that a gradual increase in micronucleus counts from normal mucosa to precancerous lesions to carcinomas suggests a link of this biomarker with neoplastic progression.

Inflammation of mild to moderate severity was found in 60% of the cases. It has been reported that HIV infection leads to long-term immune activation, chronic inflammation and high levels of inflammation associated diseases. Fungi were detected in 56% of the patients. The most common was the Candida albicans. No study has been reported that describes the frequency of fungi in the oral squamous cells of HIV/AIDS patients. Hence, the results of the present study cannot be compared to the other studies. Nuclear atypia showing altered N/C, nuclear pleomorphism, increased typical mitosis, prominent nucleoli, binucleation, multinucleation, karyorrhexis, and karyolysis was seen in 44% of the cases. Dysplasia showing features of atypical mitosis, hyperchromasia, nuclear pleomorphism, multinucleation was seen in 16% patients. Dysplasia and atypical nuclear changes in the oral squamous cells may lead to oral malignancies. Shiels et al. reported that HIV/AIDS positive patients are at increased risk of developing oral cancers. Pineda and Welton reported that abnormal cytological changes including nuclear atypia and dysplasia may be mostly seen with low CD4+ lymphocyte count, especially < 200 cells/mm³.

When the clinical and cytological variables were compared with the CD4+ lymphocyte groups using Chi-square test inflammation was found to be statistically significant (P = 0.03). All other variables yielded insignificant associations, but most of the clinical and cytological changes were seen in CD4+ lymphocyte Group 1 having CD4+ count < 350 cells/mm³ which is the state of advanced immunosuppression according to WHO immunological classification. Hence, it can be inferred that oral changes are frequent with low CD4+ count. This finding is concordant with the different studies reported in the literature. When the clinical and cytological variables were compared with WHO clinical stages using Chi-square test, oral candidiasis, fungi and dysplasia were significantly (P < 0.05) increased in CD4+ Group 1. Furthermore many clinical and cytological variables were increased with the advancing WHO clinical stage, which may show that oral changes may be increased with increasing immunosuppression. This finding is in accordance with the results of Hegde et al.

CONCLUSION

Varied oral mucosal changes were observed in the HIV/AIDS patients including oral ulcers, pseudomembranous candidiasis,
chronic periodontitis and oral pigmentation clinically while mild to moderate inflammation, fungi, micronuclei, nuclear atypia and dysplasia cytologically. Oral clinical and cytological mucosal changes were frequent with the low CD4+ lymphocyte count especially < 350 cells/mm³ hence these oral changes can be used as noninvasive and cost effective markers of immunosuppression and disease progression.

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Lipomas of Oral and Maxillofacial Region: A Case Series

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ABSTRACT
Objective: Lipomas are the most common soft tissue tumors in the human body, but only 15-20% of cases occur in the oral and maxillofacial region. Hence in this study, we describe the clinical and histopathologic features of eight cases of lipomas in the oro-facial region. Materials and Methods: The cases reported during the period 2009-2014 to the Department of Oral and Maxillofacial Pathology were retrieved for the study as none of the cases of lipomas reported before. Clinical data were collected from patient’s records, and cases were reviewed and classified microscopically. Results: Of the eight cases, six were female patients, and two were males; their mean age was 47 years (ranges: 22-76 years). In the present case series, lipomas showed multiple site involvement in the oral and maxillofacial region with the mean size of tumor being 3 cm (ranges 1.5-4.5 cm). Microscopically, three cases were classic lipomas, four were fibrolipomas and one was intramuscular or infiltrating lipoma. All cases had been treated by simple surgical excision, were followed, and no recurrence was reported. Conclusion: Lipomas of oral and maxillofacial region are relatively uncommon tumors. They have no gender as well as the site predilection for occurrence. The most common histological variant was found to be fibrolipoma. Surgical excision is the treatment of choice with a good prognosis.

Key words: Benign tumor, fibrolipoma, intramuscular, intraoral site

INTRODUCTION
Lipomas are benign soft tissue neoplasms of mature adipose tissue.[1] They most commonly involve proximal portions of the extremities and seldom the oro-maxillofacial region.[3] 15-20% of the cases involve the head and neck region, whereas 1-4% cases affect the oral cavity which is very uncommon.[3] As lipomas are relatively rare in oral and maxillofacial region, very few case series have been published in the literature review.[4-6] Therefore, the aim of this study was to assess the clinical behavior, histopathologic features and differential diagnosis of eight cases of lipomas located in oral and maxillofacial region.

MATERIALS AND METHODS
Registry of the Department of Oral and Maxillofacial Pathology of the institution during the period 2009-2014 was analyzed for benign soft tissue tumors. We found eight cases of lipoma amongst 205 cases of benign soft tissue tumors reported as none of the cases of lipomas reported before 2009. All lipoma cases were retrieved for this case series. Clinical data, such as age and gender of the patient, site and size of the tumor, origin, progress, duration of the lesion, treatment and follow-up were obtained from the patient’s records. Hematoxylin and eosin stained slides of each case was reviewed microscopically and classified according to Gnepp[7] as follows: Simple lipoma, other variants: fibrolipoma, spindle cell lipoma, intramuscular or infiltrating lipoma, angiolipoma, salivary gland lipoma (sialolipoma), pleomorphic lipoma, myxoid and atypical lipomas.

RESULTS
The clinical features, origin, progress and duration, histological subtypes, treatment with follow-up of the eight cases of lipomas is summarized in Table 1. Of eight cases, six patients were females, and two were men, with a mean age of 47 years (ranges: 22-76 years). In six cases, the reported duration of the complaint varied from 12 to 48 months (mean 28 months). The exact history of duration was not reported in the remaining two cases. Considering the site of lesion amongst the total eight cases, there was one case each on buccal mucosa, labial mucosa, floor of mouth, anterior palate, vermillion border of lower lip, tongue, buccal vestibule and attached gingiva. The size of the tumors varied from 1.5 to...
4.5 cm (mean 3.0 cm). Clinically all cases presented as painless, well-circumscribed, submucosal nodules, with yellowish discoloration and fibro-elastic consistency [Figure 1]. All lipomas were freely movable except intramuscular type that exhibited diminished mobility. All patients were treated by surgical excision without any recurrence in the follow-up period (ranges: 6-48 months).

Microscopically, three cases were classified as classic lipomas (28.5%), four were fibrolipomas (57.1%), and one was intramuscular lipoma (14.3%). Mature adipose cells without atypia and necrosis, formed the classic lipomas [Figure 2]. The fibrolipoma was composed of the mature adipose cells and was surrounded by dense fibrous connective tissue [Figure 3]. Intramuscular lipoma showed mature adipocytes with infiltrating growth pattern extending in between skeletal muscle bundles [Figure 4].

**DISCUSSION**

Lipomas are benign mesenchymal neoplasms of mature adipocytes mostly occurring in subcutaneous tissue, rarely in deep tissues and oro-maxillofacial regions. The first reported case of oral lipoma was described by Roux in a review of alveolar masses, and he referred it to as “yellow epulis” (Roux 1848). 

The etiology and pathogenesis of lipomas are unclear, although mechanical trauma, endocrine and inflammatory influences have been reported. Most lipomas are developmental and the ones occurring in maxillofacial regions, usually, arise late in life and may present as a neoplasm.

