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Original Research

EFFECT OF MODIFIED CARNOY'S SOLUTION ON INFERIOR ALVEOLAR NERVE: AN ANIMAL STUDY

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ABSTRACT

AIMS AND OBJECTIVES : This is an in vivo study to evaluate the critical exposure time of modified carnoy's solution to rabbit's inferior alveolar nerve. The objective of the study is to find the critical exposure time for which an inferior alveolar nerve can be safely exposed without any damage to the nerve. The data is obtained based on histopathological findings.

MATERIALS AND METHOD: 20 New Zealand rabbit's were included which were divided into 5 equal groups based on 1-minute, 2-minutes, 3-minutes, 5-minutes and 10-minutes interval groups. Following anesthesia, using intramuscular injection of ketamine hydrochloride and chloroform vapors, the inferior alveolar nerve was exposed by creating a bony window in the mandible via extraoral Risdon's approach. After exposing this nerve to modified carnoy's solution, it was irrigated with normal saline and the nerve was resected and sent for histopathological study.

RESULTS: Damage to the endoneurium is seen in the 2 minutes group in only one of the four specimens where as it is damaged in all the specimens in the 3minutes group. Axonal contents are damaged in two of the four specimen in the 3minutes group where as it is damaged in all the specimens of 5minutes and 10minutes group.

Keywords : Economic evaluation, cost-effectiveness, analysis.

INTRODUCTION

Modified Carnoy's solution, described by Cutler and Zolinger contains absolute alcohol, chloroform, glacial acetic acid and ferric chloride. This is one of the caustic agent used for intracavity,intravital fixation and hence decreases the recurrence rate of the treated cyst and tumours.

Cyst and tumours of the head and neck region, have higher predilection for mandible, particularly, angle region and ascending ramus as compared to the maxilla. Enlargement of this lesions over a period of

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time results in involvement of the surrounding soft and hard tissue like the cortical plates, teeth, inferior alveolar nerves and vessels, muscles and the attached mucosa.

Enucleation followed by application of modified carnoy's solution in the bony cavity for an ideal time period of 3 minutes has proven to be one of the best conservative modes of treating cases of odontogenic keratocyst and ameloblastomas, with recurrence rates comparable to that of aggressive treatments like resection.

In larger cysts, post enucleation, the inferior alveolar nerve may be exposed at the surgical site, or the amount of bone between the bony cavity and the nerve is very minimal. Application of the modified carnoy's solution for 3 minutes in such intrabony cavity results in direct exposure of the nerve, causing long lasting neurotoxicity to the nerve by damaging the nerve sheath. This results in lifelong neurosensory deficit in the area of distribution of the inferior alveolar nerve.

In this study, an attempt is being made histopathologically, to correlate the damage caused by the direct exposure of the modified carnoy's solution to the inferior alveolar nerve of the rabbit at various time intervals as specified in this study model.

METHODOLOGY

In this prospective study 20 New Zealand adult rabbit's were selected from the department of pharmacology and toxicology, St. John's Pharmacy College, Bangalore in which the Carnoy's solution was placed to the surgically exposed inferior alveolar nerve of the rabbit's. The study protocol was approved by the ethical committees of the St. John's Pharmacy College and The Oxford Dental College, Hospital & Research Centre, Bangalore and was conducted according to the guidelines for the research principles involving animals as set by the CPSEA guidelines, taking appropriate measures for minimizing pain and discomfort to the animals.

STUDY DESIGN

20 New Zealand rabbit's aged about 4-5months housed under standard laboratory condition were used for the study. They were divided into five equal groups namely A, B,C,D,E, consisting of 4 rabbit's each. Each group was further regrouped as A1, A2, A3, A4 and so on. These groups were based on the various time interval's, the surgically exposed inferior alveolar nerve is subjected to the modified carnoy's solution. Group A exposure time being 1 minute, B - 2 minutes, C 3 minutes, D 5 minutes and E 10 minutes.

METHOD

Under intramuscular ketamine hydrochloride injection, at 0.5mg/kg body weight and intermittent inhalation of chloroform vapours, the rabbit's were anaesthetized.

FIGURE 1 : SHOWING INTRAMUSCULAR INJECTION OF KETAMINE HYDROCHOLORIDE

The surgical site was shaved, and standard betadine skin preparation was done. Skin incision 1.5-2 cm was placed in the submandibular area, 1cm below the lower border of the mandible. The subcutaneous tissue, fascia and the muscle were dissected anterior to the attachment of the masseter muscle the mandible till the periosteum was incised and the buccal cortex of the mandibular body exposed.

FIGURE 2 : SHOWING EXPOSED BODY OF MANDIBLE

Next using a micro motor with a stainless steel round bur and copious saline irrigation, 1cm window was created in the body of the mandible by postage stamp method which was further connected using a mallet and chisel and the inferior alveolar nerve exposed.

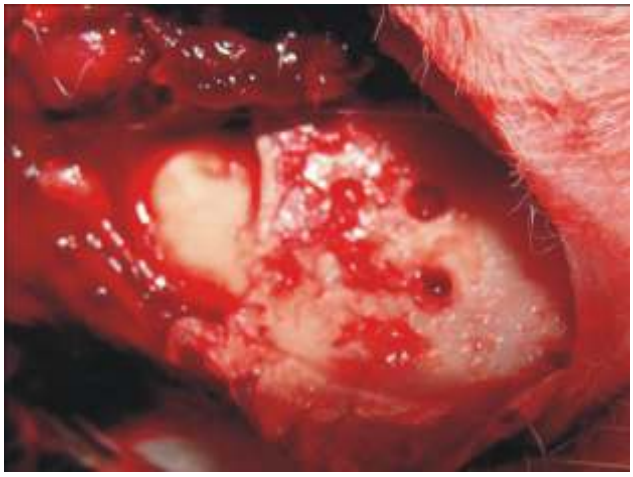


FIGURE 3 : SHOWING BUR HOLES DRILLED FOR CREATING A BONY WINDOW

On exposure of the inferior alveolar nerve, the surrounding soft tissue was isolated. Inferior alveolar nerve was exposed to modified carnoy's solution for 1 minute, 2 minutes, 3 minutes, 5 minutes and 10 minutes in the different study group. After the specified time of exposure it was irrigated with normal saline and a segment of exposed nerve was resected and sent for histopathological analysis. The surgical sites were closed in three layers using vicryl and prolene as the suture material.

FIGURE 4 : EXPOSED INFERIOR ALVEOLAR NERVE

Once the rabbit's recovered from the anaesthesia, they were housed in an controlled aseptic condition with free access to water and food. A course of antibiotic injection Amox 500mg in three divided doses for 5days and analgesic injection Inac 5mg twice a day for 5days were given intramuscularly.

The resected nerve segments were placed in formalin before processing to haematoxyline and eosin stained paraffin sections. The sections were then viewed under compound microscope for accessing the nerve damage.

STATISTICAL ANALYSIS

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in number (%). Significance is assessed at 5 % level of significance. 2x5 Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

TABLE 1 : CUMULATIVE EFFECT ON EPINEURIUM

Epineurium effect	Presence (n=20)	Cum.%
1 min	4	20.0
Up to 2 mins	8	40.0
Up to 3 mins	12	60.0
Up to 5 mins	16	80.0
Up to 10 mins	20	100.0

GRAPH 1

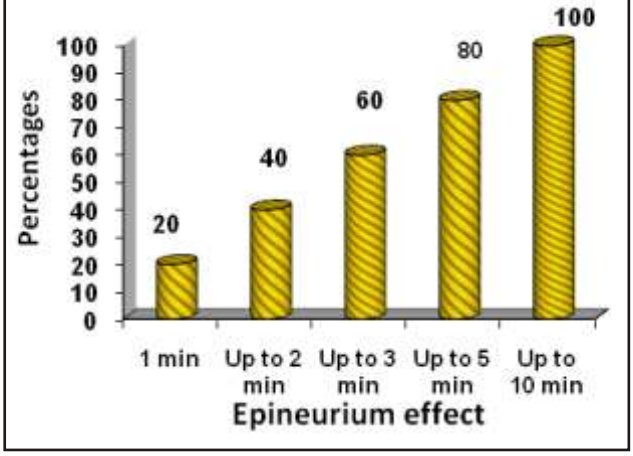


TABLE 2 : CUMULATIVE EFFECT ON ENDONEURIUM

Endoneurium effect	Presence (n=20)	Cum.%
1 min	0	0.0
Up to 2 mins	1	5.0
Up to 3 mins	5	25.0
Up to 5 mins	9	45.0
Up to 10 mins	13	65.0

GRAPH 2

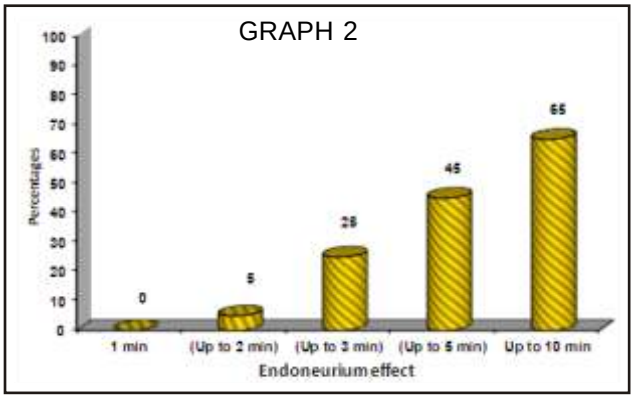
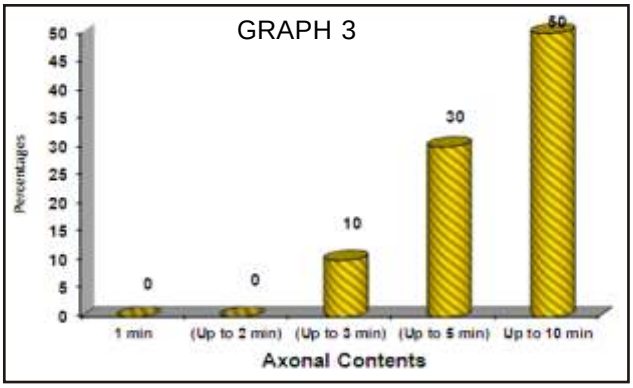


TABLE 3 : CUMULATIVE EFFECTS AN AXONAL CONTENTS

Axonal Contents	Presence (n=20)	Cum.%
1 min	0	0.0
Up to 2 mins	0	0.0
Up to 3 mins	2	10.0
Up to 5 mins	6	30.0
Up to 10 mins	10	50.0

GRAPH 3



RESULTS

1. Fisher Exact test, let there exist two such variables x and y, with m and n observed states, respectively. Now form an m x n matrix in which the entries a_{ij} represent the number of observations in which $x = i$ and $y = j$.

Calculate the row and column sums R_i and C_j, respectively, and the total sum of the matrix

$$N = \sum_i R_i = \sum_j C_j$$

Then calculate the conditional probability of getting the actual matrix given the particular row and column sums, given by:

$$P_{\text{cutoff}} = \frac{(R_1!\,R_2!\cdots R_m!)\,(C_1!\,C_2!\cdots C_n!)}{N!\,\prod_{i,j} a_{i,j}!}$$

which is a multivariate generalization of the hypergeometric probability function.

2. Significant figures

* Suggestive significance (P value: 0.05 < P < 0.10)

** Moderately significant (P value: 0.01 < P 0.05)

*** Strongly significant (P value: P 0.01)

Statistical software : The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and microsoft word and excel have been used to generate graphs, tables etc.

DISCUSSION

In the available literature, there is a paucity of information on the time for application of Carnoy's solution to peripheral nerve tissue before damage leads to nerve dysfunction. Voorsmit, showed a mean penetration depth of 0.15mm in histologic sections of nonviable neurovascular bundles of cadavers, but his study was inadequate in defining a critical time of exposure in terms of functional neurosensory damage. Our experimental study protocol of histological findings following excision of the nerve tissue after application of modified Carnoy's solution for the specified time intervals supported the hypothesis that the inferior alveolar nerve has a time related risk of producing sensory impairment or loss.

Marci showed that the inferior alveolar nerve canal was placed 4.9mm and 17.4mm from the buccal and superior cortical surfaces of the mandible respectively. The bucco-lingual inferior alveolar nerve canal position was associated with age and race. In our study although the nerve was surgically exposed and the Carnoy's solution was in direct contact with the nerve, the above mentioned position of the inferior

alveolar nerve canal in the mandible will help in treatment of cases where the nerve is not directly exposed at the surgical site, as there is a layer of bone separating the lesion from the inferior alveolar nerve. The depth of penetration in cancellous bone at 3 minutes interval is found to be 1.5mm and 2mm to 8mm at 5 minutes interval beyond the radiographic margin.[2]

Surgical dissection of the inferior alveolar nerve from its intraosseous course without compromising its functional integrity proved to be a hazardous and a difficult task. Surgical manipulation can easily produce a lesion of Sunderland degree I- IV[1].

In our study, on gross examination, the colour of the nerve tissue specimen showed variation in colour ranging from dull grey to dark brown based on the various time intervals. This could be because of various degree of intravital fixation of the nerve tissue by modified carnoy's solution.

Histological findings of the study showed that the epineurium was affected in all the study groups with statistical similarity across the groups with P=1.0000. Although epineurium was affected in the 1minute study group, the axonal contents appeared to be normal, as the endoneurium acted as a tight diffusion barrier, paramount for maintenance of functional integrity of the axonal contents.

Upto 2-minutes of exposure showed that 25% of the cases (1 out of 4), the endoneurium was minimally disintegrated whereas exposure of about 3-minutes and above showed complete disintegration of the endoneurium along with the axonal contents.

Exposure for 3-minutes showed total damage to the endoneurium but only 50% (2 out of 4) of the cases had axonal disintegration. The incidence of effect of axonal contents is significantly more in 3-minutes, 5-minutes and 10-minutes interval group with P<0.001.

In the rat sciatic nerve, carnoy's solution produces a functionally relevant chemical injury after a 2-minute exposure, whereas, this process takes 3-minutes in the rabbit inferior alveolar nerve.[1] The thickness of the protecting nerve sheath varies between species, it may be appropriate in clinical setting to use a 3-minutes exposure whenever an inferior alveolar nerve is unprotected subsequent to a rupture or leakage of the cystic wall or when a bony cavity is treated with modified carnoy's solution.[1] This is in contrast to our study which showed damage to endoneurium in one of the four specimens on histological analysis ,thus suggesting an exposure for 2-minutes to be on a safer side as compared to 3-minutes exposure.

CONCLUSION

According to the results obtained from this study, it has been seen that application of modified carnoy's solution to the inferior alveolar nerve upto 2-minutes is advisable, as it causes minimal damage to the neural sheath of the nerve, thus preventing neurosensory impairment.

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Review Article

STRESS AND BURN OUT IN DENTISTRY - THE SILENT "PROFESSION KILLERS" !

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ABSTRACT

Dentistry is a stressful profession demanding physical and mental efforts. Dentists encounter numerous sources of professional stress, beginning in dental school. This stress can have a negative impact on their personal and professional lives, which can later lead to a condition called professional burnout. Burnout can lead to early retirement and indifference to treatment outcomes and patients' conditions or needs. The affected dentist also tends to avoid contact with people, including colleagues, patients, friends or even family. Burnout therefore obviously has serious detrimental effects on the profession as well as on society. To enjoy satisfying professional and personal lives, dentists must be aware of the importance of maintaining good physical and mental health.

Keywords : Burnout, stress, dentistry

INTRODUCTION

Dentistry is a stressful occupation[1-3]. Mental and physical states of exhaustion in this profession has been known for a long time, but it was Freudenberger in 1974 who first coined the term “burnout” for the mental and physical exhaustion of voluntary workers in various social fields[4,5]. The term “burnout syndrome”, mainly applied to the caring professions, defines the breakdown of energy resources and adaptability as a reaction to chronic stress [6,7] . It is generally conceptualised as a syndrome with three dimensions: emotional exhaustion, depersonalisation and reduced feelings of personal accomplishment[7].

In severe cases a burnout syndrome can become an exhaustion depression, i.e. a major depression. First, the person is exhausted mentally or emotionally. Second, the person develops a negative, indifferent or cynical attitude toward patients, clients or co-workers; this is referred to as depersonalization or dehumanization. Finally, there is a tendency for people to feel dissatisfied with their accomplishments and to evaluate themselves negatively. The effects of burnout, although work-related, often will have a negative impact on people's personal relationships and well-being[8, 9,10,11]. Burnout is best described as a gradual erosion of the person.

Researchers who looked at three types of clinicians found that general dentists and oral

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surgeons had the highest levels of burnout and that orthodontists had the lowest levels of burnout[12-16]. Moreover, several studies have shown that burnout (i.e. a job stress syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment) is by no means rare among dentists[17,18]. In addition, a good deal is known about the job demands associated with job stress and burnout. A literature review [19] reported that demanding patient interactions, workload, time pressure, physical demands, and inflicting pain or fear have been identified as possible causes of job stress in dentistry. However, little is known about how dentists manage to cope with their job demands and stay engaged in their work.

American burnout research, dominated by social psychologists, for a long time favoured the organisational and institutional aetiology hypothesis of burnout being, among other things, a reaction to chronic stress, job dissatisfaction[20] and an increasing loss of idealism and energy as a result of working conditions[21] .The environment was considered to be the principal trigger for the burnout process[22,23]. On the other hand, the question repeatedly posed is why, under the same working conditions, one individual burns out, while another shows no symptoms at all. It seems fair to assume that other causes such as personality may also play a role.

Therefore the aims of this review article is to

1) Highlight the various factors that cause stress and burnout among dentists.

2) Assess the different methods to overcome these factors to enjoy a satisfying professional and personal life.

STRESS AND DENTISTRY

The stress-related problems associated with dentistry arise from the work environment and the personality types of the people who choose the profession. Usually the main reasons are that the operatory is usually small, and the dentist's focus is on an even smaller space, the oral cavity. Dentists are required to sit still for much of their workday, making very precise and slow movements with their hands, while their eyes remain focused on a specific spot. Isolation from other dentists also is common. Additionally, a study has shown that dentistry tends to attract people with compulsive personalities, who often have unrealistic expectations and unnecessarily high standards of performance, and who require social approval and status.[24]

Dentists perceive dentistry as being more stressful than other occupations. A study of more than 3,500 dentists found that 38 percent of those surveyed always or frequently were worried or anxious. Moreover, 34 percent of the respondents said that they always or frequently felt physically or emotionally exhausted, and 26 percent said they always or frequently had headaches or backaches.

These symptoms often are associated with anxiety and depression. Problems with time management and staying on schedule appeared in several surveys. There are even factors like working only in a dental college without a private practice. The stress they face in the department as well as when they teach students. It is interesting to note that anxious patients often create less stress for dentists than running behind schedule. Other stressors that appear in these surveys include coping with difficult or uncooperative patients, the workload, the risk of cross infections, new developments in dentistry such as complex new treatment techniques, governmental interventions and a constant drive for technical perfection.

THE MANIFESTATIONS OF STRESS

ANXIETY DISORDERS

All anxiety disorders are bound together by the common theme of excessive, irrational fear and dread. Unlike the relatively mild, brief anxiety caused by a stressful event such as a presentation, anxiety disorders are chronic and relentless and can grow progressively worse if not treated.[21] Two common and potentially overlapping anxiety disorders are panic disorder and generalized anxiety disorder, or GAD. In panic disorder, feelings of extreme fear and dread strike unexpectedly and repeatedly for no apparent reason, and they are accompanied by intense physical symptoms. These symptoms may include “a pounding heart”; feeling sweaty, weak, faint, dizzy, flushed or

PSYCHOLOGICAL EFFECTS OF STRESSFUL SITUATIONS[24,25]			
STRENGTH OF STRESSORS	DURATION OF STRESSORS		
	SHORT TERM	MEDIUM TERM	LONG TERM
WEAK - LOW DEMANDS	Bored, restless, Lethargic	Torpidity, loss of direction, helplessness	Dismay, disillusionment, depression, sense of failure, alienation
MODERATE - CHALLENGING DEMANDS	Aroused, lively, Fun	Challenged, enjoyment, satisfaction, self-efficacy	Achievement, feeling of adequacy or competency, high self-esteem
STRONG - EXCESSIVE DEMANDS	High arousal, tension, excitement	Anger, fear, worry, tiredness, accomplishment (if coping)	Anxiety, depression, exhaustion, loss of self-confidence

chilled; having nausea, chest pain, smothering sensations, or a tingly or numb feeling in the hands; a sense of unreality or a fear of impending doom; or loss of control. Panic attacks, one manifestation of panic disorder, can occur at any time, even during sleep. Some people's lives become so restricted that they avoid normal, everyday activities such as grocery shopping or driving.

GAD involves much more than the normal amount of anxiety people experience from time to time. It is characterized by chronic exaggerated worry and tension, even though little or nothing has provoked it. “People with GAD seem to be unable to shake their concerns, even though they usually realize that their anxiety is more intense than the situation warrants. Their worries are accompanied by physical symptoms, including fatigue, headaches, muscle tension, muscle aches, difficulty swallowing, trembling, twitching, irritability, sweating and hot flashes. When impairment associated with GAD is mild, people with the disorder may be able to function in social settings or in a job. If the impairment is severe, GAD can be debilitating, making it difficult to carry out ordinary daily activities.

DEPRESSION

While major depression can develop at any age, the average age of onset is in the mid-20s. Depressive disorder often occurs with anxiety disorders and substance abuse. Major depression is an illness that involves the body, mood and thoughts[21]. It affects the way people eat, sleep, feel about themselves and think about things. According to the National Institute of Mental Health, “A less severe type of depression, dysthymia, involves long term, chronic symptoms that do not disable, but keep one from functioning well or feeling good.” A depressive disorder is not the same as a passing blue mood, and it is not a sign of personal weakness or a condition that can be willed or wished away. Without treatment, symptoms can last for weeks, months or year. Depressive illnesses often interfere with normal functioning and cause pain not only to those who have the disorder, but also to those who care about them. Often, a combination of genetic, psychological and environmental factors is involved in the onset of depression. Those people who have low self esteem or are pessimistic in nature can be more prone to depression as well. Later episodes of illness typically may be precipitated by only mild stresses or none at all.

SYMPTOMS ASSOCIATED WITH DEPRESSION.[25,26]

- Frequent depressed mood, most of the day, nearly every day.
- Diminished interest or pleasure in all or almost all activities.
- Significant weight loss or weight gain.
- Frequent insomnia or hypersomnia.
- Psychomotor agitation or retardation

- Frequent fatigue or loss of energy.
- Feelings of worthlessness or inappropriate guilt.
- Indecisiveness or decreased ability to think or concentrate.
- Recurrent thoughts of death or suicidal ideation.

HOW TO HELP YOURSELF IF YOU ARE DEPRESSED?

- Set realistic goals.
- Break large tasks into small ones.
- Try to be with other people and to confide in someone.
- Participate in activities that may make you feel better.
- Participate in mild exercise, go to a movie, or participate in religious, social or other activities.
- Expect your mood to improve gradually, not immediately.
- Postpone important decisions until the depression has lifted.
- Practice positive thinking that will replace the negative thinking that is part of the depression.
- Let your family and friends help you.

PROFESSIONAL BURNOUT

Burnout is not the same as stress, which in some cases can even cause people to flourish. Burnout is less likely for people who are cynical and lacking in compassion, but dentists, for the most part, are caring and dedicated professionals. Professional burnout is one of the possible consequences of chronic occupational stress. Dentists have a very high rate of career burnout. Burnout occurs when people are depleted emotionally, physically, and mentally. The burned-out dentist loses enthusiasm for dentistry, and is often late for work and impatient with staffs. Ceaseless work to improve the dental practice that seems never to end, but only to increase, leads to a sense of lack of accomplishment, and financial insecurity intensifies the anxiety dentists often feel. Patients may tend to be perceived as problems, rather than as people who need help. Dentists often suffer from isolation; more than three quarters are in practice alone. Staff turnover in dental offices are high, reflecting the inability of many practitioners to handle management problems effectively. Solutions to burnout among dentists include the following steps: admit the problem; assume responsibility for solving it; decide what can be changed and what cannot; and take time off to allow more objective analysis of the problems.

NEUROTICISM AND BURNOUT

Empirical connections between neuroticism and burnout were found in 1978.[23] Investigations confirm the results of Piedmont, who found that people with high neurotic values also show higher values for the burnout variables “emotional exhaustion” and “depersonalisation”. Neuroticism is sometimes described as a super ordinate for characteristics of general personality, needs and motives that predispose burnout. It is a factor of psychological vulnerability which is probably made up of several sub factors. Anxiety, diminished self-esteem, feelings of guilt and compulsive tendencies, as well as the tendency to worry, irritability and depression are all part of a neurotic personality. Various authors confirm the direct influence of neuroticism on psychological indisposition. In spite of normally conformist social behaviour, a basically neurotic personality displays neurotic behaviour mainly in stress situations. Subjectively, these persons experience more lack of success in what they set out to do, and stress is experienced more negatively, independent of type and time of the stress situation. Because of misinterpretation of subjective and objective stress these individuals are significantly less able to deal adequately with stress, as is particularly notable in fields of work where situational stress is unavoidable, e.g. in intensive care units. As subjective or objective stress is often described as a basic prerequisite for burnout , neuroticism accelerates the burnout process through a disproportionally pronounced feeling of stress.

EXTROVERSION AND BURNOUT

The search for something new, adventurousness and impulsiveness characterise the extrovert.

Individuals seeking excitement and deliberately taking risks have a greater tendency to become emotionally exhausted. In contrast to the general statements of personality literature, which evaluate extroversion as a psycho-protective factor and equate it with happiness, results show a positive connection between "extraversion", "emotional exhaustion" and "depersonalisation". This might be due to the weighting of the sub dimensions of the extroversion scale. Piedmont was able to show that the sub-variable "excitement seeking" of the extraversion scale correlates positively with the burnout variable "emotional exhaustion".[27] Under the title "First inflamed then burnt out", Schwanold, Anderson and Sachse describe the process of emotional exhaustion of caring people changing from highly motivated beginners to resigned, unfeeling and callous professionals. Freudenberger and Richelson write in the same vein: "Burning out is confined mainly to dynamic and ambitious men and women, who, in all that they do, give of their best and with heart and soul". Emotional exhaustion and depersonalisation are here to be seen as the end of a process that takes place in people who have battled on to the end of their emotional strength.

EXTERNAL LOCUS OF CONTROL AND BURNOUT

Results show a clear prognosis value of the personality factor "external locus of control" for the burnout process. Great significance for the burnout process is whether the individual believes that his or her own behaviour determines what he or she encounters. People scoring high in "external locus of control" generally expect that important events in their lives are determined by forces beyond their control (i.e. powerful others, chance, luck). The factor "external locus of control" correlates positively with the burnout variables "emotional exhaustion" and "depersonalisation". This confirms an association between externality, helplessness and self-aggression as a consequence of frustration. Longer periods of helplessness and frustration diminish emotional resources and may therefore lead to emotional exhaustion. Depersonalising behaviour can be interpreted as a protective reaction to the emotional overload. The variable "locus of control" appears to be influenced by one's coping strategies. Distress increases when emotion-focused coping strategies are used with stressors perceived as controllable or when problem-focused strategies are used with uncontrollable stressors. Individuals with high scores on "external locus of control" attempt to use emotion focused coping strategies even with stressors basically perceived as controllable, such as time pressure, staff management or schedule. This mismatch increases the subjectively experienced emotional stress and leads to emotional exhaustion. There are studies which substantiate that emotionalism is in general more unstable in individuals with high scores on "external locus of control" than those with high "internal locus of control"

MENTAL HEALTH AND BURNOUT

The evaluation of data shows that the factor "mental health" or "psychoprotection" is important for all the burnout variables. It measures personality traits such as high self-esteem, efficient coping strategies and autonomy. A person is mentally well to the extent to which he or she succeeds in dealing with internal and external demands. Internal demands are for example daily needs, while external demands, in the field of caring professions, are for example dealing with patients. Anticipated or actual failures are accompanied by negative emotions which lead to physical and psychological withdrawal from patients. The successful mastering of work demands or personal aims lead to positive emotions. These emotions develop a certain regulating behavioural character and in a feedback process influence the personality. "Ability to love" can be seen as a universal indicator for mental health. Low scores for "ability to love" have an influence on the strength of the burnout factor "depersonalisation". It describes people who are in general indifferent towards other people, having difficulties in empathising, being neither very helpful nor considerate. Since they generally show little interest in the lives of friends, they form fewer friendships and appear unsociable and introverted.

An inability to perceive that other people have similar feelings, impulses and thoughts as oneself is caused by a basic inability to love. Although the variable "ability to love" is not explicitly mentioned in association with burnout, the literature describes

different personality types susceptible to burnout whose common factor is the inability to express emotions. The protective function of mental health for the prevention of burnout is well known. Burnout may also be described as a state of “mental illness” as opposed to mental wellness.

HOW TO COPE WITH STRESS AND BURNOUT?

The goal of coping with stress and burn out is to offset the negative effects of by using appropriate coping strategies. The literatures suggests that stress management programmes should be directed at two levels of practitioners: dental students and dentists. Studies have emphasized the importance of stress management training during dental education. Workshops focusing on this may include deep breathing exercises; progressive effective relaxation of areas of the body; listening to audiotapes of oral instructions on how to relax; meditation; information on the topics of practice and business management, time management, communication and interpersonal skills; and the use of social support systems such as study groups or organized dental meetings.

Researchers have found that dentists who take on teaching or leadership roles with other professionals in addition to their clinical practice roles may find that it mitigates stress and burn out. The reasons for this are speculative. The researchers suggest that some reasons may be lessened isolation, increased self-esteem in response to the attention of students, a sense of autonomy over what and when to teach, power over those in a more junior position, added interest in patients as a source of teaching opportunities, and a sense of helping the students.

However, not all stress-burn out producing situations in the dental practice can be eliminated. Stressors such as failing to meet personal expectations, seeing more patients for financial reasons, working quickly to see as many patients as possible for financial reasons, earning enough money to meet lifestyle needs and being perceived as an inflictor of pain are all stress-burn out producing situations. These issues generally require a reassessment of one's own attitudes and expectations in the light of whether they are realistic, achievable or rational.

CONCLUSION

Dentists often perceive dentistry as being stressful. The sources of stress arise from the work environment (for example, workplace, financial and practice management issues) and from the personality types of the people who choose the profession. Stress can elicit varying physiological and psychological effects on a person. With professional burnout, people become emotionally and mentally exhausted; develop a negative, indifferent or cynical attitude toward patients, clients or co-workers; and evaluate themselves negatively. Burnout can be avoided by taking time off regularly; making time to ''decompress'' after work; keeping work and home life separate; creating a social life that is truly satisfying; establishing good personal and professional networks; and searching out people who will actively listen in a nonjudgmental manner. Feelings of burnout can also be used as motivators in changing priorities. Factors like talking to a professional for help, meditation and visiting spiritual places also plays an important role.

Some stress is inherent in dental practice, requiring that dentists learn coping strategies to minimize the effects of stress. Stress management should be targeted to dental students and practicing dentists. The dental educational curriculum should be modified to include business management, stress management and communication skills. Some dental associations offer stress management workshops, professional help, counselling services and support networks. In addition, dentists should assess their own attitudes and expectations to determine if they are realistic, achievable or rational. Finally, dentists must realize that help is readily available if the effects of stress become overwhelming

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Journal Of The Oxford Dental College

Review Article

AN EYE ON EYE SAFETY

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ABSTRACT

Eye injuries at work are common. Every year about 70,000 workers injure their eyes. Approximately 10% of these injuries are severe enough to require days away from work to recover. Luckily, 90 percent of all workplace eye injuries are preventable with the use of proper safety eyewear. The best place to start preventing eye injuries is by identifying the eye hazards in your job. The dental office can be a source of ocular injury due to mechanical, chemical, microbiological and electro-magnetic insult. Accidents resulting in injury to the eye and face of dentists, auxiliaries and the patient can occur at any time. In this safety conscious age all general dental practitioners should be promoting the use of eye protection. The aim of this review is to highlight the uptake of eye protection by all clinical staff and patients within the general dental practice setting, with regard to adequate protection and its use at appropriate times.

Keywords : Eye protection, Ocular injuries, Dentists, Occupational hazards, Safety glasses.

INTRODUCTION

In the modern dental practice, safety concerns must be paramount to avoid injury and litigation. Dentists must be vigilant in wearing personal protective equipment to ensure their own personal safety and thus remain healthy and active in their profession. Dental students are taught many basic safety practices and learn about the importance of personal protective equipment prior to reaching the clinic floor and, hopefully, continue to employ safety practices well past graduation. Because the vast majority of dental procedures are accomplished with instruments being passed over or near the patient's face and with aerosols and chemicals frequently in close proximity, both patients and dental students should wear eye protection. [1]

Till 1970s, many dentists performed dental procedures with no or little knowledge of personal protection. The perceived risk of infection was thought to be low and few dentists wore operating gloves, masks or eye protection. The increasing awareness of personal protection and cross infection control, from both dental professionals and patients has changed this perception. While the use of protective gloves and

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masks by all the dentists appears now to be a routine behaviour, still eye protection is not of great concern.[2]

The dental office can be a source of ocular injury due to mechanical, chemical, microbiological and electro- magnetic insult. Accidents resulting in injury to the eye and face of dentists, auxiliaries and the patient can occur at any time.[3]

Ocular injuries during dental practice may have serious and long term effect and sometimes lead to loss of vision in one or both eyes. Symptoms of direct mechanical trauma often correlate with severity and type of trauma, and include pain, epiphora, and blurring of vision.[2]

Penetrating ocular trauma might lead to serious complications and require extensive surgery. Chemical injuries can result in corneal damage and lead to visual impairment and discomfort, which may limit a dentist's future clinical practice. In minor trauma, generally the eye heals well and rarely are there any long term complications, with the exception of recurrent erosion syndrome which needs long term treatment with lubricants and mild steroids.[2]

Every practice must have a written infection control policy, stating the necessity to wear eye protection.[4] Failure to employ adequate methods of cross infection control may render a dentist liable of serious professional misconduct or susceptible to litigation. Each individual dentist is responsible for the uptake and use of such protection by themselves, their immediate staff and importantly the patient under their care in the surgery environment; it is suggested that compliance with health and safety form part of an employee's contract of employment.[5]

Therefore aim of this review is to highlight the uptake of eye protection by all clinical staff and patients within the general dental practice setting, with regard to adequate protection and its use at appropriate times.