Hypertrophy theory suggests that the obesity and inadvertent growth of adipose tissue are contributory to the formation of these lesions. The fat from lipomas is not used up in general metabolism during periods of starvation like fat from normal adipose tissue. Another theory known as “metaplasia theory” suggests that lipomatous development occurs due to aberrant differentiation of mesenchymal cell-lipoblast. Lin and Lin suggest that lipomas are congenital lesions arising from embryonic multipotent cells. The factors contributing for etiology of lipomas as enumerated by Enzinger and Weiss include chromosomal abnormality like translocation of t(3:12)(q127:q13) and I (3:12)(28:q14), diabetes mellitus, hypercholesterolemia and obesity. In our case series, four cases gave a history of trauma, two were obese with high lipid profile, while others had unknown etiology.

The peak incidence of age for lipomas is fourth to fifth decades of life. However in our case series, we had two

<table>
<thead>
<tr>
<th>Patient’s age (years)</th>
<th>Gender</th>
<th>Site of tumor</th>
<th>Size of tumor (cm)</th>
<th>Duration of lesion (months)</th>
<th>Histologic subtypes</th>
<th>Follow-up (month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Female</td>
<td>Buccal mucosa</td>
<td>2</td>
<td>12</td>
<td>Lipoma</td>
<td>48</td>
</tr>
<tr>
<td>22</td>
<td>Female</td>
<td>Labial mucosa</td>
<td>1.5</td>
<td>14</td>
<td>Intramuscular lipoma</td>
<td>32</td>
</tr>
<tr>
<td>70</td>
<td>Female</td>
<td>Floor of mouth</td>
<td>2.5</td>
<td>15</td>
<td>Fibrolipoma</td>
<td>-</td>
</tr>
<tr>
<td>41</td>
<td>Male</td>
<td>Anterior palate</td>
<td>4</td>
<td>-</td>
<td>Fibrolipoma</td>
<td>24</td>
</tr>
<tr>
<td>54</td>
<td>Female</td>
<td>Vermilion border of lower lip</td>
<td>4.5</td>
<td>-</td>
<td>Lipoma</td>
<td>-</td>
</tr>
<tr>
<td>60</td>
<td>Male</td>
<td>Tongue</td>
<td>3</td>
<td>48</td>
<td>Lipoma</td>
<td>18</td>
</tr>
<tr>
<td>30</td>
<td>Female</td>
<td>Buccal vestibule</td>
<td>2.5</td>
<td>12</td>
<td>Fibrolipoma</td>
<td>36</td>
</tr>
<tr>
<td>76</td>
<td>Female</td>
<td>Attached gingival</td>
<td>3.5</td>
<td>24</td>
<td>Fibrolipoma</td>
<td>6</td>
</tr>
</tbody>
</table>
cases each in the range of second to third decade and sixth to seventh decade. The prevalence does not differ with gender, although a male predilection has been recorded for oral lipomas in the literature that is not in accordance with our case series.\textsuperscript{[18]} Clinically lipomas are sessile, painless, solitary, well circumscribed yellowish lesion with soft doughy consistency and occur in various anatomic sites including buccal mucosa, lip, tongue, palate, vestibule, floor of mouth, mandible and major salivary glands.\textsuperscript{[4]} Our case series does not report intraosseous lesion. Interestingly, we report one uncommon case on the attached gingiva. Signs and symptoms may include feeling of fullness and discomfort with functional problems like dysphagia, difficulty in speech and mastication.\textsuperscript{[3]} Multiple lipomas have been associated with certain syndromes like Neurofibromatosis, Gardner’s syndrome, Decrum’s disease, Proteus syndrome, Cowden’s syndrome and Pai syndrome.\textsuperscript{[19]} Due to the diverse modes of presentation some other lesions should be considered in the differential diagnosis and these include oral lymphoepithelial cysts, epidermoid and dermoid cysts, mucocele, ranula, benign salivary gland tumor, benign mesenchymal neoplasms.\textsuperscript{[3,16]}

Superficial lipomas in oro-maxillofacial regions can be clinically diagnosed with the help of palpation, but deep lesions adherent to muscle or salivary gland require imaging techniques such as computerized tomography, magnetic resonance imaging and ultrasonography.\textsuperscript{[2]}

Interesting criteria considered for diagnostic purpose is that after removal of the lesion, the soft tissue specimen should float when placed in a water pot.\textsuperscript{[11]} All cases reported to our department fulfilled the same criteria.

Microscopically, it is difficult to differentiate between normal adipose tissue and lipomas, therefore, accurate clinical and surgical information must be provided by the clinician to the pathologist for making definitive diagnosis.\textsuperscript{[4,16]} Based on microscopic features lipomas are classified into classic lipoma, fibrolipoma, angiolipoma, spindle cell lipoma, pleomorphic, myxoid, sialolipoma and intramuscular lipoma. Histologically, classic lipomas are composed of adult fat cells that are subdivided into lobules by thin fibrous connective tissue septa, whereas the fibrolipomas consist of adipose cells surrounded by dense fibrous connective tissue. Classic lipomas are the most frequent histologic subtype\textsuperscript{[4]} but the incidence of fibrolipoma was more in our case series as compared to classic lipomas. But, the equal incidences of classic lipomas and fibrolipomas have been reported in the literature\textsuperscript{[4,14]} that probably may be due to subjective variation in the diagnosis. One histologic variant in our study was an intramuscular or infiltrative lipoma. These lipomas generally present as a noncircumscribed nodule and is, usually, seen on the tongue\textsuperscript{[2]} but in our case series it was found on lower labial mucosa which is rare.

The treatment for lipomas in oral and maxillofacial region is adequate surgical excision. The surgical approach is dependent on the site of the tumor and the proposed cosmetic result.\textsuperscript{[16]} In our case series, all the patients were treated surgically, with excellent outcome and no recurrence was noted in the follow-up.

**CONCLUSION**

Lipomas of oral and maxillofacial region are relatively uncommon tumors although they are reported to be most common soft tissue tumors. Lipomas can occur at any intra-oral site, and there is no gender predilection. Most common histologic type in our case series is the fibrolipoma. Surgical excision is the treatment of choice, with no recurrence on follow-up.

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INTRODUCTION

Diagnosis and prevention are important factors to be considered to tackle dental caries, one of the major health problems of the human race.\(^1\)

With the advent of minimal intervention dentistry, dental practitioners are searching for newer and more efficient techniques for caries detection. Several diagnostic techniques are available, such as, visual, visual-tactile, radiographic examination, a number of scoring systems has also been devised, using nominal or ordinal scales for recording and detecting its severity (Ekstrand et al., 2011).\(^2\) Recent fluorescence-based methods, such as the laser fluorescence device, DIAGNOdent pen (KaVo, Biberach, Germany), and fluorescence camera (FC, Vista Proof, Durr Dental Germany) have been developed to detect and quantify carious lesions. The aim of introducing these devices was to harness the fluorescence of red light in detecting and quantifying the demineralized tissue. This aids in the detection of caries which may have been overlooked by the earlier conventional diagnostic methods.\(^3\)

For a method to be considered innovative and reliable for caries diagnosis, its performance must be superior to other available methods. Thus, the comparison of the laser fluorescence device with conventional diagnostic methods, such as the radiographic method seems to be essential.\(^3\) The clinical implication would be that the clinicians can rely on the laser fluorescence readings not only as a detection tool but also to track the growth of a carious lesion over time.\(^4\)

Thus, the purpose of this study was to evaluate the efficiency of laser fluorescence DIAGNOdent measurements in comparison with conventional radiography for occlusal caries detection. It also assessed the correlation of depth and volume of decay removed by conventional methods of cavity preparation with DIAGNOdent readings.

SUBJECTS AND METHODS

Patient selection

Sixty lesions were identified in recorded patients, to whom the aims and procedure of the study were explained, and informed consent was obtained. The procedure was conducted according to Helsinki Declaration 1975 and after the Institutional Review Board approved the protocol. The teeth selected were permanent maxillary or mandibular molars. Caries represented an active primary carious lesion involving occlusal surfaces (Class I). The teeth were free of any...
restoration, hypoplastic pits, and degree of fluorosis. Teeth with frank cavitation or symptoms of pulpitis were excluded.

**Diagnostic procedure**
Each tooth received a visual and tactile examination. Instruments used for visual examination were standard dental mouth mirror, probe, and the operatory chair side light. Exposure of a bitewing radiograph using intraoral films and DIAGNOdent (KaVo, Biberach, Germany) evaluation were done. All the examinations were done independently by two operators. One conducts the study and the other examiner have at least 10 years of experience.

After drying the tooth with compressed air, the area of the lesion was evaluated from the occlusal aspect using direct and reflected light.

**DIAGNOdent readings**
Following the manufacturers’ instruction, calibration of the DIAGNOdent was performed. Following the visual and tactile examination, initial DIAGNOdent reading (D1) was recorded. The peak value was referred to as the highest level scanned on the occlusal surface. The surface was then thoroughly washed and cleaned by ultrasonic scaling and air-dried. A second DIAGNOdent reading was taken (D2) [Figure 1]. If the peak values differed between the readings, the numbers were averaged to determine the surface DIAGNOdent reading.

**Operative procedure**
The other operative and restorative procedures were performed by one investigator. A dual impression tray was used and with the help of putty impression material (Aquadent, Dentsply Caulk International), the bite of the patient was recorded. A conservative dissection of the carious lesion was done with a straight fissure diamond (SF41) point and a small round (BR45) bur (Mani Co.). The active carious lesion was removed using rotary instruments. Following the tooth preparation, the amount of tooth structure removed was quantified using composite resin. Composite resin (Amelogen Plus, Ultradent, South Jordan, UT, USA) was used to fill the prepared cavity and the patient was asked to bite again on the previously taken putty impression and excess flash was discarded. The composite was removed from the cavity and weighed on a sensitive digital weighing machine (Kerro BL 3003, Columbus, USA) [Figure 2]. The volume was calculated multiplying the measured density of composite (2.1317 g/mm³) and weight of the recovered sample. The depth of the cavity was measured using a measuring periodontal probe (UNC15 measuring probe, Trudent Co., India). The cavity was restored with Amelogen Plus. Results and analysis are provided in Tables 1-4 and Graphs 1-3.

**DISCUSSION**
The pits and fissures on the occlusal surfaces of the teeth are most susceptible to caries.[5,6] The new laser-based device DIAGNOdent would allow early and more conservative treatment, hence ensuring maximum preservation of tooth structure.[5,7]

DIAGNOdent (KaVo Dental Corporation, Lake Zurich, IL, USA), a 655nm diode laser, is one such device. It is a small, lightweight, battery-powered, chair side, handheld instrument that is intended to detect cavitated and non-cavitated occlusal and smooth surface caries. As the incident laser light is propagated into the site, two-way handpiece optics allows the unit to simultaneously quantify the reflected laser light energy. The carious lesion when exposed to this specific

<table>
<thead>
<tr>
<th>Table 1: Comparison of D1 and D2</th>
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<tr>
<td>Mean</td>
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Independent t-test showed level of significance of 5% between D1 and D2. Since the P=0.05, we accept the null hypothesis and conclude that there is no significant difference between D1 and D2 means
fluorescence readings were not only a detection tool but also tracked growth of a carious lesion over time.\[4\]

It is important to stress that dental plaque and remnants of material such as pastes, powders or gels may emit some fluorescence and lead to false positive results. Thus, professional cleaning and drying are advised to ensure the correct detection of caries lesions through fluorescence measurements. There is an increase in the LF readings if the prophylactic material is not removed completely (Diniz et al.).\[6,8\] In the current study, only ultrasonic scaling with water was opted. This was done to determine the influence of plaque on DIAGNOdent readings. Means of D1 and D2 of both examiners were taken, and D1 was found to be 33.49 and D2 was found to be 32.69. At a value of $P = 0.05$, there was no significant difference between the two. Different prophylactic methods (e.g. sodium bicarbonate jet and fluoridated, non-fluoridated prophylactic pastes)

### Table 2: Correlation of DIAGNOdent values

<table>
<thead>
<tr>
<th>Correlations</th>
<th>DIAGNOdent</th>
<th>Volume</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>0.139</td>
<td>0.179</td>
</tr>
<tr>
<td>Significant (2-tailed)</td>
<td>0.291</td>
<td>0.171</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Volume</td>
<td>0.139</td>
<td>1</td>
<td>0.587**</td>
</tr>
<tr>
<td>Significant (2-tailed)</td>
<td>0.291</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Depth</td>
<td>0.179</td>
<td>0.587**</td>
<td>1</td>
</tr>
<tr>
<td>Significant (2-tailed)</td>
<td>0.171</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed). The correlation between DIAGNOdent and volume is 0.139 ($r=0.139$) shows some correlation. The correlation between DIAGNOdent and depth is 0.179 ($r=0.179$) shows some correlation. The correlation between volume and depth is 0.587 ($r=0.587$, $P < 0.001$) shows significant correlation.

### Table 3: Correlation between DIAGNOdent and radiograph values

<table>
<thead>
<tr>
<th>Correlations</th>
<th>DIAGNOdent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman’s rho</td>
<td>DIAGNOdent</td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>1.000</td>
</tr>
<tr>
<td>$P$</td>
<td>60</td>
</tr>
<tr>
<td>Radiography</td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.200</td>
</tr>
<tr>
<td>$P$</td>
<td>0.126</td>
</tr>
<tr>
<td>N</td>
<td>60</td>
</tr>
<tr>
<td>Interpretations</td>
<td></td>
</tr>
<tr>
<td>The correlation between DIAGNOdent and radiographic values was not significant ($r=0.200$, $P &gt; 0.05$)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: Correlation between DIAGNOdent and visual tactile values

<table>
<thead>
<tr>
<th>Correlations</th>
<th>DIAGNOdent</th>
<th>Visual Tactile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson’s</td>
<td>DIAGNOdent</td>
<td></td>
</tr>
<tr>
<td>Correlation Coefficient</td>
<td>1</td>
<td>0.398**</td>
</tr>
<tr>
<td>$P$ value</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

The Correlation between DIAGNOdent and visual tactile is 0.398 ($r = 0.398$, $P < 0.05$), shows significant correlation. The correlation between DIAGNOdent and visual tactile is more significant than that of DIAGNOdent and Radiograph.

wavelength, it emits more intense fluorescence as compared to the sound tooth structure. This is mostly due to organic components and protein chromophores found in the affected tooth structure.

The readings correlate not only with the presence or absence of caries, it also correlates with the extent of caries within the tooth structure. The clinical implication would be that laser
influenced the performance of DIAGNOdent as per their efficiency. In the current study, prophylaxis using ultrasonics was employed, and no significant difference was observed in the two DIAGNOdent readings.