2. FACTORS PROMOTING EYE INJURIES

Apart from mechanical trauma from steel, gold or amalgam particles, dental personnel are at high risk of microbial infection from saliva, blood, calculus and infected tooth material. Dental turbine's create aerosols of bacteria in areas up to four feet from patient's mouths .[6,7] At a normal working distance, there is no zone of safety from organism bearing droplets and bacteria may remain in suspension in the air for up to 30 minutes.[8,9] There is a risk that the protective mechanism's of the eye may be overwhelmed by such high concentrations of pathogens. The eyes, in particular, are also at risk from various chemicals used in clinical dentistry, particularly sodium hypochloride and phosphoric acid, trichloracetic and chromic acids. Laboratory materials constitute a more significant hazard. Apart from acids, methyl metharylate monomer, if splashed into the eye, can cause a painful reaction.[10] Plaster of Paris contains small quantities of lime and quartz, which can damage the eye; whilst pumice can abrade it.[11]

Contamination of the eye with bodily fluid accidentally such as blood and saliva carries with it several potential risks, both bacterial and viral.[12] Previous studies emphasize that eye infection were common among dentists and although many were concerned, few were using proper eye protection.[13,14] Since the surface of the eye is a vital structure, simple contact with an infected substance, for example from a contaminated aerosol, has the potential to cause infection, without the need to be abrased or breached.[15]

Among eye infections, Herpetic Keratitis is one of the worst that can be contracted by clinical dental staff, but bacterial conjunctivitis caused by Staphylococcus aureus is more common. Other conjunctival pathogens such as Chlamydia trachomatis have been reported, although rarely, to have been trans-mitted in dental practice.[16] More recently, concern has been raised about infections caused by methicillin resistant staphylococcus aureus (MRSA). This can be spread by direct contact and although not normally found within the oral cavity, it is found in nostrils. In addition it has been occasionally isolated from oral infections. It must be emphasized that most carriers of latent infection are unaware of their condition and it is important that the same infection control routine is adopted for all patients; surgeon's are more likely to use adequate protection, if a patient is known to be infected.[15]

A standard dental light curing unit emits blue light between 350-500 nm, which includes UV group C, which is harmful for the eye indicating the necessity for filtration to protect the eye. Protection against UV and blue light should be incorporated in safety glasses to prevent acute and chronic changes in ocular structures, such as UV cataracts, solar retinitis, corneal and conjunctiva dystrophies and macular degeneration, which may lead to irreversible damage.[17]

Continuous developments within dentistry have seen an increased use of light cured materials and it may be some time before any correlation is made between exposure to UV radiation, ocular symptoms and dentistry. Suitable eye protection against electromagnetic radiation must be considered to avoid irreversible damage. More recent dental light sources, such as the light emitting diode, plasma arc curing, quartz tungsten halogen and laser curing lights, not only require eye protection against the intense light but also the associated increased temperature.[18]

3. POSSIBLE ADVERSE EFFECTS ON THE EYES:[12]

Infective / trauma	Effect	Cause	Symptom	Treatment	Outcome
Trauma	Corneal abrasion	Foreign Body	Acute pain	Self limiting	Heals rapidly Recrurrent erosion syndrome 2nd infection
	Hemorrhage in the anterior chamber. Torn Iris	Penetrating foreign body	Acute pain, altered vision, altered shape	Remove foreign body	Heals rapidly Recrurrent erosion syndrome 2nd infection
	Laceration	Blunt / sharp object	Laceration and May involve the lid margin	Automatic repair	Scarring and Lid deformity
	Chemical injury	Acid / alkali	Mild Conjunctivitis	Copious irrigation Remove particles, Epithelial erosion, keratopathy	Usually Recovered, Corneal opacities, Perforation, adhesion
Infective	Bacterial conjunctivitis	Staph, strepneumonia haemophilus	Redness, discharge, ocular irritation	Usually self limiting	Heals
	Bacterial Keratitis	Staph, epidermides, auereus, Strep pneumonia, Pseudomonas heamophilus	pain, purulent discharge. Ciliary infection. Visual impairment, Corneal opacity	Topical antibiotics	Heals
	Viral conjunctivitis	Adeno virus, Coxsacki picornavirus	Watery purulent discharge, chemosis, excess lacrimation	Self limiting but highly infective	Heals
	Viral keratitis	Herpes Simplex	Dendritic ulcer in the cornea and may involve the stroma	Acyclovir	Ulcer heals without scarring. Risk of permanent scarring and blindness
	Hepatitis B and C HIV	Hepatitis virus HIV	Systemic infection	Interferon Supportive drug treatment	Chronic infection, cirrhosis, cancer, poor prognosis and death

4. TYPES OF EYE PROTECTION:[14]

TYPES	ADVANTAGES	DISADVANTAGES
Safety glasses	- Good dimensions with side shields - Tinted lenses offer adequate filtration - Cost effective - Child sizes available - Can be used with loupes - Protect against vapour	- Optically imperfect - Tinted lenses - Clear lenses inadequate filtration of UV light, additional protection required
Visors	- Less claustrophobic to wear - Protect face from splatter - Clear - Face more visible to patient - Shields easily replaced - Cost effective	- Optically imperfect - Need for additional UV protection - Not suitable for patients - Must be adjusted to use with loupes
Personal glasses	- Needed for vision correction optically perfect - Side shields can be added - A degree of UV filtration can be added - Convenient for patients - Can be used with loupes	- Unsuitable dimensions for adequate protection - Need for additional UV protection

5. DO'S AND DON'TS OF EMERGENCY EYE CARE:[14]

If an eye accident occurs, see a medical doctor or eye care professional as soon as possible since an injury may not be immediately obvious until a medical professional can be seen, heed the advice below.

Do's :

- Protect the eye from further damage by holding a folded cloth over the eye, having it act as a shield.
- Seek eye care immediately.
- Bandage any cuts around the eye to prevent contamination or infection.
- Flush the eye with water in the case of a chemical burn or if there is small debris in the eye.
- Use a cold compress to treat a blunt trauma injury such as a black eye, but be careful not to apply additional pressure.

Don'ts :

- Do not remove any objects that are stuck in the eye as this could worsen the injury.
- Do not wash out the eye when dealing with cuts or punctures to the eye.
- Do not attempt to self-medicate, apply ointments or take any medications, including over-the-counter drugs.
- Do not rub the eye or apply pressure. Doing so may cause more damage.

6. SAFETY PROTOCOLS

In February 2003, the British Dental Association (BDA), published an advice sheet, 'Infection Control in Dentistry, distributed it to their members and made it freely available.[18] The BDA advice sheet stated that:

Operators and close support clinical staff must protect their eyes against foreign bodies, splatter and aerosols that may arise during operative dentistry:

- During scaling, (manual and ultrasonic)
- Using rotary instruments
- Cutting and use of wires
- Cleaning instruments.

Ideally protective glasses should have side protection. Patients' eyes must always be protected against possible injury; tinted glasses may also protect against glare from the operating light.'

The American Dental Association (ADA) has published following Guidelines for Infection Control in Dental Health Care Setting 2003"[19]

"Protective eyewear with solid side shields or a face shield should be worn by dental health care personnel during procedures and patient-care activities likely to generate splashes or sprays of blood or body fluids. Protective eyewear for patients shields their eyes from spatter or debris generated during dental procedures."

The use of protective clothing, including eye wear, is also advised by the Health and Safety Executive, Control of Substances Hazardous to Health (COSHH), 2002[4] and Personal Protective Equipment, (PPE), at work Regulations, 1992.[20]The routine use of goggles or spectacles with side pieces and plastic lenses conforming to British Standard BS2092 are recommended.

Safety protocols must be adhered to in order to avoid permanent damage to the eyes. The eyes are the most important sense to the practice of dentistry. And, since vision provides more than 75% of all sensory information, every factor that affects vision should be given ample and immediate attention. Although many hazards exist in the dental setting, fortunately, most eye injuries can be prevented through use of protective measures. The Occupational Safety and Health Administration (OSHA) has regulations currently in place to reduce potential ocular threats among employees in the dental setting. Dentists should be aware of these laws and promote compliancy among all team members.[21]

7. PREVENTION AND RECOMMENDATIONS

The universal precautions for eye protection may help in avoidance of eye injury or infection but do not provide a guarantee of total safety from foreign bodies or conjunctivitis. Close viewing and treating anterior teeth increase the exposure to missile damage. Eyes must be protected from foreign bodies, infected material, chemicals, and the various forms of radiation. Some 53 per cent of dentists wear glasses because of sight defects,[11] but the simplest and most effective methods of preventing eye injury is the use of proper protective spectacles preferably with plastic lenses and side shields. All dental personnel should be familiar with first aid measures and the location of a stock of suitable eye irrigants. This may prevent serious complications in case of eye injury or conjunctivitis. To avoid the unforeseen serious situation, the universal precautions should be adopted in routine clinical and dental laboratory procedures. This may help in better and healthier, low risk working environments with the notion of safety at work.[3]

The ADA and the BDA recommend wearing visors, manufactured safety glasses or personal glasses with additional side shields. Visors and safety glasses are made of polycarbonate which is optically imperfect, and although causing no permanent damage it may be an inconvenience when carrying out work with defined precision. The use of personal glasses may be a suitable means of protection for clinical staff and patients.[5] Personal glasses should have an adequate frame diameter to shield the ocular area, and preferably have additional side shields; suitable UV protection is required in conjunction. However, modern prescription glasses are becoming increasingly small and narrow making them unsuitable for the use of eye protection. It is therefore up to the General dental Practitioner (GDP) to judge whether the patient's, or indeed their own, glasses will offer adequate protection, and if not, provide adequate protection.[3] It is also recommended that patients should wear eye protection for all treatment modalities, particularly when supine as the risk of injury is increased.

Eye protection does prevent injury, but needs to be worn 100% of the time during exposure prone procedures to ultimately reduce the risks, since injuries were recorded during all of the procedures questioned. The only time eye protection is not

imperative for staff is during a basic oral examination. In view of this, the necessity for a practice policy with reference to eye protection adhered to by staff and patient's alike is evident, as well as compulsory. Patient and staff cooperation requires implementation of the practice policy through good communication and clear explanations as to why eye protection is required.[5] The public generally welcomes and accepts the use of barrier protection by dentists, if educated in its advantages and necessity.[22]

Dentists should take the responsibility for their team for occupational safety and hazard free working environments, with first aid available. The awareness of self-protection should be highlighted at all clinical and research symposia and meetings. Protection of the eyes should be emphasised and practised at undergraduate level (safety glasses, face shields etc.). In the case of an eye injury or infection, it should be reported and registered at the workplace. Further studies are needed to assess the financial implications of ocular injuries or infections in dental institutions and practices.[3]

8. CONCLUSION

Although a low level of work related incidents involve the eye, studies by various authors have highlighted the eye as a vulnerable target, especially with prolonged exposure. Risks encountered within the dental environment do cause harm to the unprotected eye, which can be reduced or even eliminated by improving the uptake of suitable eye protection; several choices for eye protection are available.[23] This review emphasizes the need for appropriate eye protection in the general and all dental subspecialties practice setting during at risk procedures and is something which should be expected from the whole dental team; with effective communication and education of patients, this should result in 100% compliance by all.

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Review Article

ACCURACY OF MAXILLARY SUPERIOR REPOSITIONING IN LEFORT I OSTEOTOMY - A REVIEW

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ABSTRACT

Lefort I osteotomy with superior repositioning is one of the most difficult maxillary osteotomies to replicate preoperative planned movements in anterior and posterior maxilla. Thereby leading to post operative complications like open bite, post operative asymmetry, excessive tooth show etc post operatively. In this article we have reviewed literature as to determine the best method to achieve accurate maxillary repositioning following Lefort I osteotomy superior repositioning. According to most of the authors using a combination of extraoral and intraoral reference points intraoperatively leads to most accurate maxillary repositioning.

Keywords: Lefort I, orthognathic, Accuracy.

INTRODUCTION

Orthognathic surgery is gaining popularity as the number of adults seeking orthodontic and orthognathic surgical treatment increases. Its popularity is also a result of greater predictability and accuracy in its outcome. However, the planned surgical outcome is dependent on the accuracy with which the surgeon can achieve the planned movements during the operation. This is not always achieved in the operating theatre.[1] The surgical techniques have not changed much over the years, and the three-dimensional control of intraoperative maxillary movement is not standard. If interocclusal wafers are used, transverse and sagittal repositioning is predictable. Virtual, computer-assisted models can improve the accuracy of the splints, but do not improve vertical control of the maxilla because of autorotation. Schneider et al. showed that the most important differences between planned and achieved movements are in the vertical dimension.[2]

Intraoperative positioning of the maxilla in Le Fort I osteotomy is usually guided by points marked on bone above and below the osteotomy cuts. Reliance on these internal reference points (IRPs) alone has inherent weakness. Horizontal anteroposterior (AP) movements of the maxilla can lead to inaccuracies in measuring vertical movements because there is a triangulation effect when reliance is placed on the IRP above and below the bone cuts, as these two points are relatively close together[2]. In addition, movements at the incisor tips may be different from the IRP selected on the maxilla.

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Navigational operating results in greater inaccuracies than the techniques already known in orthognathic surgery. Several have been described for vertical control, including intraoral or extraoral reference points[12], intraoperative face-bow transfer, and the three-split technique with positioning plates. Several studies have shown that extraoral reference points are more reliable than intraoral one[11-12]. As movement of the skin leads to inaccurate measurements with skin markers, some authors have proposed bone-anchored devices such as Kirschner (K) wires or miniscrews.[2]

MATERIALS AND METHODS

A Systemic computerized database search was done using sciencedirect, Wiley and Blackwell. The terms orthognathic surgery, Lefort 1 osteotomy and maxillary osteotomy were used for searches. Once the original search was completed, pertaining articles were selected from the abstracts with following initial inclusion criteria: clinical trials in humans, orthognathic surgery with or without orthodontic treatment and use of computer software or manual tracings for predictions. The actual articles of the selected abstracts thereafter retrieved and independently reviewed again by the same authors. The reference list of all the selected articles were also searched for any potential articles that might have been missed in the electronic search of the databases and additional information not available through the article was directly obtained from the print journals.

REVIEW

Giancarlo Renzi et al[3] described a simple, noninvasive intraoperative technique that is useful in measuring the vertical dimension of the maxilla and helps to indicate precise repositioning. In their study they obtained intraoperative measurement of the anterior vertical dimension of the maxilla between the inferior margin of the infra orbital foramen and the neck of the maxillary canine and the posterior vertical dimension between the inferior margin of the infra orbital foramen and the neck of the first molar bilaterally. Subsequently, following Le Fort I osteotomy, the maxilla was precisely repositioned in 3 dimensions, But According to various studies[2,4,6,7,8] intraoral reference points are not as accurate as extraoral reference points.

T.K. Ong et al[2] in their study utilized extraoral reference point using a 2 mm titanium bone screw 10 mm long placed at the nasion through a stab incision for vertical anterior maxillary repositioning and internal reference points for posterior vertical repositioning. Positioning of the mobilized maxilla in the vertical dimension was guided externally by repeated measurements of the distance between the central hole in the nasion screw and a point on the orthodontic bracket of a central incisor with large calipers. Smaller calipers were used for internal measurements of bony points marked above and below the osteotomy cuts. An intermediate wafer was used to control the AP and transverse dimensions. Comparing pre and post surgical cephalometric analysis they achieved 97% accuracy in anterior vertical repositioning whereas only 77% accuracy in posterior vertical repositioning.

W.B. Kretschmer et al[1] in a study investigated the accuracy of a modified pin system for the vertical control of maxillary repositioning in bimaxillary osteotomies. The preoperative cephalograms of 239 consecutive patients who were to have bimaxillary osteotomies were superimposed on the postoperative films. Planned and observed vertical and horizontal movements of the upper incisor were analysed statistically. The mean deviations of -0.07mm (95% confidence intervals (CIs) -0.17 to 0.04 mm) for the vertical movement and 0.12 mm (95% CI -0.06 to 0.30 mm) for the horizontal movement did not differ significantly from zero. Comparison of the two variances between intrusion and extrusion of the maxilla did not differ significantly either ($p = 0.51$). These results thereby suggested that the modified pin system for vertical control combined with interocclusal splints provided accurate vertical positioning of the anterior maxilla in orthognathic surgery.

DISCUSSION

Historically many surgeons have used various techniques to achieve accuracy in maxillary superior repositioning following lefort I osteotomy with variable success, each having its own advantages and

disadvantages. Extraoral reference points on the skin were used initially but they showed non-directional mean deviations of up to 0.96 mm, but because of the mobility of the skin this technique has been criticised in many papers.[4,5]

The results of the studies presented by Polido et al, [6] Stan-china et al, [7] and Van Sickels et al[8] have revealed a high degree of imprecision in maxillary surgical repositioning measured on the basis of IRPs, with significant differences appearing in the vertical dimension between the planned skeletal movements and those actually accomplished.

Placement of a nasion screw as an external reference point involved a small wound with minimal scarring is being used with good accuracy in vertical dimension in anterior maxilla.[6] This confirmed the findings of Ferguson and Luyk.[7] Whereas positioning of the posterior maxilla in the vertical dimension compared with the anterior maxilla was less accurate but satisfactory. One explanation is the inherent larger margin of error as a result of superimposition of the posterior molars on the two sides of the maxilla in the lateral cephalometry. It is possible that the three-dimensional guidance system advocated by certain authors may achieve more accurate results. The use of an anteriorly placed nasion screw as the external reference point creates a geometry of measurements that explains the better results anteriorly than posteriorly. There is an arc of constant radius from the screw that fixes the change in anterior height but allows variation in the posterior horizontal and vertical measurements.[1]

Studies with extraoral bony reference points have shown better results. Ferguson and Luyk described a precision of 0.6 mm,[4] while Perkins et al reported even better results with a K-wire at the nasion and an adaptable caliper to avoid triangulation effects;[5] they presented a non-directional mean deviation of 0.5 mm. Measurement with the modified pin provides accurate vertical repositioning of the maxilla in bimaxillary or Le Fort I osteotomies. In contrast to the use of miniscrews, no scars are visible. Direct measurement avoids sources of error such as face-bow transfer, model operations, and wafers. The vertical position of the incisors can also be controlled at any time during the operation. It can also be combined with virtual methods for the fabrication of wafers. A combination of the new pin with positioning plates for the fixation of the condyles might be an ideal solution. Studies with larger samples of the K-wire technique and a comparable statistical evaluation are necessary to show clinically relevant differences between the two devices. Kretschmer reported a mean (SD) deviation of 0.06 (1.2) mm and 75.2% of the values within 1 mm either way.[5]

Over a period of time it has been observed by various surgeons in literature that extraoral reference points in combination with IRPs give a satisfactorily accuracy in overall vertical repositioning of maxilla[9-12]. Unfortunately, immediate postoperative radiographs were not used or the authors presented their methods as technical notes, rather than objective assessments.

CONCLUSION

The simulated treatment plan can be transferred to model surgery, and finally to the orthognathic surgical procedures with relatively good hard and soft tissue predictability. Use of external reference points especially for maxillary procedures improves predictability and facebow transfer and two thin occlusal wafers further increase the accuracy. However, the variability of the predicted hard and soft tissue individual outcome seems to be relatively high in maxilla, and caution should therefore be taken when the planned and predicted hard and soft tissue positional changes are presented to the patient preoperatively.

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Journal Of The Oxford Dental College

Review Article

PRECISION DENTISTRY WITH DENTAL OPERATING MICROSCOPE

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ABSTRACT

Microscope has redefined the concept of visualization in the field of medicine. The enhanced magnification and illumination of Dental Operating Microscope (DOM) provides a fascinating potential to make it an excellent tool for dealing with almost all clinical situations in dental practice and makes it possible for achieving previously unattained levels of dental care due to greater precision, thereby minimizing clinical errors. Apart from the obvious optical advantages, DOM also offers ergonomic benefits to the dentist. By integrating DOM in clinical practice the dentist is rewarded with the benefits of excellent visualization coupled with completely comfortable upright working posture, significantly reducing fatigue and eye strain.

Keywords : Dental operating microscopes, Precision dentistry, Ergonomics.

INTRODUCTION

The microscope, an invention that has changed the way we perceive the world, evolved through the process of much experimentation and has certainly been one of the most ground breaking discoveries in the field of health care. The discovery of microscope has enabled man to learn a great deal about life on the atomic and microscopic level.

Roger Bacon (1267) developed a lens for the first time. Earliest documented use of microscope is accredited to Hans Lipershey and Zacharias Jansen (1595). They were eye glass makers experimenting with lenses to see things too small to be visualized by the naked eye. Antony Von Leeuwenhoek, championed as the “Father of Microbiology” improved the basic model of microscope by his unique manipulation and shaping of lenses, thereby leading to invention of compound microscope by which he went on to discover the capillary system, observed protozoa, bacteria, muscle tissue as well as studied the life cycle of ants.

The microscope has redefined the concept of visualization in medical field. Surgical operating microscopes have become standard tools used in operation theatres in the specialities of ophthalmology, otorhinolaryngology, gynaecology, neurosurgery and plastic surgery. In the present era of

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precision in every field, dentistry too is neither lagging behind in making use of microscopes for visual enhancement. Global Microscopes are the world's first commercially available microscopes designed specifically for dentistry. The American Dental Association (1998) has also recognized the importance of dental operating microscopes and has made it mandatory that all accredited US post graduate programmes must teach the use of DOM in speciality of endodontics.[1]

A typical DOM is equipped with a binocular tube fitted with lenses that provide magnification of 5X to 25X, a fibre optic coaxial light source that provides a field of illumination of 70mm and an adjustable working distance of 8 to 12 inches. It can also be fitted with optional accessories like beam splitter which can direct the display image into more directions like camera, video, TV monitor or to an extra set of binocular. The DOM has 4 mounting possibilities, on the wall, on the ceiling, on a mobile floor stand or customised to mounts in cabinets.[2]

The enhanced magnification and illumination of DOM provide a fascinating potential to make it an excellent tool for dealing with almost all clinical situations in dental practice.

The following section enumerates some of the clinical applications of DOMs:

1. DOMs are valuable for closer inspection of oral cavity during the initial dental check-up especially in critical areas of teeth, gingiva and mucosa otherwise not perceptible to the naked eye, to obtain precise diagnosis.

2. Improved patient communication and treatment acceptance.

Capturing digital images helps in improving the patient's awareness of the condition of their oral cavity, especially in cases which are asymptomatic and makes them realize the necessity for treatment. By using DOMs the clinician can demonstrate the patient's oral condition before, during and after the treatment. Incorporating the images on still camera or video enables the patient to observe enlarged images of their teeth, thereby the patient's confidence in the dentist increases and they co-operate better during treatment.

3. Documentation of the findings using DOMs on DVDs, VHS, or in digital system also aids in patient education, record keeping and can be used for medico legal purposes.

4. Caries diagnosis

Visual examination has been an indispensible part of dental examination. But sometimes there are certain areas of the oral cavity that cannot be visualised easily with the human eye and might be neglected by the dentist during routine dental examination. By using DOM, the dentist can locate decay or other disorders even in those areas of the oral cavity that are hard to reach. E.g. Retromolar areas, pits and fissures.

5. Caries removal

Dentists can differentiate between primary and secondary dentin by their shades. Healthy tissues can be preserved and in some cases if used in conjunction with caries detector dyes the dentist can restrict to removal of decayed tissues (infected dentine) only and even avoid RCTs.

6. Diagnosis of fractures / cracks on patients teeth or restorations

7. In endodontics

The practice of endodontics formerly relied on tactile sensation, radiographic interpretation, experience and the ability to visualize the tooth in 3 dimensions. But with DOM, treatment can be performed under direct vision and we can visualize what we used to feel by tactile sensation, as in case of teeth with straight root canals, wherein the pulp chamber can be viewed all the way up to the apex. DOMs aid in identification of hidden canals and accessory canals[3], [4], superior root canal cleaning and shaping[5], removal of broken instruments, dealing with calcified canals[6], perforation repairs, evaluating the quality of restoration and detecting overhangs.

8. In periodontics

Scaling and cleaning of teeth done under DOM afford better removal of calculus and stains.

Periodontal flap surgery done under DOM allows better removal of diseased tissues with little damage to nearby healthy tissues. Suturing and healing by primary closure will be more accurate resulting in faster healing, better aesthetics and less post operative pain and discomfort to the patient. [7]

9. In prosthodontics

To evaluate the tooth preparation for finish lines and proper seating of prosthesis / crown margins. Dental technicians have for long been using DOMs to examine the margins of the prosthesis to ensure better fit and excellent aesthetic results.

10. In minimally invasive surgical techniques like sinus floor elevation[8], endodontic surgeries[9] and periodontal surgeries. [10]

11. Using this revolutionary, cutting-edge, state of the art dental gadget enhances the prestige of the clinician and improves his / her reputation.

The cost factors and the additional time required for training and adjustment phase with four handed dentistry may pose as hindrances for the use of DOMs. But the long term advantages overweigh these initial limitations.

Enhanced magnification and illumination make it possible for achieving previously unattained levels of dental care due to greater precision and consistency in treatment outcome, minimizing the chances of clinical errors. Apart from the obvious optical advantages DOMs offer numerous ergonomic benefits to the dentists.

A significant number of practicing dentists are at risk of developing Musculoskeletal Disorders (MSD), whose cumulative effect may lead to injury or even a career jeopardising disability. The World Health Organization defines MSD as “a disorder of the muscles, tendons, peripheral nerves or vascular system not directly resulting from an acute or instantaneous event (e.g., slips or falls). These disorders are considered to be work-related when the work environment and the performance of work contribute significantly, but are only one of a number of factors contributing to the causation of a multi factorial disease.” [11]

The most common MSDs that dentists experience include the following :

1. Chronic low back pain: Pain in the lower back, often referring to the hip, buttock or leg. The cause may be muscle strains or trigger points, instability due to weak postural muscles, hypo-mobile spinal facet joints, or degeneration or herniation of spinal disks.

2. Tension neck syndrome: Pain, stiffness and spasm in the cervical musculature, referred pain between shoulder blades or the occiput and sometimes numbness or tingling in the arm or hand. Forward head posture may precede this syndrome, precipitating muscle imbalance, ischemia, trigger points or cervical disk degeneration / herniation.

Dentists during the course of delivering treatment find themselves in sustained awkward postures. These postures often consist of forward bending and repeated rotation of the head, neck and trunk towards one side. Over a period of time, the muscles responsible for rotating the body to one side may become stronger and shorter, while the opposing muscles become weaker and elongated. The stressed shortened muscles can become ischemic and painful, exerting asymmetrical forces on the spine that can cause misalignment of the spinal column and decreased range of motion in one direction over the other.

Continuous work in front of and below the operator's eye level leads to a forward head and rounded shoulder posture. This can cause weakening and elongation of the “stabilizer” muscles of the shoulder blades (middle and lower trapezius, rhomboid and serratus anterior muscles). As a result, the shoulder blades tend to move away from the spine resulting in rounded shoulder posture. Meanwhile, anterior “mover” muscles (scalene, sternocleidomastoid and pectoralis) become short and tight, pulling the head forward. Ligaments and muscles then adapt to this new position, making it uncomfortable to assume correct posture. The cycle of muscle imbalance perpetuates as tighter muscles become tighter and weaker muscles become weaker. In addition, major nerves to the arm run behind certain tight muscles and nerve entrapment syndromes may occur as a result of pressure on these nerves. The

forward-head-and-rounded-shoulder posture induces stress on the upper neck muscles (trapezius and levator scapulae) and on the spinal intervertebral disks. This can result in ischemia and pain in the overworked muscles.

Repeated leaning towards a patient can also cause strain and overexertion in the low back extensors, while the deep stabilizing abdominal muscle (transversus abdominis) tends to become weaker. [12]

With proper ergonomic features, DOM facilitates a near-neutral head posture. Indirect viewing of the oral cavity is achieved by optics in the scope, which bend the path of the image to 90° or greater (with inclinable binoculars) allowing an upright posture.

Apart from DOM, two other types of magnification devices available in the market today are the procedure scopes and loupes (or telescopes). [13] The procedure scopes have an extra oral camera placed above the patient's mouth that projects the image onto a large, flat LCD video screen. The screen is mounted at eye level, allowing the operator to move freely around the patient while visualizing the screen. The depth of field is 4 inches and the entire mouth can be in focus at the same time.

Loupes are available in 2 basic types: front lens mount (flip-ups) and fixed mounts, also called through- the-lens (TTL).

Comparative analysis of the various magnification devices (Table 1)

CONCLUSION

By integrating DOMs in clinical practice the dentist is rewarded with the benefits of excellent visualization, completely comfortable upright working posture and no extra weight on the head. The operator is able to sit upright without fatigue, tension and stress in the neck or lower back muscles. Focussing completely on the task, the eyes of DOM users remain focussed on infinity (don't have to accommodate or converge), thus remain in relaxed state, as opposed to loupes users whose eyes are crossed (converged), eventually resulting in fatigue and eye strain. As human beings we always strive for perfection and microscope assisted precision dentistry with the technique of visual enhancement is emerging

TABLE 1: COMPARATIVE ANALYSIS OF THE VARIOUS MAGNIFICATION DEVICES

Magnification Type	Forward Head Posture*	Vision	Magnification	Portable	Lighting/Angle of Light
Procedure Scope	Near neutral	2-D image on flat LCD screen	1 to 23X	Mobile floor stand available	Standard/Parallels operator line or sight
Microscope	Near neutral	3-D image; binocular vision with proper scope adjustment	2 to 20X	4 mounting options available	Standard/Parallels operator line or sight
Flip-up Loupes	20° to 30° forward	3-D image; convergence angle	2 to 5X	Yes	Optional/Head mounted? 15°
TTL Loupes	25° to 40° forward	3-D image; convergence angle	2 to 5X	Yes	Optional/Head mounted? 15°

* Best working postures measured by the author during in-office dental ergonomics consultations, representing various manufacturers' magnification systems.

as new standard of care for the 21st century which helps to treat the patients a lot better than before.

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Review Article

USE OF CONE BEAM CT IN MINOR ORAL SURGERY

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ABSTRACT

Cone beam CT (CBCT) produces three-dimensional information on the facial skeleton, teeth and their surrounding tissues; and is increasingly being used in many of the dental specialties. This is usually achieved with a substantially lower effective dose compared with conventional medical computed tomography (CT). Periapical pathologies, root fractures, root canal anatomy and the true nature of the alveolar bone topography around teeth may be assessed. CBCT scans are desirable to assess posterior teeth prior to periapical surgery, as the thickness of the cortical and cancellous bone can be accurately determined as can the inclination of roots in relation to the surrounding jaw. The relationship of anatomical structures such as the maxillary sinus and inferior dental nerve to the root apices may also be clearly visualized. Measurements on CBCT are more accurate when compared with OPG. Therefore, CBCT permits the clinician to have all necessary information when planning dental implants.

Hence, this paper aims to provide core information on cone beam computed tomography (CBCT) technology by reviewing 4 cases and its potential applications in oral & maxillofacial surgical practice. This article also provides an overview of the unique image display capabilities of maxillofacial CBCT systems and to illustrate specific applications in clinical practice.

Keywords : CBCT, Anatomical Structure, Diagnosis, Low Dose, Tomography, Quantitative Analyses, Bone Density

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INTRODUCTION

Dental imaging is an important diagnostic adjunct to the clinical assessment of dental patient. After introduction of panoromic radiography in 1960s, dental radiology had become a field of immense progress and enabled clinicians to see jaw and maxillofacial structures with a single radiography. However, two dimensional (2D) images with intraoral and extraoral procedures of three dimensional (3D) maxillofacial region have some drawbacks such as magnification and superimposition. To eliminate this drawbacks 3D imaging technics have been developed. Subsequent period digital imaging, computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET) and cone beam computed tomography (CBCT) had been developed [1].

Cone beam CT (CBCT) was first developed for use in angiography. In 1998, Mozzo et al[2] reported the first CBCT unit developed specifically for dental use, the NewTom 9000 (Quantitative Radiology, Verona, Italy). Other similar devices introduced at around that time included the Ortho-CT, which was renamed the 3DX (J. Morita Mfg Corp, Kyoto, Japan) multi-image micro-CT in 2000 [3, 4]. In 2003, Hashimoto et al[4] reported that the 3DX CBCT produced better image quality with a much lower radiation dose than the newest multidetector row helical CT unit (1.19 mSv vs 458 mSv per examination).

CBCT is capable of providing clear, submilimeter resolution images at shorter scan times, lower patient dose and lower cost compared with medical CT. Increasing availability of this technology provides the clinician's 3D representation of maxillofacial region ranging from facilitate diagnosis to image guidance of operative and surgical procedures. Moreover, this technique is able to produce images in axial, sagittal, frontal planes.

The potential scope of clinical applications for cone-beam imaging is vast and currently has been shown to be particularly useful in the following dental and maxillofacial areas [5]:

- Investigation of jaw pathology including cysts, tumours and fibro-osseous lesions;

Investigation of the paranasal sinuses;

Investigation of the bony components of the TMJ;

Pre- and post-implant assessment;

Orthodontic assessment, both dental development and skeletal base relationship;

Assessment of wisdom teeth, in particular their relationship to the inferior dental canal;

Evaluation of facial trauma.

The dental CBCT is recommended for: assessment of bone support for the application of dental implants; TMJ's analysis to diagnose degenerative bone changes; examination of teeth and facial structures to start orthodontic treatment; proximity viewing of wisdom molars to lower mandibular canal, prior extractions; diagnosis of cysts, tumors or infections of the teeth and jaw bones.