It was necessary to set a cut-off limit for identifying the occurrence of dentinal caries, based on DIAGNOdent readings. In vitro analyses suggest lower cut-off limits as compared to in vivo studies. Krause et al. suggested cut-off point of 36 but have insisted that clinical use of these cut-off values should not be done, these merely provide adjunctive information. The cut-off point of 20 for in vitro analyses and cut-off points around 25 for in vivo analyses were recorded, and accordingly preventive or conservative treatment was indicated (Lussi et al.). Khalife et al. set a cut-off point between 35 and 40 in his in vivo study. The readings were distinguished according to their location within the tooth structure and cut-off limit for dentinal caries was placed to be above 30.

Once the DIAGNOdent readings were sorted, its performance was compared with conventional diagnostic methods (visual-tactile and bitewing radiography). Such a comparison helped to determine if the newer system was innovative and reliable. Spearman's rho test was performed to determine the correlation between DIAGNOdent and radiographic values was not significant ($r = 0.000$, $P > 0.05$). The second correlation was done between DIAGNOdent and visual-tactile values using Pearson's test. There was significant correlation between DIAGNOdent values and visual-tactile ($r = 0.398$, $P > 0.05$). Thus, we can conclude DIAGNOdent is most sensitive in caries detection followed by visual tactile and then bitewing radiography. In an in vitro study, diagnostic accuracy of DIAGNOdent was better than that of conventional radiographs. While comparing the sensitivity of bitewing radiograph, visual-Diagno, and DIAGNOdent, Lussi et al. suggested that DIAGNOdent was more sensitive than visual-tactile and radiographs and a combination of visual examination and DIAGNOdent was recommended.

In the current study, the lesion depth was measured at the deepest portion of the cavity with the calibrated periodontal probe similar to the method opted by Khalife and Krause. The volume of the lesion depends on the mass and density of available tooth structure. Composite was used to fill the prepared cavity. Hence, the volume of the lesion was calculated using the weight of the composite used to restore the prepared cavity and the density of composite resin ($2.1317 \text{ g/cm}^3$).

Pearson correlation coefficients were calculated for DIAGNOdent measurements and lesion depth and volume. The DIAGNOdent readings correlated with clinical depth ($r = 0.179$). DIAGNOdent readings also correlated with volume ($r = 0.139$) and depth of the lesion. Thus, the correlation between volume and depth ($r = 0.587$, $P < 0.001$) was weakly significant. The reason for determining the correlation between DIAGNOdent readings, volume and depth was that depth and volume represented lesion extension in a multidimensional perspective. And this weak correlation showed that the intensity of fluorescence was not proportional to the size of caries lesion.

Sensitivity is the ability to recognize dentinal caries in teeth with/without cavitation and specificity is the correct recognition of sound tooth structure. The sensitivity and the specificity in the current study were 0.68% and 0.35%, respectively. Thus, the sensitivity was higher, whereas specificity was low. Higher sensitivity determines the ability of DIAGNOdent to identify caries which may have been ignored in the visual examination. Low specificity results in the likelihood of false positive diagnosis and leads the clinician to intervene in a surface that may actually not be carious. According to Lussi et al., sensitivity was greater than 92% in comparison to the 31% of visual-tactile method. Similarly, Anttonen et al. in his study derived a sensitivity 93% and specificity of 63%.

DIAGNOdent was a highly sensitive diagnostic system, as observed by the above-mentioned studies.

**CONCLUSION**

The accuracy and precision of the methods used in the current study have their own limitations but, with the help of two examiners for each reading, attempts have been made to minimize the errors. From the above analyses, it was suggested that DIAGNOdent was a sensitive diagnostic system in case of enamel caries, but accurate determination of deep dentinal caries was not possible.

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An *In-vitro* Evaluation of the Effect of Anti-candidal Herb (Olive) on *Streptococcus Mutans*

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**ABSTRACT**

**Aim:** The aim was to evaluate the antimicrobial effect of olive extracts on *Streptococcus mutans* in *in-vitro* conditions. **Materials and Methods:** An *in-vitro* experimental study was conducted in a laboratory setting. Ethanolic extract of olive was prepared separately by cold maceration technique. The extract was then diluted with an inert solvent, dimethylformamide, to obtain five different concentrations (2%, 4%, 6%, 8%, and 10%) of each. 0.2% chlorhexidine was used as a positive control and dimethylformamide was used as a negative control. The different extracts, along with controls, were then subjected to microbiological investigation to determine, which gave a wider zone of inhibition against *S. mutans*. The zone of inhibition was measured in millimeters. **Results:** Olive extract presented the largest zone of inhibition of 33 mm at the concentration of 8%. **Conclusion:** Ethanolic extract of olive demonstrated antimicrobial activity against *S. mutans*.

**Key words:** Antimicrobial, olive, *Streptococcus mutans*

**INTRODUCTION**

The practitioners of the traditional system of medicine treat about 80% of patients in India, 85% in Burma and 90% in Bangladesh.[1] Medicinal plants rich in secondary metabolites (potential sources of drugs) and essential oils are of the important advantage claimed for their therapeutic uses in various ailments besides being safe, economical, effective and easily available.[1]

Moreover in today’s world consumer and producer alike have become highly conscious about the health benefits of food leading to value added products in health sector and discovery of “functional food” that encompasses all edible items having a health-promoting and/or disease-preventing property beyond the primary function of providing nutrients. Some of these have already been used in successful management of both general and oral disease conditions such as bronchitis, bronchial asthma, skin diseases, oral thrush, oral cancer, periodontal diseases, etc.

Several plants such as olive, ginger, tulsi, garlic, and turmeric have been used as nutraceuticals in treatment of oral candidiasis by local and systemic routes.[2-6] When used locally or systemically they also affect the oral bacterial flora, some having proved their action against bacteria like *Streptococcus mutans*, the main causative organism for dental caries.

Lack of sufficient data on effect of olive needs to be accounted against *S. mutans* owing to their day to day use. The aim of present study was to comparatively evaluate the antimicrobial effect of olive extract on *S. mutans* in *in-vitro* conditions.

**MATERIALS AND METHODS**

**Prestudy procedure**

**Preparation of olive extract**

Fifty grams of sun-dried finely powderd olive fruits were macerated with 150 ml of 100% ethanol and then subjected to filtration with Whatman filter paper to obtain a clear filtrate. The filtrate so obtained was reduced in a borosilicate glass beaker at a low temperature of <40°C with the help of a soxhlet extraction unit (heating mantle) Macro Scientific Works (MSW) - 436 of MAC MSW Limited., to obtain semi solid residue of olive extract. From 50 g of powder dissolved
in 150 ml of ethanol, 2 g of residue extract was obtained, so the yield was 2% w/w.

Preparation of different concentrations of olive extract
Two grams of extract was dissolved in 20 ml of dimethylformamide to obtain 10% concentration of the extract, which was used as a stock solution. Subsequent serial dilution of the stock solution with dimethylformamide was done to obtain 2%, 4%, 6%, 8% and 10% concentration of stock solution of olive extract.

Furthermore, 1% of the extract of the stock solution was used as a starting point, followed by other concentrations as mentioned above for minimum inhibitory concentration (MIC) determination.

Controls
Control of 0.2% chlorhexidine was used as a positive control, a gold standard for comparison and dimethylformamide was used a negative control to rule out its effect on S. mutans.

Collection of micro-organisms
Microbial type culture collection (MTCC) strain number 497 was obtained from MTCC and Gene Bank, Chandigarh. The strain belonged to genus Streptococcus while the species was mutans that is, S. mutans, was used for the study purpose.