There are four components to CBCT image acquisition [6]:

1) X-ray generation,
2) Image detection,
3) Image reconstruction, and
4) Image display.

It is beyond the scope of this article to detail these elements, however, it is important to recognize that the specifications of currently available systems reflect proprietary variations in these parameters.

Types of CT Scanners

Computed tomography can be divided into 2 categories based on acquisition x-ray beam geometry; namely: fan beam and cone beam.

In fan-beam scanners, an x-ray source and solid-state detector are mounted on a rotating gantry. Data are acquired using a narrow fan-shaped x-ray beam transmitted through the patient. The patient is imaged slice-by-slice, usually in the axial plane, and interpretation of the images is achieved by stacking the slices to obtain multiple 2D representations. The linear array of detector elements used in conventional

helical fan-beam CT scanners is actually a multi-detector array. This configuration allows multi-detector CT (MDCT) scanners to acquire up to 64 slices simultaneously, considerably reducing the scanning time compared with single-slice systems and allowing generation of 3D images at substantially lower doses of radiation than single detector fan-beam CT arrays [7].

Cone-Beam CT Technology

CBCT scanners are based on volumetric tomography, using a 2D extended digital array providing an area detector. This is combined with a 3D x-ray beam. The cone-beam technique involves a single 360° scan in which the x-ray source and a reciprocating area detector synchronously move around the patient's head, which is stabilized with a head holder. At certain degree intervals, single projection images, known as “basis” images, are acquired. These are similar to lateral cephalometric radiographic images, each slightly offset from one another. This series of basis projection images is referred to as the projection data. Software programs incorporating sophisticated algorithms including back-filtered projection are applied to these image data to generate a 3D volumetric data set, which can be used to provide primary reconstruction images in 3 orthogonal planes (axial, sagittal and coronal) [6].

Advantages of CBCT

The use of CBCT technology in clinical practice provides a number of potential advantages for maxillofacial imaging compared with conventional CT [6]:

X-ray beam limitation :

Reducing the size of the irradiated area by collimation of the primary x-ray beam to the area of interest minimizes the radiation dose. Most CBCT units can be adjusted to scan small regions for specific diagnostic tasks. Others are capable of scanning the entire craniofacial complex when necessary.

Image accuracy :

The volumetric data set comprises a 3D block of smaller cuboid structures, known as voxels, each representing a specific degree of x-ray absorption. The size of these voxels determines the resolution of the image. In conventional CT, the voxels are anisotropic rectangular cubes where the longest dimension of the voxel is the axial slice thickness and is determined by slice pitch, a function of gantry motion. Although CT voxel surfaces can be as small as 0.625 mm square, their depth is usually in the order of 12 mm. All CBCT units provide voxel resolutions that are isotropic equal in all 3 dimensions. This produces submillimetre resolution (often exceeding the highest grade multi-slice CT) ranging from 0.4 mm to as low as 0.125 mm (Accuitomo).

Rapid scan time :

Because CBCT acquires all basis images in a single rotation, scan time is rapid (1070 seconds) and comparable with that of medical spiral MDCT systems. Although faster scanning time usually means fewer basis images from which to reconstruct the volumetric data set, motion artifacts due to subject movement are reduced.

Dose reduction :

Published reports indicate that the effective dose of radiation (average range 36.950.3 microsievert [μSv][7]) is significantly reduced by up to 98% compared with “conventional” fan-beam CT systems (average range for mandible 1,3203,324 μSv; average range for maxilla 1,0311,420 μSv[8]). This reduces the effective patient dose to approximately that of a film-based periapical survey of the dentition (13100 μSv) or 415 times that of a single panoramic radiograph (2.911 μSv) [9].

Display modes unique to maxillofacial imaging :

Reconstruction of CBCT data is performed natively by a personal computer. In addition, software can be made available to the user, not just the radiologist, either via direct purchase or innovative “per use” licence from various vendors (e.g., Imaging Sciences International). This provides the clinician with the opportunity to use chair-side image display, real-time analysis and MPR modes that are task specific. Because the CBCT volumetric data set is isotropic, the entire volume can be reoriented so that the patient's anatomic features are realigned. In addition, cursor-driven measurement algorithms allow the clinician to do real-time dimensional assessment.

Reduced image artifact :

With manufacturers artifact suppression algorithms and increasing number of projections, CBCT images can result in a low level of metal artifact, particularly in secondary reconstructions designed for viewing the teeth and jaws [7].

Limitations [5]:

1. Research into cone-beam imaging has to meet the challenge of rapid changes in both hard- and soft-ware technology.
2. The equipment itself is changing in order to meet the clinical requirements reported to manufacturers, who in turn have markets to consider. However, there are intrinsic limitations in the technique which mean, in some circumstances, other forms of dental imaging would be more appropriate. Caries and teeth adjacent to amalgam and other dense prosthetic restorations are not well imaged by cone-beam technology owing to beam hardening and streak artifact. Even gutta percha may give rise to streak artifact and appear as dense as amalgam might on conventional CT. This should be borne in mind when assessing a potential site for implants adjacent to rootfilled teeth.
3. Both lamina dura and bony detail can be better assessed on periapical radiographs compared to cone-beam [10].
4. In order to acquire an undistorted image with cone-beam imaging, it is essential that the patient's head is kept still during the gantry rotation. As with dental panoramic tomography, patient movement can limit the technique for very young children, those unable to stay still or with movement disorders.
5. Interestingly, to those not used to working with 3-D volumes, radiological interpretation can be difficult when using a smaller field of view, as it is easy to become disoriented when scrolling through the images, as points of reference such as normal dental landmarks, or anomalous anatomy can make orientation difficult.
6. CBCT based on an image intensifier may allow the periphery of the image to be distorted.
7. CBCT gives little in the way of soft tissue detail and, and in no way compares to those capable of conventional CT. This, precludes the technique in the assessment of head and neck malignancy where evaluating the soft tissue extent of the lesion is crucial.

Clinical applications of CBCT in Dentistry [11]

With CBCT technology, all radiographic images can be taken in less than a minute. Dental clinicians can have the diagnostic quality of periapical radiographs, panoramic radiographs, cephalograms, occlusal radiographs, and TMJ images at their disposal, along with views that cannot be produced with regular radiographic machines such as axial and cross-sectional views. A number of clinical applications have already been reported in the literature.

Impacted Teeth

Impacted maxillary cuspids have been reported to be distributed as 85% palatal and 15% buccal. The CBCT allows for a more precise analysis of the extent of the pathology related to the ectopic tooth. Clinical reports using 3-dimensional imaging have shown that the incidence of root resorption of teeth adjacent to impacted teeth is greater than previously thought. CBCT images can be used to locate the precise position of ectopic cuspids and to design treatment strategies that would result in less invasive surgical intervention. Computer- and image-guided surgical exposure allows for less invasive surgery, smaller incisions, more conservative flap design, and overall reduced morbidity associated with the surgery [12,13] (Fig: 1, 2, 3)

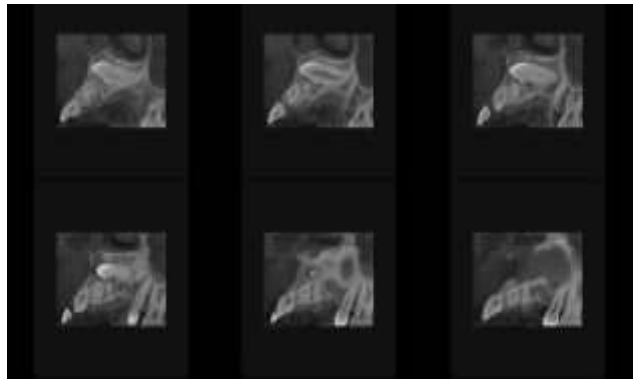

Fig 1 : Impacted bilateral Maxillary canines

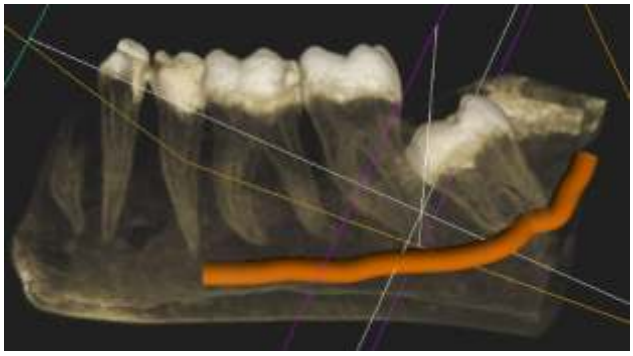

Fig 2 : Close proximity of the impacted lower third molar to the inferior alveolar canal

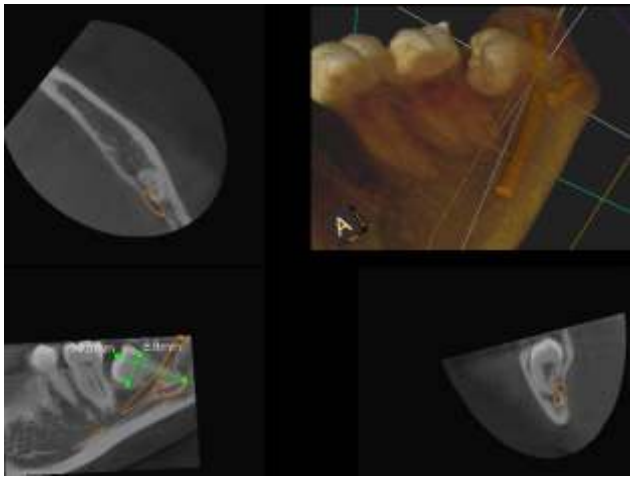

Fig 2 : Bifid inferior alveolar canals with impacted lower third molar

Pathology

Another use of CBCT is the location of (oral) pathologic lesions such as periapical cysts. CBCT has been evaluated for the detection of carious lesions and has shown better results than F-speed film in assessing the depth of proximal lesions [14].

Airway Analysis

CBCT technology provides a major improvement for evaluation of the airway, allowing for 3-dimensional and volumetric determinations. Airway analysis conventionally has been carried out by using lateral cephalograms. Three-dimensional airway analysis will be useful for the understanding of more complex conditions such as obstructive sleep apnoea (OSA) and enlarged adenoids [15].

Implant Planning and Bone Quality Assessment

Implantologists have long appreciated the value of 3- dimensional imaging. Conventional CT scans are used to assess the osseous dimensions, bone density, and alveolar height, especially when multiple implants are planned. Locating landmarks and anatomy such as the inferior alveolar canal, maxillary sinus, and mental foramen occurs more accurately with a CT scan. The use of the third dimension has improved the clinical success of implants and their associated prostheses, and led to more accurate and aesthetic outcomes [16] (Fig: 4, 5, 6, 7)

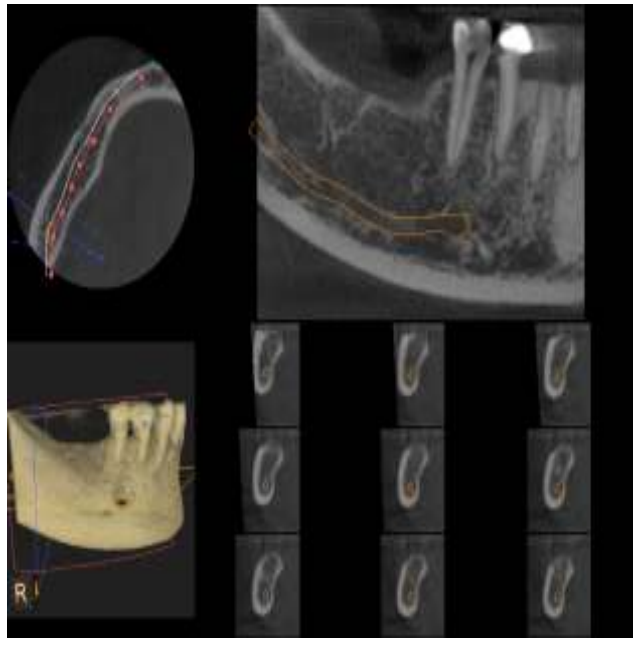

Fig 4 : Tracing the course of the inferior alveolar canal

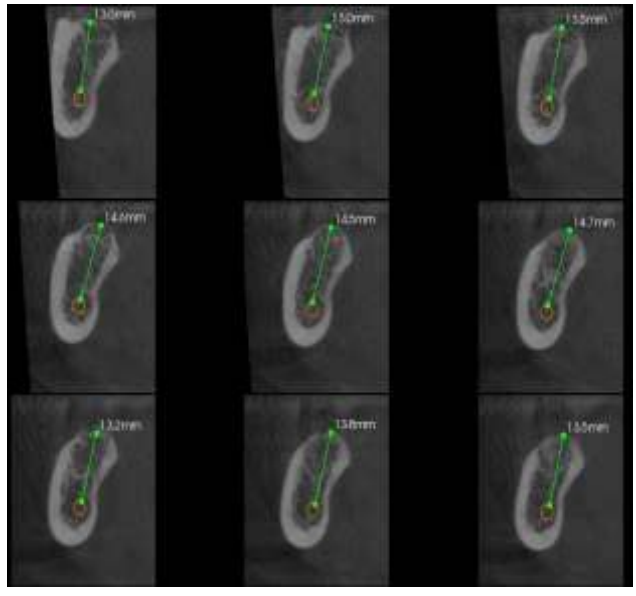

Fig 5 : Bone Height measurements on the mandible for implant planning

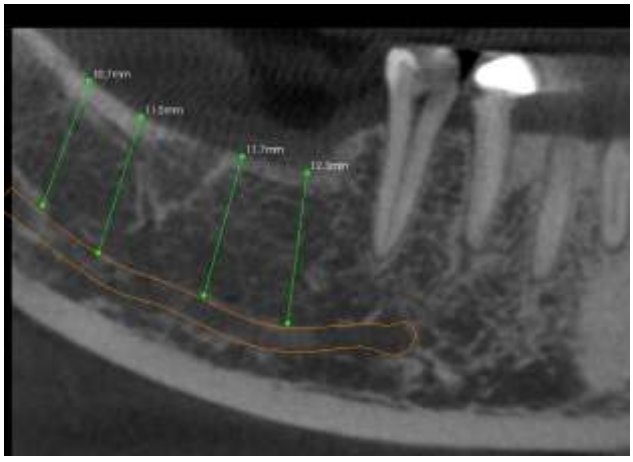

Fig 5 : Bone Height measurements on the mandible for implant planning

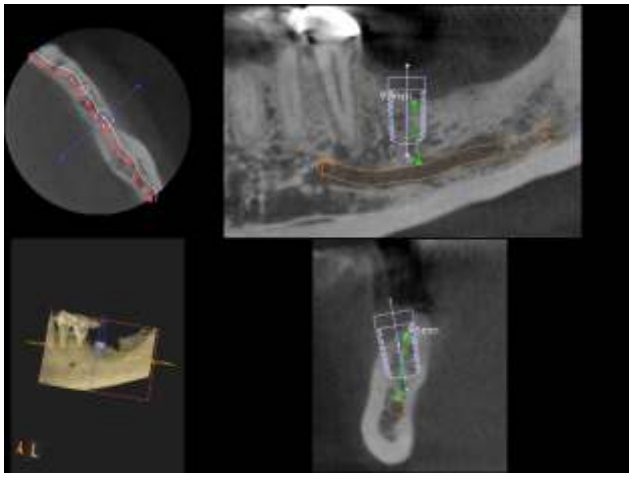

Fig 7 : Implant Simulation

CBCT has been in use in implant therapy and may be employed in orthodontics for the clinical assessment of bone graft quality following alveolar surgery in patients with cleft lip and palate. The images produced provide more precise evaluation of the alveolus. This technology can help the clinician determine if the patient should be restored or if teeth should be moved orthodontically into the repaired alveolus [17].

Location of Anatomic Structures

Anatomic structures such as the inferior alveolar nerve, maxillary sinus, mental foramen, and adjacent roots are easily visible using CBCT. The CBCT image also allows for precise measurement of distance, area, and volume. Using these features, clinicians can feel confident in the treatment planning for sinus lifts, ridge augmentations, extractions, and implant placements.

Temporomandibular Joint (TMJ) Morphology

CBCT imaging of the temporomandibular joint has been evaluated and compared to other methods. The CBCT showed greater sensitivity and accuracy than the helical CT in the identification of mandibular condyle abnormalities. Recent 3-dimensional studies have attempted to understand how the condyle remodels, and preliminary data suggest that much of the condylar remodeling is a direct result of the surgical procedure [18].

DISCUSSION

Cone-beam imaging, sometimes referred to as digital volume tomography, is one of the most exciting developments in dental and maxillofacial radiology and, owing to its versatility, will almost certainly become an increasingly popular form of imaging available in dental practice [5].

Interpretation demands an understanding of the spatial relations of bony anatomical elements and a comprehensive pathological knowledge of the various maxillofacial structures involved. Obviously, this information can extend beyond purely the dento-alveolar complex. The obvious potential for missed occult pathology with these units does, if nothing else increases the risk of litigation. A recent study using CBCT showed 24.6% had incidental findings. It would be in the patient's best interest that an imaging specialist with optimal knowledge of this area view the total volume obtained during image acquisition [5].

Kobayashi et al. [19] confirmed the superiority of PSR 9000 cone beam CT to spiral CT in terms of spatial resolution on cross-sectional images. Similar findings were reported when comparing images from an anthropomorphic phantom taken by both the 3DX Multi Image Micro CT (J. Morita) and the multidetector Aquilion Multi-Slice CT (Toshiba Medical Co Ltd, Tokyo, Japan). The superiority of the 3DX cone beam device in the images' resolution was demonstrated by means of a high resolution score of the periodontal ligament space and the lamina dura.

Honda et al.[20] compared helical CT with the Ortho- CT and reported that the image quality obtained with the Ortho-CT far surpassed that of the helical CT. To achieve accurate information and sufficient detail for preoperative planning of implant surgery, image quality of the different devices should be analyzed.

The problem is exacerbated by the fact that cone-beam imaging uses ionizing radiation doses exceeding any other existing form of dental imaging. The basic tenets of ALARA and maximizing the benefit/risk ratio to the patient still apply when selecting cases for imaging. With increasing potential use of cone-beam imaging for a variety of clinical situations, guidelines need to be developed indicating best practice. Dental undergraduates will require training in the interpretation and limitations of cone-beam CT. The ability to export data into software packages, such as Simplant/Materialise and Nobel Biocare and their manipulation should also form part of postgraduate teaching curricula, building on an undergraduate exposure to this modality.

CONCLUSION

Cone Beam Computed Tomography (CBCT) scans have been well established as a valuable tool in the orthodontist's and surgeon's 3D toolkit. A single scan not only provides an overlap-free 3D visualization of the skull but also allows detailed evaluation of the maxillofacial structures in thin axial, coronal and sagittal slices. It provides clear images of highly contrasted structures and is extremely useful for evaluating bone. Although limitations currently exist in the use of this technology for soft-tissue imaging, efforts are being directed toward the development of techniques and software algorithms to improve signal-to-noise ratio and increase contrast. Increasing availability of this technology provides the practitioner with a modality that is extending maxillofacial imaging from diagnosis to image guidance of operative and surgical procedures.

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Original Article

BILATERAL MANDIBULAR SAGITTAL SPLIT OSTEOTOMY WITH 5mm SET BACK IN VITRO COMPARISON BETWEEN RIGIDITY OF BICORTICAL SCREWS AND A MINIPLATE

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ABSTRACT

BACKGROUND AND OBJECTIVES :

The bilateral sagittal split osteotomy (BSSO), is the most common surgical procedure for the correction of mandibular prognathism and has undergone several modifications including the method of fixating the proximal and distal segments of the mandible.The objective of the study was to compare the biomechanical stability of three bicortical screws with that of a single four-hole miniplate after 5 mm mandibular set back after a bilateral sagittal split osteotomy (BSSO) in cadaver mandibles.

MATERIAL AND METHODS :

Twenty human cadaver hemimandibles underwent BSSO followed by two different rigid fixation techniques. All specimens had no third molar or evidence of mandibular fracture. In group I, three bicortical screws were placed at the superior border and in group II, one four-hole miniplate was secured on the external oblique ridge with four monocortical screws. The bony height at the vertical cut was recorded. Maximum resistance load (MRL), the greatest load recorded just before a sudden decrease in load level (bone or fixation failure) was recorded when the mandibles were tested in a compression machine. Multiple regression analysis was used to evaluate the differences in bone height and the MRL between group I and group II.

RESULTS :

The mean bone height in group I and group II were 26.80 ± 2.61mm and 24.60 ± 3.37mm respectively. The mean MRL in-group I (18.64 ± 7.86 Kg) was greater than in-group II (9.92 ± 5.62 Kg). Statistical analysis showed no

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significant difference in mean bone height (P=0.121; P > 0.05) and there was significant difference in mean MRL (P=0.011;P<0.05) between groups II and I.

INTERPRETATION AND CONCLUSION:

The design of the present study permitted the assessment of rigidity between the bicorticai screws and miniplate-monocortical screws. Both these techniques are employed for rigid internal fixation after BSSO. On the basis of this study bicorticai screws offer better rigidity after BSSO set back.

Keywords : Sagittal split Osteotomy, regid, Fixation, Bicortical Screws, Miniplate, Biomechanical Stability.

INTRODUCTION

The concept of beauty is central to all human cultures and is deeply rooted in the nature of man. In various ways, human aesthetics is woven into the tradition of human civilizations. Physical appearance plays a significant role in developing communication skills, improves ones self-esteem and quality of life[1]. Aesthetics and the art of looking good has been an integral part of human lives from time immemorial.

Orthognathic surgery is one such procedure in which controlled aesthetic alterations are possible by surgically manipulating the jawbones. People consider a straight profile, with the forehead and maxilla in the same line as chin, to have a better look. But, many have variations, in their jaws such as excess or deficiency of the either jaws and asymmetry of the face.

Different surgical techniques have been developed over the years to correct such facial abnormalities, which are collectively called as orthognathic surgeries that have undergone numerous developments in recent years.

A balanced biomechanical relationship between the masticatory muscles, jaws, temporomandibular joint and dentoalveolar segment is necessary to achieve normal function after surgical reposition of the jaws. In the past years, most of the whole jaw procedures included the use of intermaxillary fixation during the healing period, which was too uncomfortable to the patient and had many disadvantages.

Recent advances in surgical techniques include the use of rigid internal fixation with miniplates and screws that has virtually eliminated the need for maxillomandibular fixation and dramatically altered post surgical, neuromuscular and occlusal rehabilitation and stability. Psychological recovery may also be rapid if intermaxillary fixation is not used, because normal speech, effective oral hygiene measures and an earlier return to work are possible.

Rigid internal fixation is well tolerated and accepted by patient and most professionals. Also it provides for a faster healing, initiates postoperative mandibular function as early as possible and improves postoperative skeletal stability.

This study was conducted :

1. To compare bicortical screws alone and miniplates with monocortical screws as means of rigid fixation after a simulated mandibular osteotomy on dry mandible.

2. To assess the maximum resistance load a mandible can withstand after osteotomy and fixation with bicortical screws or miniplates with monocortical screws.

3. To assess if height of the mandible has any relation to the maximum resistance load.

MATERIAL AND METHODS

Ten human cadaver mandibles were obtained from the Department of Anatomy, The Oxford Dental College Hospital and Research Center, Bangalore.

Each mandible was sectioned into two hemi mandibles. None of the specimen had third molar or evidence of mandibular fractures. The hemi mandibles were randomly divided into two groups and underwent a standard sagittal split osteotomy. The sagittal split was performed using rotary instruments and a thin osteotome and mallet. 5mm of the distal end of the proximal segment was excised to allow reapproximation of the proximal and distal segments and simulate a mandibular setback. A bone clamp was used to hold the proximal and distal segments together, before application of rigid internal fixation.

In Group I - Three bicortical screws (2mm diameter, 14mm length) were placed at the superior border, distal to the vertical cut. Before placement of the bicortical screws a 1.7mm drill bit was used to drill holes at the predetermined locations, followed by placement of screws.

Fig 1 : Bicortical Screw fixation

In Group II - Single four-hole miniplate was placed along the external oblique ridge. The miniplate was secured with four monocortical screws (2mm diameter, 8mm length).

Fig 2 : Miniplate monocorfical screw fixation

After application of rigid internal fixation, two metal bars were placed in the condylar region for retention and connected with self-curing acrylic before the specimen was mounted in a block of dental stone. The condylar end of the specimen was placed in a preplanned position in the block with the inferior border perpendicular to the horizontal surface of the block . The position of the specimen was adjusted until the vertical cut was 40mm above and parallel to the horizontal surface of the block and the inferior border of the specimen was 50mm above the horizontal plane. The block was fixed on to a horizontal metal clamp before the specimen was placed in the testing machine.

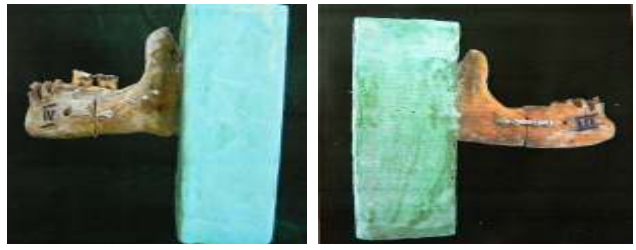


Fig 3 : Stabilization of both bicortical Screw & multiple function.

Before testing the specimen the height of the bone at the vertical cut was recorded. The mounted specimen was fixed with a C-clamp onto the platform of compression load cell of the Instron Universal Testing Machine (Model: 1011) and testing was conducted. The accuracy of the machine was caliberated before the test as specified by the manufacturer. The full-scale load was 50 kg. The mount-to-load application position provided a 50mm moment arm and the velocity of loading was lmm/min. The maximum resistance load (MRL) was recorded during testing. The latter was defined as the greatest load recorded just before any sudden decrease in load level (bone or fixation failure).

Fig 4 : Testing the strength with Instron machine

The data were recorded statistically. Statistical analysis was used to arrive at the result. The difference between the two groups of samples was analyzed by Student's't'test. The relationship between the height of mandible at the vertical cut, the maximum resistance load it can bear and time taken by the load application beam from the point of initial load application to reach to the point of maximum resistance load was assessed by Karl Pearson's Correlation coefficient.

RESULTS

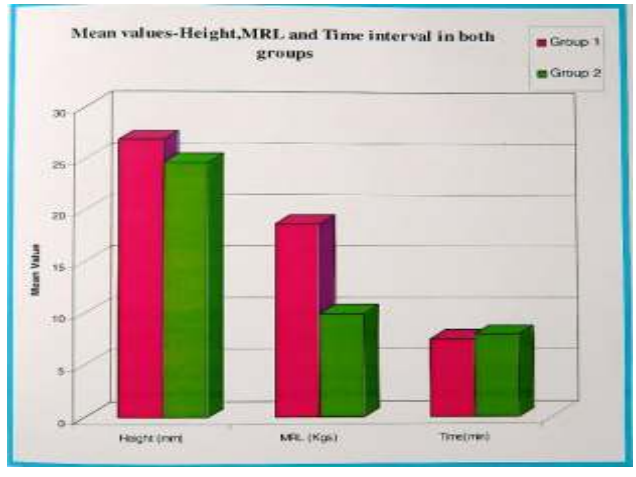
The study was conducted on twenty human cadaver hemi mandibles, divided into two groups. Each group was fixed with a different retention system, after a simulated sagittal split osteotomy of the mandible and setback of the distal fragment. Ten samples were fixed with three bicortical screws in a linear manner and the other ten samples were fixed with a four-holed miniplate and monocortical screws. After subjecting these samples to gradually increasing loads, the following results were obtained.

In group-I, the hemi mandibles had a mean bone height of 26.80 ±3.06 mm at the region of the vertical cut, and the load was applied at the second premolar region On application of a gradually increasing load, it was found that the failure of the retention system occurred at a mean of 18.64 ± 7.86 Kg. The mean time interval which is the time taken by the load application beam from the point of initial load application to the point of maximum resistance load was 7.50 ±3.24 min. In these samples, fracture of the distal osteotomy segment occurred (bone failure) just anterior to the area of fixation. By the correlation coefficient analysis it has been seen that in these samples no statistically significant correlation exists between the height of mandible, the maximum load it can bear and the time interval.

The samples of group-II had a mean bone height of 24.60 ± 3.37 mm at the region of vertical cut, and the load was applied at the second premolar region. The failure of the retention system, on application of a load, occurred at a mean of 9.92 ± 5.62 Kg and the time interval was 7.98-±2.39 min. In these samples, there was a different finding on application of maximum load. There was no fracture of the osteotomy segments but a bend occurred in the intermediate bar of the miniplate thereby indicating failure of retention system. By the correlation coefficient analysis it can be seen that there was no significant relation between the height of mandible, the maximum load the mandible can bear and the time interval.

The Student's't' test analysis was used to find relationship between height, MRL and time interval between group I and group II. The difference between the heights of mandibles of group I and group II is not significant (p=0.121; p>.05). However the maximum resistance load between groups I and II are highly significant (p=0.011 ;p<.05).The difference between the time interval of groups I and II is not significant (p=0.711) Thus it can be seen that the osteotomies fixed with bicortical screws are more stable (mean MRL= 18.64 ± 7.86 Kg) than those fixed with miniplates and monocortical screws (mean MRL=9.92 ± 5.62kg), and this increase in stability is found not to be related to the height of the mandible, but only to the method of fixation used. This can be explained as; the monocortical screws involve only the buccal cortical plate and some cancellous bone. Also the axis of fixation between the two fragments is along the axis of mandible, along which the trajectories of mandible pass. Thus when the load is applied on the mandible, it passes along the plate and gets concentrated in the plate, since there is a discontinuity in the bone at the region of osteotomy, leading to a bend in the miniplate, which is the route of escape for built up stresses.

The bicortical screws involve both the buccal and lingual cortical plates thereby having an increased



Graph 1 :P Mean values - height, MRL & time interval in between groups

area of contact between the bone and the screw, with the bone within the pitch of screw holding it more firmly. The bicortical screws are fixed across the axis of the mandible. Thus the forces are not concentrated on the fixation system but they get focused just anterior to the area of fixation and fracture of bone occurs here. However it is seen that this occurs at a higher load, thus establishing that bicortical screw fixation is more stable than monocortical screw and miniplate fixation.

DISCUSSION

In modern day, it is hard to imagine performing orthognathic surgery without rigid internal fixation. Over the past decades, orthopaedic and maxillofacial surgeons have documented the delayed and incomplete rehabilitation that resulted from the practice of immobilizing fractured bones during the healing process. Earlier the osteotomies were stabilized with interosseous wiring followed by a prolonged period of maxillomandibular fixation, which presented with a high incidence of skeletal relapse.

Roberts (1969) employed bone plates for rigid fixation of bilateral body osteotomy to achieve mandibular setback in prognathic patients.

However it was Michelet (1973) who started using small, malleable vitallium bone plates for sagittal mandibular osteotomies.He placed a four-hole plate across the osteotomy gap and claimed excellent results.

Spiessl (1974) introduced a new method of rigid internal fixation for sagittal ramus osteotomies. This technique, which used three lag screws inserted transbuccally through a trocar, has become one of the most popular methods of securing rigid internal fixation in sagittal split osteotomies. However many modifications have evolved involving the size of screws, the use of bicorticai screws instead of lag screws and the intra-oral placement of screws.

Rigid internal fixation has many advantages compared with conventional wire fixation. The condylar position and mandibular function can be confirmed at the time of surgery, while patient is still under general anesthesia. It allows the patient to maintain better oral hygiene and facilitates better speech and nutrition in the post-operative period, as the patient can open his mouth leading to a faster recovery. Also there is a lesser period of hospital stay and a better psychological feeling for the patient.

The use of miniplates to obtain stable internal fixation has several advantages when compared to bicorticai screw osteosynthesis. The plate application obviates the need for transcutaneous puncture, which results in subsequent scarring and increased risk to the facial nerve. Monocortical plates are not as dependent as bicorticai screws on the inferior alveolar neurovascular bundle location[4]. Removal of third molars and preservation of a sufficient bulk of bone on the distal segment is not a necessity for screw placement. Plates can be easily removed. Correction of condylar position involves the repositioning of only two screws. The plates can be bent to adapt to the buccal cortical plate across the osteotomy site with the proximal segment in a passive position. This results in minimal torquing of the proximal segment and prevents compression of inferior alveolar nerve.

Use of bicortical screws has several advantages over bone plate fixation. They can be applied more rapidly and also allows obtain a more anatomically accurate reduction. Displacement of bone fragments almost never occurs while applying bicortical screws.[31] They also permit rapid healing between fragments because of a closer approximation. However, the main disadvantage with bicortical screws is that the intercondylar width decreases with a setback and increases with advancement of mandible as shown by Spitzer et al , using computed tomographic scans taken immediately before and after surgery. Also bicortical screws produce a posterior shift of condyle within the fossa with mandibular advancement and vice versa. This has been shown by Kundert and Hodjianghelou.

Our study tries to evaluate both these modalities of rigid internal fixation to compare their strengths, thus deciding which provides a more stable fixation. We have measured the maximum resistance load, which is engineering standard for the evaluation of fixation systems. It represents the peak of the stress/strain curve. Theoretically, this value should indicate the maximum amount of force that is resisted by the system until the breaking point. At this load either the bone fractures or the fixation failure occurs.

Analyzing the data, it can be seen that the group fixed with bicortical screws could bear a higher load than monocortical screws and plates. These findings of ours correlates with various other studies undertaken.