Preparation of culture media
The brain heart infusion agar powder (special infusion agar) for in-vitro diagnosticks, M211, was obtained from HiMedia Laboratories Limited, Mumbai, Maharashtra, India. Fifty-two grams of this powder was suspended in 1000 ml of distilled water. It was then boiled to dissolve the medium completely and then sterilized by autoclaving at 15 lbs pressure and 121°C for 15 min. The pH of the agar was maintained at 7.4 at 25°C. The media was then mixed well and poured into petri-dishes. The process of making culture media was carried out as per the instructions provided by the manufacturer.

Streptococcus mutans MTCC was then added to nutrient broth which was incubated at 37°C for 24 h. It was sub-cultured onto nutrient agar plate and incubated at 37°C for 24 h. The inoculum for antimicrobial activity was prepared by adjusting the density of organism to approximately 10⁶ colony forming units/ml with the help of 0.5 Mcfurland opacity standards. Then it was inoculated on agar plate by lawn culture method. The growth conditions were aerobic as specified by Gene bank, Chandigarh.

Determining microbic sensitivity
Determination of microbic sensitivity mainly can be done by two methods, that is, dilution methods and diffusion methods. Ditch plate diffusion method was used in the present study as it has been proven to be more suitable for research purpose. In this method, ditches were made in petri-dishes by using a punch. These ditches were filled with the equal amount of olive extract. Six plates were used for six different concentrations. Chlorhexidine and dimethylformamide were used as controls. Plates were then incubated at 37°C for 48 h, after which zone of inhibition were measured.

Minimum inhibitory concentration was determined by broth dilution method and values were determined by visual inspection of tubes. In the series of tubes, the last tube with a clear supernatant was considered to be without any growth and taken as MIC value.

Study procedure
Antimicrobial susceptibility testing
The ditch plate method was used to test the antimicrobial activity. Ditches were prepared on agar plates with the help of the punch having 6 mm diameter and 50 μl of each concentration were introduced in each.

The plates were left for 1 h at room temp and then incubated at 37°C for 48 h and later examined for zone of inhibition.

The zone of inhibition was measured with the help of Hi Antibiotic Zone scale from HiMedia Laboratories Limited, Mumbai, Maharashtra, India, which is certified by Indian Standard Organisation and World Health Organisation Goods Manufacturing Practices. The scale used was of high quality, standardized, efficient and easy to use with high reproducibility of observations.

Statistical analysis
Statistical analysis was performed using SPSS 15.0 (SPSS Inc) windows evaluation trial version release 15.0.0, September 6, 2006, USA. The effect of olive was compared with chlorhexidine using unpaired Student’s t-test.

RESULTS
The present study was conducted to assess the efficacy of ethanolic extracts of olive on S. mutans. The zones of inhibition were measured with the help of HiAntibiotic Zone scale from HiMedia Laboratories Limited, Mumbai, Maharashtra, India. These zones were measured at the end of 48 h.

Table 1 shows the zone of inhibition of various concentrations of ethanolic extracts of olive.

The zone of inhibition did not form for 1% concentration while it was observed at 2% and above of the stock solution indicating that the MIC of olive was 2% concentration.

Table 2 shows zone of inhibition of the positive and negative controls.

Table 3 shows results for one-sample Kolmogorov–Smirnov test for normality. The results showed that data were normally distributed in all the two groups, that is, chlorhexidine and olive.
DISCUSSION

A current review of the available epidemiological data from many countries clearly indicates that there is a marked increase in the prevalence of dental caries. This increase in dental caries signals a pending public health crisis. Although there are differences of opinion regarding the cause of this global dental caries increase, the remedy could be shifting to functional food.

Functional foods have been introduced into the corporate mainstream owing to continuously increasing health care costs, an expanding aging population arising out of increased life expectancy, rising consumer awareness about health aspects of foods and food regulations and above all an increased level of education and literacy.

Olive (Olea europaea) has been commonly used as anti-candidal herb and also have been suggested to have antibacterial action. The polyphenols, oleanolic acid and secoiridoid glycosides contained in olive leaves and fruits have a broad antimicrobial activity. The flavonoid polyphenols in olive oil are natural antioxidants that contribute to a bitter taste, astringency, and resistance to oxidation and host beneficial effects from healing sunburn to lowering cholesterol, blood pressure, and risk of coronary disease. Owing to these properties the aqueous extract of olive have already shown antimicrobial activity against pathogens like Staphylococcus aureus ATCC 43300, and S. aureus MU 40, Escherichia coli and Klebsiella pneumoniae CCM 2318. In the present study, different concentrations of ethanolic olive extract were used of which, 8% ethanolic olive extract showed highest antimicrobial activity against S. mutans with maximum zone of inhibition of 33 mm at 50 μl. At higher concentrations the zone of inhibition did not increase further.

In the present study, ethanol was used as a solvent because the essential oils in olive are more soluble in alcohol when compared with distilled water. Dimethylformamide, an inert solvent, was used to dilute the extract to neutralize the effect of alcohol, which itself is an antiseptic, attributing the result solely to olive, respectively.

The volume of extract to be used for the study was determined randomly since this study was the first of its kind where the in-vitro effect of ethanolic extract of olive was evaluated against S. mutans, furthermore no attempt had been done to recommend precise amount of drug to be used for antimicrobial sensitivity tests and also the objective of studying the efficacy of olive extract was achieved with a single volume.

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Table 4: Comparison of effect of olive and chlorhexidine on Streptococcus mutans using unpaired t-Test

<table>
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<th>Mean</th>
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A Versatile Spring Design for Management of Impacted Teeth in Anterior Arch

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ABSTRACT
A new orthodontic spring design that can be employed in the narrow labial vestibule to provide traction force for movement of impacted teeth in the anterior arch is described. The spring is fabricated at chairside in TMA wire of 0.016 × 0.022” or 0.017 × 0.025” size. The method for deployment of this spring design is illustrated with a case report of management of horizontally impacted maxillary central incisor in an 18-year-old patient. The spring design was able to deliver variable force vectors that are customarily required to move impacted teeth from a horizontal to vertical orientation.

Key words: Disimpaction, impacted incisor, orthodontic spring

INTRODUCTION
Management of impacted teeth in the anterior arch always poses a considerable challenge to the clinician on account of root crowding that is invariably present in these cases; and lack of adequate space to maneuver the tooth through the narrow confines of alveolar cortical plates in this region. The need for precise management assumes further significance in the socio-developmental context where patients presenting with impacted teeth in the anterior arch belong to a younger age group. In contemporary society perceptions are dominated by esthetics and vital first impressions and the absence of an anterior tooth in a young adolescent demands immediate attention.

There are limited options in managing impacted teeth in the anterior arch; these being passive observation, exposure with traction applied to the tooth for alignment or extraction of tooth with later replacement. For the maxillary incisors, the traction option is often undertaken because of the important role these teeth play in building esthetics.[1,2] Anterior teeth may also present with the angulation directed labio-lingually. An impaction of this type is almost always difficult to treat as the orthodontic force vector has to change with sequential movement of the impacted tooth. The impacted tooth in this situation has to be moved through the path of least resistance in two different planes to effect disimpaction and alignment.

Various configurations of elastics and springs are employed for application of desired force vectors. Ballista spring,[3] K9 spring,[4] universal spring,[5] and Kilroy spring (American Orthodontics, Inc., 1714 Cambridge Ave., Sheboygan, WI 53082) are examples of such arrangements. These springs are largely directed towards the goal of managing impacted canines. Treatment for an impacted maxillary central incisor would inevitably require a spring that operates in the narrow labial vestibule and is versatile enough to provide force direction in more than one plane.

The design and application of a new spring configuration for management of impacted teeth in the anterior arch is described with the help of a case report in this article.

CASE REPORT
The 18-year-old female patient reported with chief complaint of an unerupted upper front tooth. The patient was made aware of the existence of an impacted maxillary incisor during a recent dental X-ray examination. Patient was in good health and gave no history of medical concerns or dental trauma.

On clinical examination, the patient had balanced facial proportions, an orthognathic profile and a modified smile
in which a conscious effort to cover maxillary anterior teeth was evident and only mandibular anterior teeth were displayed [Figure 1]. Intraoral examination revealed a generally satisfactory dentition with the exception of dental caries in # 36 and # 46 and a grossly decayed # 26 [Figure 2].

The patient had normal overjet and overbite, class I molar relationship on the right side and a class I canine relationship bilaterally.

Orthopantomogram examination showed an impacted no. 21 and a mesiodens in the same region. The impacted incisor was positioned horizontally with its crown close to the middle third of the root of the maxillary right central incisor, and its root in close relation to the root of the maxillary left lateral incisor. Apical pathology in carious no. 46 was seen [Figure 3]. Patient’s dental development was commensurate with her age.

Analysis of the lateral cephalogram revealed an orthognathic hard and soft tissue profile and dental/skeletal cephalometric parameters within normal limits [Figure 4].

Problem list
Spaces among maxillary anterior teeth, a compromised smile, minor spaces in the mandibular anterior teeth, carious # 36, 46 and a decayed # 26 were salient in the problem list. Maxillary midline deviation was observed due to drifting of adjacent teeth into the unoccupied space at impacted # 21 region. Mandibular midline was also shifted to the right [Figure 2].

Treatment objectives
• Restorative treatment for carious and decayed teeth.
• Leveling and alignment of maxillary and mandibular arches and recovering space in the maxillary arch for the impacted left central incisor.
• Restoration of maxillary left central incisor at recovered space and achieve normal appearance of anterior segment
• Establish an acceptable and stable, functional occlusion.

Orthodontic treatment options
• Extraction of the impacted maxillary central incisor, creation of space with orthodontic therapy, and restoration with an implant or a fixed partial denture.
• Extraction of impacted maxillary central incisor, orthodontically substituting the lateral incisor for the central incisor, followed by a prosthetic restoration.
• Surgical exposure of the impacted maxillary central incisor, recovery of necessary space and application of orthodontic traction to move incisor into alignment.

Orthodontic treatment plan
Treatment options were explained to the patient and her parents, and it was decided that the impacted tooth be salvaged and brought into occlusion with orthodontic movement. Taking into consideration the position of the impacted central incisor and its vicinity to the root of the lateral incisor, treatment was decided to be conducted in two phases.

Phase I included extraction of the mesiodens in relation to 11 and 21, leveling and aligning of maxillary and mandibular arches with fixed orthodontic appliance and space regain for the impacted maxillary incisor. Phase II included surgical exposure of the crown of an impacted tooth, uprighting it from a horizontal to a vertical position, followed by subsequent orthodontic traction to bring it into occlusion.

Orthodontic treatment progress
An MBT prescription, 0.022 slot bracket system was placed with bands on teeth nos. 17, 26, 37, 46 and initial leveling was completed with a 0.016” NiTi wire. With a relatively rigid stabilizing wire (0.017 × 0.025” stainless steel) on the maxillary arch, a NiTi Open Coil Spring was used between 11 and 22 to create adequate space for the impacted incisor.

Once the required space was achieved [Figure 5], exposure of the impacted central incisor was performed, and the exposure site was allowed a short healing period before further treatment was carried out.
A maxillary central incisor bracket was bonded onto the available labial surface of the crown of the incisor with its horizontal slot as parallel as possible with the incisal edge of the tooth [Figure 6].

Initial traction on the impacted tooth was applied with a 0.016” NiTi wire riding piggyback on a 0.017 × 0.025” SS main archwire. The auxiliary wire was ligated loosely to the impacted tooth [Figure 7]. This initial procedure made adequate surface of the crown available for application of uprighting spring.

The impacted tooth needed to be uprighted to a vertical orientation to allow for further orthodontic traction. This was done by the use of an auxiliary spring constructed from a 0.016 × 0.022” TMA archwire [Figure 8]. The spring was designed in a manner so as to upright the impacted incisor while simultaneously continuing application of orthodontic traction to bring the tooth into occlusion. One end of the spring was ligated to the main archwire through all teeth in the first quadrant while the free end was engaged as possible to the horizontal slot of the bracket bonded on the impacted incisor. The design of the spring allowed for application of...
force to bring the tooth downward and provide a labial root torque to upright it.

As the tooth gradually uprighted and progressed towards occlusion [Figure 9], modifications were made in the spring with third order bends to continue traction in the same direction and exerting root torque on the tooth [Figure 10]. The spring was discontinued after the tooth was close to the occlusal plane, at which point it was tied to the main arch wire with an elastic chain [Figure 11].

Progressive changes in the bracket placement were made as and when possible and elastic traction was continued [Figure 12].

At this stage, it was possible to engage a 0.016” NiTi wire in the bracket slot, and regular alignment mechanics could be used [Figure 13]. Archwires were upgraded sequentially to a 0.019 × 0.025” NiTi archwire for final alignment of the tooth [Figure 14].

**Treatment result**
The impacted maxillary central incisor was brought from a horizontal and embedded position into arch and alignment after 10 months of treatment. The patient was happy with her improved smile and there was a perceptible gain in patient’s confidence.

Restorative management of carious teeth has been carried out in respective departments.

**Spring design**
The versatile spring was used in this case for management of impacted maxillary central incisor [Figure 8], though the uniplaner design of its active component permits operation in labial vestibule in both maxillary and mandibular anterior arches. It is constructed using commonly available TMA wire of 0.016 × 0.022” or 0.017 × 0.025” dimensions. It can be easily activated at various bends [Figure 10] to direct force in the desirable direction or to impart root torque. The passive and retentive component of the spring is the archform segment that rides piggyback to main archwire or can be ligated with main archwire or under tie-wings.

**DISCUSSION**
Maxillary central incisor is probably the most prominent among dental esthetic components.[1,2] Rarely missing and normally erupting at 6-8 years of age, an impacted maxillary
Proffit[7] has considered problems in treating impacted teeth in three distinct areas: Surgical exposure for access, placement of a utilitarian attachment and orthodontic force application. The first two areas have common solutions. Exposure can be performed in 3 accepted ways: 1. Circular excision of the oral mucosa immediately overlying the impacted tooth; 2. Apically repositioning the raised flap that incorporates attached gingiva overlying the impacted tooth and 3. The closed-eruption technique in which the raised flap that incorporates attached gingiva is fully replaced in its former position, after the attachment has been bonded to the impacted tooth.[8]

While orthodontic traction for treatment of impacted teeth that are vertically oriented in the alveolar bone requires only time and patience, challenges are different when the tooth is impacted horizontally. In the present case, a new design for an auxiliary spring was used that was capable of exerting force in variable directions with suitable activations. The spring was successfully used to meet treatment objectives.