Other findings of this study are, in the case of fixation with monocortical plates, failure of fixation occurred in the plate itself. At the maximum load, a bend occurred in the intermediate bar of the miniplate. However in the case of fixation with bicortical screws, the screws were intact but fracture occurred in the distal bone fragment just anterior to the fixation point resulting in bone failure. A miniplate spanning the buccal osteotomy gap of a sagittal split osteotomy is placed at a biomechanical disadvantage. It is placed along the trajectories of the mandible and the interfragmentary diastema produced by mandibular repositioning requires load transfer between segments to occur mainly through miniplates since all the forces exerted onto the mandible are concentrated on the miniplate. Thus miniplate or hardware failure occurs. However in case of bicortical screws, since it engages both the cortices of bone and is perpendicular to the direction of transmission of forces, it is more resistant to displacement tendencies through its resistance to axial and shear stresses.[32] Since all fixation forces are directed across the long axis of the screw and there are no metal-to-metal friction points, these screws obtain and retain stability better than any other mode of fracture fixation. Also bicortical screws have a very high coefficient of fixation.[33] This achieves an absolute immobilization of the osteotomized fragments in a chosen position, reducing the potential for post-operative relapse and delayed bone union.

CONCLUSION

In this study, being an in-vitro one, the type of fixation, the strength of the fixation system and the relationship of the mandibular vertical bone height are considered. However, in patients, a lot of other factors control the stability of fixation system such as the muscular influences, the disturbances produced in the temporomandibular joint apparatus and also on the advancement or pushback procedure conducted. In our study, there was no relation between the mandibular height and the resistance offered by the rigid internal fixation. Bicortical screws better resisted compressive strength and offered better rigidity than miniplate after bilateral sagittal split osteotomy. In our study we have come to the conclusion that bicortical screws provide a stronger fixation than miniplate with monocortical screws.

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Original Article

THE EFFECT OF VARIOUS IRRIGANTS AND INTRACANAL MEDICAMENTS ON CANDIDA ALBICANS WITHIN ROOT CANALS

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ABSTRACT

The aim of this study was to evaluate, the efficacy of 3% sodium hypochlorite(NaOCl), and 17% Ethylen ediamine tetra-acetic acid (EDTA)as irrigants and calcium hydroxide (CaOH) and 2% chlorhexidinegluconate(CHX) as intracanal medicaments in various combinations on Candida albicans (C albicans) harvested in root canals after 48 hours and 10 days. Method Ninety five non-carious single rooted human teeth were taken. Root apices were sealed with cavit temporary cement and C. albicans inoculum was injected into the prepared canals. The teeth were coronally sealed and incubated at 37±1º Cin humid environment for 7 days. The teeth were randomly divided into following treatment regimes. Group 1: (n=15) control group with saline only. Group 2A: (n=20) 3% NaOCl as irrigant and CaOH as intracanal medicament, Group 2B: (n=20) 3%NaOCl as irrigant and 2% CHXas intracanal medicament, Group 3A: (n=20) 3%NaOCl and 17% EDTA as irrigant and CaOH as intracanal medicament, Group 3B: (n=20) 3%NaOCl and 17% EDTA as irrigant and 2% CHX as intracanal medicament. Microbial samples were taken after 48 hours and10 days and serial dilution and culturing was carried out to determine CFU/ml (colony forming units/ml). Results showed, in comparison to control group all the groups for 48 hours and 10 days, the p value was significant (p<.05). Conclusion The combination of NaOCl and EDTA as irrigants and CHX as intracanal medicament was most effective against C. albicans.

Keywords : Candidaalbicans, Chlorhexidine, EDTA, intracanal medicament

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INTRODUCTION

It has been established long back that almost all the pulpal & peri-apical pathosis are caused by micro-organisms. The resultant endodontic infections are known to be polymicrobial in nature, consisting. of various species of bacteria. Over the past two decades, even the virus & fungi have been isolated from these infections. The most common organisms isolated from the root canals with secondary apical periodontitis are the E. faecalis, a gram positive, facultative, anaerobic bacteria & C. albicans, a fungi.[1, 2] For the success of endodontic treatment, thorough debridement involving disruption & removal of microbial ecosystem as well as their toxic products from within the canal is essential. Therefore, the infected root canal is subjected to combined chemo-mechanical treatment consisting of instrumentation, copious irrigation & the use of an intra-canal, inter-appointment disinfectants.

Sodium hypochlorite (NaOCl) is a potent antimicrobial agent, killing most bacteria instantly on direct contact. It also effectively dissolves pulpal remnants and collagen, the main organic component of dentin. Complete cleaning of the root-canal system requires the use of irrigants that dissolve organic and inorganic material. EDTA effectively dissolves inorganic material, including hydroxyapatite. Its antifungal activity also has been well demonstrated.[3] Chlorhexidine digluconate (CHX) 2% when used within the root canals as an intracanal medicament has shown potent results against C. albicans[4,5]. CHX exhibits a property of substantivity, which is the release of biologically active component over a period of time which may be up to 12 weeks.[6]

Since, Candida albicans are frequently recovered from the re-treatment cases, it shows that they are able to survive in environments with sparse nutritional supply.[7] There is also an increased risk of fungal infection in root canal system with patients having poor functioning of immune system. There is no study on the most suitable combination of available irrigants & intracanal medicaments in multivisit endodontics.

Waltimo et al in their studies showed that C.albicans penetrate the dentinal tubules to a variable extent[5] because of its invasive affinity to dentin[8.] Hence, extracted teeth were inoculated with C.albicans to check, the antimicrobial efficacy of 3% NaOCl and 17% EDTA as irrigantandCaOH and 2% CHX as intracanal medicament in various combinations on C. albicans in root canals for 48 hours and 10 days.

METHODOLOGY

This study utilised 95 non-carious human single rooted teeth, stored in 10% formalin for 24 hours. Each tooth was digitally radiographed, to confirm the presence of a single, straight or slightly curved canal. External debris and calculus was removed with an ultrasonic scaler. The crowns were sectioned such that root length was standardized to 16mm. Roots having apical diameter greater than size 10 K file were discarded. They were stored in physiologic saline until use.

All the canals were prepared with Gates Glidden drills No.1-4 for coronal preflaring followed by apical preparation up to size 50 to within 1mm of the apex by using K files(Dentsply-Maillefer) using 3% NaOCl solutionas irrigant.

After instrumentation, the canals were rinsed with 1 ml of 17% EDTA for a minute followed by flushing with 5 ml of distilled water to remove any debris and residual irrigants. The external surfaces of the roots were coated with epoxy resin (Araldite) and were sterilized by autoclaving at 121^0 C for 20 min.

C.albicans broth was prepared and kept for overnight incubation. The broth was matched with a spectrophotometer to 0.5 McFarland tube which corresponds to 1.5 $x10^8$ microorganisms/ml. The remaining procedures were conducted inside laminar flux chamber using sterile materials and instruments.

Root apices were sealed and 10 microliters of the inoculum was injected into the prepared canals. The roots were incubated after coronal sealing 37±10ºC (in humid conditions) for 7 days. To facilitate the growth, on the 4^{th} day all teeth were replenished with 1ml of the nutrient broth. On the 7^{th} day microbiological sampling was carried out and after serial dilution, evenly spread on 4% Sabouraud dextrose agar plate to verify the growth of C. albicans.[9] The CFU/ml of C. albicans was of average $32x10^5$/ml in all the roots. After removal ofthe temporary fillings the canals were dried using paper point for gross excess fluid removal

and were subjected to the following treatment regimes. Group 1 (n=15) control group, only saline was added. Group 2 (n=40)1ml of 3% NaOCl, followed by normal saline. Group 3 (n=40) 1ml of 3%NaOCl followed by 17% EDTA (exclusively prepared for the study). The time of contact for each irrigant was 1 minute, and a final flush of 5ml normal saline was done to terminate the action of the irrigant. Group 2 and 3 were further subdivided into subgroup A and B, of 20 teeth each. In subgroup A of both Group 2 and 3, NaOCl was followed by placement of paste of CaOH in distilled water (3:1 ratio). In subgroup B of both Group 2 and 3, NaOCl and EDTA were followed by placement of 2% CHX solution (ammdent). Intracanal medicaments were injected using 26 gauge needle until the canals were full and mechanical agitation with sterile K file was done to facilitate their placement. The root canals were coronally resealed. The specimens were incubated at 37^0C according to the two experimental time periods of 48 hours and 10 days.

The coronal seal of 45 teeth (10 from each subgroup and 5 from control) were removed, instrumented with 50 H file to create dentinal shavings and microbiological sampling was carried out. The microbiological sampling were incubated for 30 min at 37ºC. Serial dilution and culturing was further carried out to determine CFU/ml. On the tenth day of incubation, microbiological samplings of remaining teeth were done similarly and CFU/ml determined.

Analysis of Variance (ANOVA) was used to find the significance of study parameters between the groups, Student "t" test (two-tailed, independent) was used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Post-hoc test was used to find the significance pairwise comparison.

RESULTS

The results are presented in Table I and II.After the application of irrigant and intracanal medicament the CFU/ml were reduced significantly. NaOCl and EDTA as irrigant and CHX as intracanal medicament was most effective in comparison to any of the subgroups at 48 hours and 10 days.

$Ca(OH)_2$ CH & for how much time period?

DISCUSSION

C. albicans has the ability to colonize dentin, because of its invasive affinity to dentin, hence most often found in endodontic infections[8,10]. It penetrates into dentinal tubules by its various growth pattern like hyphae and blastospores to a variable extent.[4]C. albicans produce a collagenolytic enzyme that can degrade the human dentin collagen[10]. Other virulence factors are adherence, thigmotropism and phenotype

Table 1 : Comparison of CPU / ml at different study time - Group analysis (ANOVA)

Treatment Group	Colony Forming Unit (CFU in $x10^5$)			p value
	Pre-treatment	48 hours	10 days	48 hours vs. 10 days
1. CONTROL	34.25±2.79	31.32±1.57	39.09±5.18	0.077+
2A. NaOC1 + CaOH	32.94±3.67	1.98±0.62	0.309±0.07	<0.001**
2B. NaOC1 + CHX	31.76±4.36	0.29±0.11	0.051±0.023	<0.001**
3A. (NaOCI + EDTA) + CaOH	34.35±3.71	0.13±0.05	0.049±0.008	<0.001**
3B. (NaOCI + EDTA) + CHX	32.64±4.38	0.095±0.04	0.025±0.009	0.001**
p value	-	<0.001**	<0.001**	-

Table 2 : Pair wise comparison of CFU/ml ($X10^5$)
Group Analysis : Post - hoc Tukey test

Pair	48 hours		10 days	
	Difference	p value	Difference	p value
Gp1 - Gp2	29.34	<0.001**	38.78	<0.001**
Gp1 - Gp2B	31.02	<0.001**	39.03	<0.001**
Gp1 - Gp3A	31.19	<0.001**	39.04	<0.001**
Gp1 - Gp3B	31.22	<0.001**	39.06	<0.001**
Gp2A - Gp2B	1.68	<0.001**	0.26	0.999
Gp2A - Gp3A	1.85	<0.001**	0.26	0.999
Gp2A - Gp3B	1.89	<0.001**	0.28	0.999
Gp2B- Gp3A	0.17	0.969	0.002	1.000
Gp2B - Gp3B	0.20	0.938	0.026	1.000
Gp3A - Gp3B	0.04	1.000	0.024	1.000

switching[9]. Hence, in this study antimicrobial activity of various irrigants and medicaments on Candida albicans was tested on extracted teeth in preference to the agar diffusion test.

The samples were irrigated with saline between each irrigant and before the placement of medicament to prevent any decrease in efficacy of irrigants or medicaments when mixed together[11]. The root canals were instrumented till file size 50 before innoculating with microorganisms and no further instrumentation was done so as to evaluate the effectiveness of the irrigant/medicaments only and not the cumulative effect of instrumentation and irrigation/medicaments. Microbial samples were then harvested from the canals.

The results (Table 1) show greater reduction of CFU/ml from 48 hours to 10 days in all the subgroups. In group 2B (NaOCl and CHX) and group 3B (NaOCl+ EDTA and CHX) the effect can be attributed to the substantivity shown by chlorhexidine. CHX has an affinity to dental hard tissues (hydroxyapatite) and once bound to a surface, has prolonged antimicrobial activity by release of biologically active component over a period of time. Studies have shown gradual release of this bound CHX could maintain an even level of the molecule sufficient to act as a bacteriostatic in root canals over a prolonged period of time which may be up to 12 weeks.[6,10]

The group 2A(NaOCl with CaOH) andgroup 3A (NaOCl+EDTA with CaOH) also showed reduction of CFU/ml from 48 hours to 10 days. The effect of CaOH on C. albicans is controversial. In a study by Turk et al, all CaOH preparations were found effective on C. albicans. Another study showed that CaOH was

effective till 72 hours[12]. Furguson et al too found that paste form of CaOH was effective in killing C. albicans[13]. Waltimo et al have shown that C. albicans is resistant to CaOH. The C. albicans MTCC 183 strain used in this study may differ in susceptibility to CaOH from the 16 C. albicans strains tested by Waltimoet al[5].

Table 2 shows that in comparison to control group and all the subgroups for 48 hours and 10 days, the p value is significant. It shows antimicrobial activity of irrigant and intracanal medicament has a positive role in controlling the growth of Candida albicans.

NaOCl as an irrigant dissolves pulp, necrotic material and the organic components of the smear layer. It has a broad spectrum of antibacterial activity[4,14]. Antimicrobial activity of sodium hypochlorite has been attributed to the fact that it ionizes water, into Na^+ and hypochlorite ion (OCl^-), establishing an equilibrium with hypochlorous acid (HOCl). Hypochlorous acid is responsible for the antibacterial activity; the OCl^- ion is less effective than the undissolved HOCl. Hypochlorous acid disrupts metabolic reactions of the microbial cell, resulting in death of bacterial cell[7]. Several authors have shown effectiveness of NaOCl on fungi[9,15,16,17].

Mechanical instrumentation produces a smear layer which can be penetrated by bacteria and may offer protection to biofilms adhering to root canal walls and one has to rely on demineralizing agents like EDTA to remove the smear layer which also soften the dentin and makes shaping procedures easier.[3] EDTA may have an antifungal potential with its chelating property because calcium ions have a critical role in morphogenesis and pathogenesis of C. albicans. EDTA reacts with calcium ions in dentine to form soluble calcium chelates andeffectively removes smear layer from the root canal walls.[3] C. albicans have shown to be more resistant in the presence of smear layer than in the absence of smear layer as shown in the study by J Craig et al[18].

EDTA is not a powerful antimicrobial agent and does not affect protein and DNA synthesis of C. albicans but, it has Anti-colonization property andAnti-growth property. By chelating calcium ions into the medium, EDTA prevents binding of C. albicans to the proteins in a dose dependent manner and reduces the growth of C. albicans by removing calcium from cell walls causing collapse in the cell wall and by inhibiting enzyme reaction.[4] Favourable results with EDTA in this study is in accordance with several other studies[8,9,10,11,17,19].

Chemomechanical preparation is effective in reducing the number of microorganisms but not completely eliminate them. Microorganisms may remain viable even after root canal preparation, multiplying between appointments. Thus an intracanal medication may be a valuable adjunct to chemomechanical preparation in further disinfection of the root canal system.[20]

Between the Group 2A and 2B, the study proved that the combination of NaOCl and CHX (Group 2B) showed more effectiveness against Calbicans than the combination of NaOCl with CaOH (Group 2 A). This is because of the role played by CHX which has been claimed to be an effective inhibitor of both membrane bound and soluble ATPase uptake in Enterococcus faecalis. Although CHX collapses the membrane potential, it is membrane disruption rather than ATPase inactivation that is responsible for its lethal effects. The effects of CHX on yeast cells are probably similar to those described above[21]. In the present study there was increased lysis of C.albicans which may be due to the absence of organic matter in this in vitro study as suggested by Zerella et al[22].

Studies have shown that C.albicans are resistant to the antimicrobial effects of CaOH. It is partly due to an effective proton pump mechanism found in C.albicans which maintains optimal cytoplasmic pH levels, thus, is unaffected by the high pH of CaOH. Also C.albicans penetrates into the dentinal tubules and there thus avoids effective concentration of the therapeutic agent. C.albicans tolerates high alkalinity even longer than Enterococcus faecalis[4,23]. Also dentin has proved to have an inhibitory effect on the action of CaOH due to its buffering capacity[24].

Group 3 A (NaOCl and EDTA with CaOH) showed less CFU's/ml after 48hours, when compared with group 2A [NaOCl+ CaOH]. The reason can be

attributed to the action of EDTA. Further Group 3 B NaOCl and EDTA with CHX) showed least CFU's/ml when compared to all the other subgroups. This may be the result of combined effect of EDTA and CHX.

This study would have been of greater significance if oral cavity isolate was taken which shows more resistance to disinfecting solutions. Direct conclusion should not be made from in vitro studies with isolated single microorganisms to clinical situation with polymicrobial endodontic infections.

CONCLUSION

Under the limitations of the present in vitro study it may be concluded that:Combination of NaOCland EDTA as irrigant and Chlorhexidine CH Xas intracanal medicament is most effective against growth of C. albicans. Combination of NaOCl and EDTA inhibits growth ofC. albicans greater than when NaOCl is used alone. This study reinforces the importance of endodontic treatment in 2 sessions with use of long intracanal medication to eliminate C.albicans present in the root canal systems.

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Original Article

AN INVITRO COMPARATIVE EVALUATION OF THE SHEAR PUNCH STRENGTH OF COMPOSITE AND POLYACID - MODIFIED COMPOSITE RESTORATIVES UNDER THE INFLUENCE OF FOOD SIMULATING LIQUIDS

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ABSTRACT

Aim : The present study evaluates the effect of food-simulating liquids on the shear punch strength of composites and polyacid-modified composites.