Ideally, an orthodontic spring should be unobtrusive to occlusion, be nonirritating to surrounding soft tissues, provide adequate force and have a long range of action.[9,10] The spring configuration used and presented in this case met all these criteria. In addition, it can be activated to provide force direction in different planes with suitable modifications. Chairside fabrication of this spring for easy customization is recommended.

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Gorlin-Goltz Syndrome

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ABSTRACT

Gorlin-Goltz syndrome is an autosomal dominant disorder showing multiple organ involvement. The syndrome consists principally of nevoid basal cell carcinomas, keratocystic odontogenic tumors (KCOT), skeletal anomalies and intracranial calcifications. A case report of a 25-year-old female patient emphasizing its clinical and radiographic manifestations is presented in this article. Radiographs and computed tomography showed recurrent, multicellular and expansile lesions, which were examined histologically, confirming the diagnosis of KCOT. Skin lesions in the form of palmar pits and solitary pigmented nevi were seen. The sella turcica was bridged and the right fifth rib was bifid. The bilamellar falx cerebri calcification was confirmed on computed tomography of brain. The patient was treated and explained about the prognosis.

Key words: Gorlin-Goltz syndrome, nevoid basal cell carcinoma syndrome, keratocystic odontogenic tumors

INTRODUCTION

Gorlin-Goltz syndrome, also known as nevoid basal cell carcinoma syndrome, is syndrome of jaw cysts, basal cell tumors and skeletal anomalies polycystoma. The syndrome consists of multiple nevoid basal cell epitheliomas, jaw cysts and bifid ribs with its manifestations also affecting the central nervous, ophthalmic, endocrine and urogenital systems.[1] The incidence of the disorder is estimated to be 1 in 50,000 to 150,000 in general population. It appears in all ethnic groups but most often in whites. The male to female ratio is 1:0.62 for keratocystic odontogenic tumor (KCOT) not associated with the syndrome and 1:1.22 for KCOT associated with the syndrome, thus estimating that KCOT are more common in males but more females seem to have the syndrome.[2] The syndrome warrants early diagnosis, effective counseling and aggressive treatment at the earliest because of the high recurrence rate of KCOT and possible complications of pathologic fractures and neoplastic changes being associated with them.[3]

CASE REPORT

A 25-year-old girl of western Indian origin, third child of non-consanguineous parents of normal stature presented with a 12-month long history of a slowly progressing bilateral facial swelling with severe facial disfigurement [Figure 1]. She gave history of dull pain, restricted mouth opening and yellowish-red colored discharge intermittently from the buccal mucosa on the left side. On further questioning, she gave a history of a similar swelling on the left side 12 years back, which was surgically treated. The medical, personal and family history revealed no positive findings. General physical examination revealed areas of hyperpigmentation on the left upper eyelid and dorsal surface of the first interphalangeal joints of all fingers with multiple palmar pits and a mole on the upper trunk. Maxillofacial examination revealed areas of hyperpigmentation on the left upper eyelid and dorsal surface of the first interphalangeal joints of all fingers with multiple palmar pits and a mole on the upper trunk. Maxillofacial examination revealed facial disfigurement, restricted mouth opening, and mild hypertelorism with the canthal index measuring 38.09 and euryopia. On intraoral examination, bilateral bony hard swellings in the ramus with buccal and lingual cortical expansion and egg shell crackling, high-arched palate and missing right mandibular canine were observed.

Panoramic image revealed bilateral large expansile multi-locular lesions with scalloped, well-corticated margins involving the entire ramus with haziness in the internal structure. However, there was no displacement of teeth. The left angle of mandible showed features of previous surgery and a unilocular radiolucency was seen between roots of 44 and 45 [Figure 2]. CT axial sections showed large bilateral hypodense areas involving ramus and body of mandible, which are multilocular with scalloped margins, hyperdense septae and marked expansion of buccal and lingual surface of the ramus [Figure 3]. Incisonal biopsy
was taken and on microscopic examination, characteristic 6 to 8 basal cell layer thick stratified squamous epithelium thrown into corrugations giving picket fence appearance was seen, indicative of KCOT [Figure 4]. Patient was then further evaluated for other findings. PA chest radiograph showed bifid right fifth rib. Lateral cephalometric radiograph showed calcified diaphragma sellae. CT brain revealed extensive lamellar dural calcification [Figure 5]. Urogenital evaluation by USG pelvis revealed multiple nabothian cysts in cervix. Based on these investigations and the clinical correlation, the recognizable features of the Gorlin-Goltz syndrome seen in the patient were multiple KCOT, high-arched palate, mild hypertelorism, multiple palmar pits, solitary pigmented nevus, hyperpigmentation on dorsal surface of hands, calcified diaphragma sellae, bifid right fifth rib and calcifications of the falx cerebri. Based on clinical, radiographic and microscopic data, the hypothesis of KCOTs was confirmed and the diagnosis of Gorlin-Goltz syndrome was established.

**Management**

The parents and two elder sisters were also screened for radiological and dermatological findings. They were found to be unaffected and therefore, a sporadic mutation was suspected to be the etiology. The patient received genetic counseling regarding possible future complications and was explained for the need of a long-term follow-up. A decompression surgery was performed on the mandible with arch bar stabilization of both maxilla and mandible along with instillation of carnoy’s fluid as a fixative agent for shrinkage of the lining epithelium. The patient was advised for complete removal of the cyst on a later day.

Postoperative panoramic image after 1 year showed bone deposition in the ramus area indicating a successful treatment of the case [Figure 6].

**DISCUSSION AND CONCLUSION**

Gorlin syndrome is an autosomal dominant disorder inherited with complete penetrance and variable expressivity with the defective gene called *Patched* (PTCH), a tumor suppressor
gene essential for development during embryogenesis and cell signaling in adults, identified on chromosomal location
9g22.3 – g31. However, mutations in other genes such as Patched 2 (PTCH2), Smoothened (SMO) and Sonic hedgehog (SHH)
have been reported in isolated cases of basal cell carcinoma and medulloblastoma. According to Manfredi et al., the diagnosis of Gorlin-Goltz syndrome can be confirmed when there are identified two major criteria or one major and two minor criteria.

The major criteria include:
- KCOT confirmed by histology
- Palmar or plantar pits more than three in number
- Bilaminar calcification of the falx cerebri
- Positive family history of nevoid basal cell carcinoma syndrome.

Minor criteria include:
- Congenital skeletal anomalies: bifid, fused, splayed or missing rib or bifid, wedged or fused vertebra
- Calcified diaphragma sellae
- Occipital – frontal circumference more than 60 cm
- Cardiac or ovarian fibromas
- Medulloblastomas
- Congenital malformation such as high-arched palate or cleft lip or palate, ocular hypertelorism, coloboma, cataract or prominent supra – orbital ridges.

The present case report showed a young girl presenting, among others, some of these features, such as multiple KCOTs in the mandible, high-arched palate, rib anomalies, calcification of the falx cerebri, calcified diaphragma sellae, ocular hypertelorism and multiple palmar pits, which confirmed the diagnosis of NBCCS or Gorlin-Goltz syndrome. The management of KCOT comprises enucleation or curettage of the adjacent bone. Large, destructive cases require segmental resection of the jaw bone with immediate or delayed reconstruction. Chemical cautерization as an adjunctive technique is useful to prevent recurrence by fixing the daughter cysts or remnants of epithelial lining that cannot be removed by enucleation with the use of carnøy’s solution. It has been reported that the presence of daughter cysts is related to the recurrence of KCOT. This could be one of the possible reasons for recurrence of KCOT as the patient was surgically treated before in the case reported here. Histopathological examination of the removed tumors should be performed to provide definitive diagnosis. In this case, the microscopic analysis confirmed the diagnosis of KCOT and indicated the need for monitoring the disease. Long follow-up periods are suggested for this tumor. In order to minimize secondary morbidities after the treatment, patients with KCOT should be observed carefully by radiographic imaging particularly during the first year. In summary, Gorlin-Goltz syndrome is a dominant autosomal genetic process, which is of particular interest to the oral and maxillofacial health experts. Proper evaluation and characterization of the clinical features are of the utmost importance for the correct diagnosis and treatment of affected patients. In order to be able to establish early diagnosis of NBCCS, specialists should carry out detailed clinical and imaging examinations in early ages of life. Physicians and dentists must know the features of the syndrome well.

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INTRODUCTION

Treatment and management of teeth with deep furcation involvement is a substantial clinical problem. Over the years, a variety of treatment modalities has been suggested.[1] Earlier, the opinions on the prognosis for treatment of furcation involved teeth were rather pessimistic, and the treatment of choice was commonly extractions.[2] However, the prognosis for treatment and maintenance of furcation involved teeth is now regarded more optimistically,[3-7] This is due to a better understanding of the significance of combined periodontal treatment of furcations and meticulous plaque control.[5,8]

The currently recommended treatment modalities for deep furcation defects range scaling and root planning, occlusal adjustments, and gingivoplasty procedures[6,7] to more radical approaches such as root amputation or tooth hemisection.[5] Although root amputation and tooth hemisection provide good access for plaque control, these procedures also require endodontic treatment and in some instances, a crown restoration. These additional treatments imply potential risks for complications.[9]

Tunnel preparation is another technique used to manage furcation defects especially those with “through-and-through” defects.[5] If the root anatomy permits it, the bi- or tri-furcations are widened by resection of bone, to give access for interradicular cleaning postsurgically. In general, this technique does not require endodontic or restorative treatment. Tunnel preparations have, however, been associated with a poor prognosis. In particular, it has been reported that the risk of root caries development is a major concern.[5]

Commonly, this type of the resective therapy can be offered at mandibular molars, which have a short root trunk, a wide separation angle, and long divergence between the mesial and distal root. Tunnel can be prepared on a maxillary molar also (mesio-buccal and disto-buccal).

CASE REPORT

A 38-year-old female patient reported with the complaint of pain of left mandibular first molar with a recurrent swelling. On examination, there was chronic periodontal abscess on the lingual side with #36 and it was sensitive to percussion. On probing the area, there was a 7-mm-deep periodontal pocket around the furcation area [Figures 1 and 2].

On radiographic examination, severe bone loss was evident in tooth #36 with grade III furcation involvement. The bony support on mesial and distal side of #36 was relatively intact. No periapical lesion was investigated around each root [Figure 3].

Key words: Grade III furcation, osteoplasty, tunnel preparation

ABSTRACT

Treatment and management of teeth with furcation involvement is one of the most challenging problems confronting general dentist. In advanced furcation involvement, the tunnel preparation procedure is preferable to extraction when other treatments are precluded for financial or other reasons. Certain technical problems, such as gaining access for oral hygiene procedures on posterior molars, are obvious; this heroic technique could not be considered as a regular treatment modality for any tooth or any patient. This treatment was done for a 38-year-old female patient in good general health. After raising a full thickness flap on the mandibular left side of the mouth, the furcation of tooth #36 was widened by a #2 round bur and bone file. Osteoplasty continued by bur, file, and chisel until enough space was created for interdental brush use to control dental plaque. Flap was placed apically and sutured. Prosthodontic treatment was done 4 months after the periodontal therapy. After 1-year, the treated tooth is still functioning in the mouth of the patient. We are satisfied with the result of treatment.

Key words: Grade III furcation, osteoplasty, tunnel preparation

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Phase I periodontal therapy completed and patient re-evaluated after 4 weeks and scheduled for surgery [Figure 4]. Under local anesthesia, periodontal surgery was performed. On intra-operative examination, severe bone loss and grade III furcation involvement was evident with tooth #36 [Figure 5]. During the surgical procedure, following the reflection of buccal and lingual flaps, the granulation tissue in the defect was removed and the root surfaces were scaled and planed, the furcation area was widened by round burs at the entrance and then by bone files to create space for postsurgical interradicular plaque control [Figure 6]. The mucoperiosteal flaps were apically positioned and sutured [Figure 7].
After the removal of the dressing, the patient was taught to maintain the tunnel area plaque-free with interdental brushes [Figure 8]. The majority of the patients followed a postsurgical schedule, which included rinsing with a 0.12% chlorhexidine digluconate solution for 4–6 weeks. Daily rinses with 0.025% sodium fluoride solution and the use of a fluoride dentifrice applied directly by the “interradicular” brushes was also recommended, while such treated areas are more prone for caries. Patient followed regular 3–6 months maintenance visits for a period of 1 year. At this time, the patient returned to her referring dentist for continued follow-up.

DISCUSSION

The ultimate goal of treatment for teeth with advanced furcation involvement is to eliminate the furcation, which is the main plaque retentive area in multirooted teeth and makes them more difficult to clean by the patient with mechanical plaque control measures.

Alternative approach to treating an advanced Class II and Class III furcation involvement of especially a mandibular molar is called “tunnel preparation.” The clinician widened the furcation area by round burs at the entrance and then by bone files to create space for postsurgical interradicular plaque control with the help of interdental aids in the form of the interdental brush.

It is important to consider the following factors before deciding to undertake any tunnel preparation procedures:

- Advanced bone loss around furcation area acceptable
- Level of bone around the roots
- Angulations and position of the tooth in the arch. A molar that is buccally, lingually, mesially or distally titled, cannot be treated
- Divergence of the roots-teeth with divergent roots is easier to prepare the tunnel. Closely approximated or fused roots are poor candidates
- Length and curvature of roots-long and straight roots are more favorable for tunnel preparation than short, conical roots.

Initially the prognosis of this treatment modality was considered questionable, but the results from the studies in previous years demonstrated that tunnel preparation procedures for treatment of Class III furcations have a significantly better prognosis than reported earlier by Hamp et al.[5] Hamp et al. reported caries development in four out of seven “tunnels” during a 5 years “follow-up” period. This corresponds to a failure rate of about 60%.

The results from the study by Hellden et al.[10] which were based on 156 treated teeth, showed that approximately 75% of the reexamined teeth were caries free and in function at the time for the “follow-up” examination.

Root resections and tooth hemisections are usually associated with time consuming and expensive endodontic and prosthodontic treatments. The major advantage of tunnel preparation is that, in general, it does not require subsequent endodontics or fixed prosthetics. Also on teeth with reduced bone support, this treatment will not lead to significantly increased mobility such as is commonly observed after resection of one or more roots. It should be pointed out that a tunnel preparation procedure does not exclude the possibility for later hemisection or root resection if this is indicated.

Tooth extraction is the ultimate or last and radical treatment modality in periodontally compromised teeth. The tunnel preparation procedure is preferable to extraction when other treatments are precluded for financial or other reasons. Certain technical problems, such as gaining access for oral hygiene procedures on posterior molars, are obvious. This commonly necessitated a relatively radical widening of the furcation. Secondary healing and interradicular placement of surgical dressing during the initial healing period, followed by early initiation of cleaning with interdental brushes, were useful means to solve such access difficulties.
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