Methodology : 96 samples were prepared in the lab using zinc coated washers, 32 samples of each material i.e. hybrid composite, microhybrid composite and polyacid-modified composite. The specimens were of 10mm diameter and 1.6mm thickness. The samples of each materials were divided into 4 groups of 8 each and conditioned in various food-simulating liquids for 1 week at 37°C. The food-simulating liquids used in the study were distilled water, 75% ethanol water solution and heptane. Air was taken as the control group. The shear strength was tested by mounting the specimens in a special zig and tested in the universal testing machine at a crosshead speed of 1mm per minute.

Results : The results clearly showed that the composite Esthet X with the modified matrix formulation had the highest strength and was not affected by conditioning in the food-simulating liquids. The shear punch strength of Tetric Ceram was significantly reduced by conditioning in 75% ethanol solution. The shear punch strength of polyacid-modified composite Dyract AP was significantly increased by storage in water.

Conclusion : Based on the results it was found that the effect of FSLs on the shear punch strength was material dependent. Composites based on BisEMA may be more resistant to degradation by alcohol.

Keywords : Shear punch strength, food-simulating liquids, composite, polyacid-modified composites

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INTRODUCTION

Since the introduction of esthetic restorative materials almost three decades ago, the field of restorative dentistry has undergone dramatic and revolutionary changes. Improvements in formulation and increased esthetic demands by patients have substantially increased the clinical uses of restorative materials like resin composites and polyacid-modified composites.

The dynamic and complex nature of the oral environment provides multi dimensional challenges to the restorative materials. In an in-vivo situation, it can be assumed that saliva, food components and beverages can degrade and age dental restorations. Thus, interactions among many substances in the oral cavity at 37°C may have a negative impact on the long term durability of dental restorations.

A change in the formulation of resin based restorative materials may therefore be recommended before these materials can be used successfully within the dynamics of the chemical and thermal environment of the oral cavity. A new resin composite with improved matrix formulation based on BisEMA was tested in the present study.

The FDA recommends that certain organic compounds be used as food-simulating liquids (FSL) in in-vitro tests. These FSLs include various mixtures of ethanol and water, heptane, citric acid and water.

As occlusal and incisal forces during mastication and parafunction induce shear stresses in teeth and restorations, the shear punch test reflects qualities of clinical significance.

The purpose of this study was to evaluate the effect of food-simulating liquids on the shear punch strength of composites with different resin formulations and polyacid-modified composites.

Materials and Methods

96 specimens (32 samples of a microhybrid composite, hybrid composite, and polyacid-modifed composite each) were prepared using zinc pre-coated washers (20mm outer diameter, 10mm inner diameter and 1.6mm thickness). The washers were supported by glass slides. A second glass slide was placed on top of the washers and gentle pressure was applied to extrude excess material. The specimens were then light cured with visible light cure unit of mean intensity of 400 mW/cm^2 for 40 seconds. The mean intensity of the light source was determined with a commercial radiometer prior to starting the experiment.

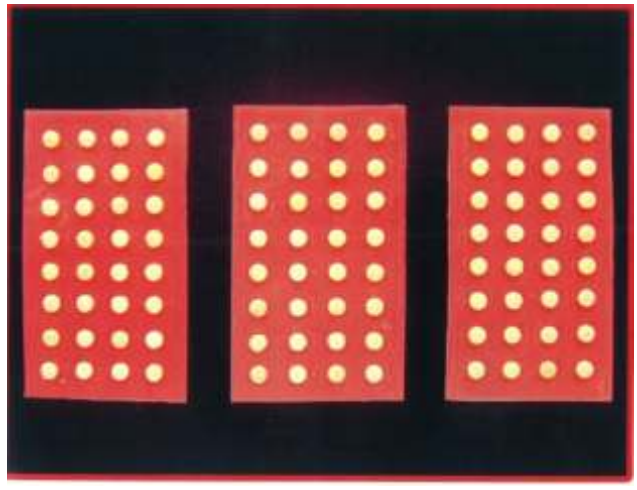


Figure 1: 96 specimens prepared

Specimens were randomly divided into 4 groups of 8 samples each and conditioned for 1 week at 37°C as follows:

- Group I: Air (control group)
- Group II: Distilled water
- Group III: 75% ethanol - water solution
- Group IV: Heptane

At the end of the conditioning period, shear punch strength of the materials was assessed. A special shear punch apparatus was designed and fabricated. The apparatus allowed for restraining the specimens during testing. Shear punch strength testing was conducted using a universal testing machine at a crosshead speed of 1mm per minute.

Prior to testing, the shear punch apparatus was aligned to the loading axis of the universal testing machine to ensure minimal frictional force compared to the value of force required to fracture the specimens. The thickness of each specimen was measured with a vernier caliper prior to placement in the shear punch apparatus. The specimens were positioned in the apparatus by means of a self-locating recess that provided a snug-fit. The specimens were

Figure 2: Shear punch zig

Figure 3: Specimen in zig

subsequently restrained by tightening the screw clamp on top. An M2 tool steel punch with a flat end (3.2mm diameter) was used to create shear force by sliding through a punch hole and having minimal clearance. A small disc from the centre of each specimen was punched out and the maximum load recorded. Shear strength was then computed using the following formula:

$$\text{Shear strength (MPa)} = \frac{\text{Force (N)}}{\Pi \times \text{punch diameter (mm)} \times \text{thickness of specimen (mm)}}$$

Figure 4 : Shear punch strength testing

Table 1: The average, minimum, maximum and standard deviation values of shear punch strength of composites and compomers after conditioning in various FSLs.

Materials	Air	Distilled water	Ethanol	Heptane
Tetric Ceram	126.4 + 0.9	128.1 + 1.4	102 + 2.2	128.5 + 3.3
	125.4 - 127.9	125.6 - 130.2	99.8 - 106.5	123.8 - 134.5
Esthet X	140.9 + 3.7	138.8 + 1.4	140.9 + 2.2	139.4 + 2.1
	133.7 - 146.6	135.8 - 140.0	138.3 - 145.7	135.5 - 142.4
Dyract AP	103.7 + 1.9	126.0 + 2.0	101.8 + 1.5	101.9 + 3.0
	100.7 - 107.1	123.1 - 129.1	99.7 - 104.1	95.3 - 104.8

Table 2 : Shows mean values and comparisons of shear punch strength of Tetric Ceram when conditioned in FSLs.

Medium	Shear strength (MPAs)	Difference between mediums		
	Mean ± SD	Medium compared	Mean difference	P-value
I. Air	126.4 ± 0.9	I - II	1.7	NS
II. Distilled water	128.1 ± 1.4	I - III	(-) 23.5	< 0.01
		I - IV	2.1	NS
III. Ethanol	102.9 ± 2.2	II - III	(-) 25.2	< 0.01
IV. Heptane	128.5 ± 3.3	II - IV	0.4	NS
		III - IV	25.6	< 0.01

Table 3 : Shows mean values and comparisons of shear punch strength of Esthet X when conditioned in FSLs.

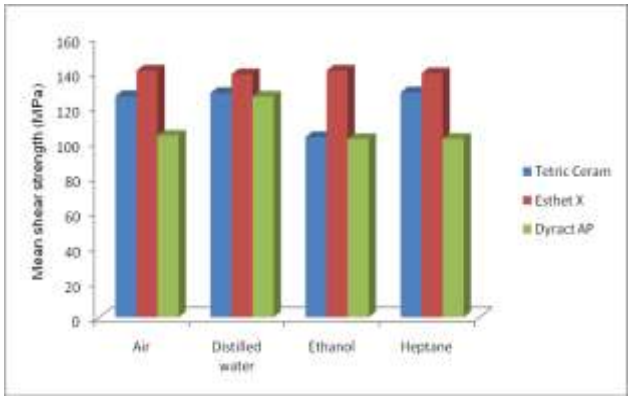
Medium	Shear strength (MPAs)	Difference between mediums		
	Mean ± SD	Medium compared	Mean difference	P-value
I. Air	140.9 ± 3.7	I - II	(-) 2.1	NS
II. Distilled water	138.8 ± 1.4	I - III	0	NS
		I - IV	(-) 1.5	NS
III. Ethanol	140.9 ± 2.2	II - III	2.1	NS
IV. Heptane	139.4 ± 2.1	II - IV	0.6	NS
		III - IV	(-) 1.5	NS

Table 3 : Shows mean values and comparisons of shear punch strength of Dyract Ap when conditioned in FSLs.

Medium	Shear strength (MPAs)	Difference between mediums		
	Mean ± SD	Medium compared	Mean difference	P-value
I. Air	103.7 ± 1.9	I - II	22.3	PS < 0.01
II. Distilled water	126.0 ± 2.0	I - III	(-) 1.9	NS
		I - IV	(-) 1.8	NS
III. Ethanol	101.8 ± 1.5	II - III	(-) 24.2	PS < 0.01
IV. Heptane	101.9 ± 3.0	II - IV	(-) 24.1	PS < 0.01
		III - IV	0.1	NS

Results

Results are expressed as Mean + SD and range values. One-way Anova was used for multiple group comparisons followed by Newmann-Keul's range test for group wise comparisons. Two-way Anova was also performed to know the interaction effect between materials and media. A P value of 0.05 or less was considered for statistical significance.



Graph 1: Mean values and comparison of shear punch strength of composites and compomers after conditioning in FSLs.

The results clearly showed that the composite Esthet X with the modified matrix formulation had the highest strength and was not affected by conditioning in FSLs. The shear punch strength of Tetric Ceram was significantly reduced by conditioning in 75% ethanol water solution. The shear punch strength of polyacid-modified composite Dyract AP was significantly increased by storage in water.

Discussion

A wide variety of materials have been used for the direct restoration of decayed or traumatized teeth. Each group of products is subjected to evaluation using standard tests developed by the International Standards Organization (ISO).[8] The primary stress properties for testing and comparing materials are those of tension, compression and shear.[12]

A shear test as described in previous literature presents a method for gauging the integrity and strength of material in thin layers by punching a small disc out of a thin sheet of material.[7,12]

As occlusal or incisal forces during masticatory cycle induce shear stress in teeth and restoratives, the shear punch test reflects qualities of clinical significance. The chemical environment is one aspect of the oral environment, which has an appreciable influence on the invivo degradation of resin composites.[5] In an invivo situation, it can be assumed that saliva, food components and beverages degrade and age dental composites.

It has been demonstrated experimentally that the polymer matrix is highly susceptible to softening by chemicals with a broad range of solubility parameters.[5] Heptane simulates butter, fatty meats and vegetable oils, while ethanol simulates certain beverages, including alcohol, vegetables, fruits, candy and syrup. Distilled water was included to simulate the wet oral environment provided by saliva and water. The solubility parameters for these organic food-simulating liquids were 1.5×10^{-4}, 3.1×10^{-4} and 4.8×10^{-4} $J^{1/2}$ $m^{-3/2}$ for heptanes, 75% ethanol solution and water respectively. A maximum softening effect is expected when the value of the magnitude of the solubility parameter of liquid is equal to that of the matrix polymer of the composite.

The effect of FSLs on shear strength was found to be material dependent.

For Group I Air (control group) Esthet X was found to be significantly stronger than Tetric Ceram and Dyract AP. This could be explained in part by filler volume. Studies have reported a positive correlation between the mechanical properties and volume fraction of fillers. Materials like Esthet X (60% filler volume) and Tetric Ceram (60% filler volume) are therefore expected to have greater shear strength than Dyract AP (47% filler volume).[1] Although Esthet X and Tetric Ceram had identical filler volumes, Esthet X was significantly stronger than Tetric Ceram. This is probably due to the differences in matrix formulation. Esthet X is BisGMA and BisEMA based whereas Tetric Ceram is only BisGMA based.[1]

For Group II Distilled water, however the strength of Dyract AP increased significantly after conditioning in distilled water. This is probably due to the acid-base reaction between the hydrated acidic functional groups and fluoroaluminosilicate glasses present in Dyract AP.

After conditioning in Group III 75% ethanol water solution, the shear punch strength of Tetric Ceram was reduced significantly. The solubility parameter of 75% ethanol is 3.1 x 10^{-4} $J^{1/2}$ $m^{-3/2}$ and is close to that of BisGMA based resins. Tetric Ceram is BisGMA based matrix formulation.[1] As the ethanol solvent penetrates the matrix and expands the opening between polymer chains, monomers may leach out. The continuous exposure of the composite materials to ethanol solution apparently resulted in ethanol diffusing far into the specimens.[11]

The detrimental effect of the ethanol water solution did not affect the shear punch strength of Esthet X, which is both BisGMA and BisEMA based. BisEMA which is the ethoxylated version of BisGMA is highly hydrophobic and may make Esthet X more resistant to the softening effects of ethanol water solution. This finding was consistent with that of previous research, which found that BisEMA based composites were highly resistant to the degradation effect of food-simulating liquids including ethanol.

As BisEMA based composite was significantly stronger than all materials after conditioning in ethanol, it may be the composite of choice for restoration of posterior teeth in patients who consume alcohol frequently and in large quantities, and in persons who use oral hygiene products containing alcohol frequently.

The clinical success of materials cannot be determined by shear strength alone. Other factors such as wear, water sorption, and bonding to tooth structure are equally important. The shear punch test, however, offers a simple, effective and reliable means of screening resin-based filling materials and evaluating material-environment interactions.

Conclusion

The effect of food-simulating liquids on shear strength of composites and polyacid-modified composites was material dependent. As BisEMA based composites was found to be most resistant to degradation by ethanol, it may be the restorative material of choice in patients who consume alcohol frequently and in large quantities as well as in persons who habitually use alcohol containing oral hygiene products.

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Case Report

TREATMENT OF CLASS II DIVISION 1 AND CLASS II SUBDIVISION MALOCCLUSION WITH BILATERAL AND UNILATERAL MANDIBULAR BITE JUMPING APPLICANCE

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ABSTRACT

Most of the class II division I malocclusion at the terminal phase of growth are treated with fixed bite jumping appliances. Bilateral and unilateral churro jumper can be used effectively for correction of class II division I and subdivision malocclusion respectively. This is a fixed flexible functional appliance which can be made by the orthodontist chair side. The costs are reduced and the time spent is minimal. In a country like India, world's 2nd most populated country, socio-economically backward, 41.6% of population is below poverty and 72.2% of population lives in rural areas. As an orthodontist our contribution and objective towards treating such population is aimed to deliver inexpensive appliance feasible to all the economic groups. Hence , churro jumper was selected for treating class II malocclusion in adolescent cases. This paper attempts to outline the differences in treatment mechanics of bilateral and unilateral churro jumper without any undesirable effects.

Keywords : Churro jumper, functional appliance, Angle's class II malocclusion

INTRODUCTION

In most of the class II division I malocclusion cases at their terminal phase of growth stages, can be corrected by using fixed bite jumping appliances.

The churro jumper furnishes orthodontists with an effective and inexpensive alternative force system for the antero-posterior correction of class II and class III malocclusions.

There are several bite jumping appliances available for correction of class II division I, sub division malocclusion. Out of all these bilateral and unilateral bite jumping appliances that are available, Churro Jumpers are the flexible fixed functional appliances which can be made by the orthodontists in their laboratories.

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CASE REPORT

Patients who came with a chief complaint of forwardly placed upper anteriors to Department of Orthodontics and Dentofacial orthopedics were selected, a detailed history with a complete orthodontic case work up was done.

CASE-1

A 15 year old female presented with forwardly placed teeth. Routine orthodontic work up with records revealed a convex profile, increased overjet and bite on Dento alveolar Angles Class II malocclusion on a Class II skeletal bases with proclined anteriors and spacing in the upper and lower arch with horizontal growth pattern in a growing patient.

PRE-TREATMENT EXTRA ORAL PHOTOGRAPHS

PRE-TREATMENT PHOTOGRAPHS

PRE-TREATMENT INTRA ORAL PHOTOGRAPHS

PRE-TREATMENT RADIOGRAPHS

Intra-oral photographs with bilateral Churro Jumper appliance

TREATMENT PLAN

- Detailed review of Cephalometric, hand-wrist radiographs, model analysis and clinical records was done. Considering the patient's convex profile and the amount of residual growth, left utilization of fixed functional appliance churro jumper was decided.
- Initial leveling and aligning followed by utilization of bilateral churro jumper to achieve class I molar and canine relation was decided.

Present Stage

PRESENT STAGE PHOTOGRAPHS

PRE-TREATMENT POST FUNCTIONAL

PRESENT STAGE

PRESENT STAGE PHOTOGRAPHS

PRE-TREATMENT

PRESENT STAGE

CASE II

- A 12 year female presented with a convex profile, dento-alveolar angles class II div1 malocclusion with End on molar and canine relation on right side and class I molar and canine relation on left side on class II skeletal bases with the upper midline was shifted to the right side in upper arch and 5mm in lower arch, with proclined anteriors and crowding in upper and lower arch in a growing patient with vertical growth pattern.

PRE TREATMENT EXTRA ORAL PHOTOGRAPHS

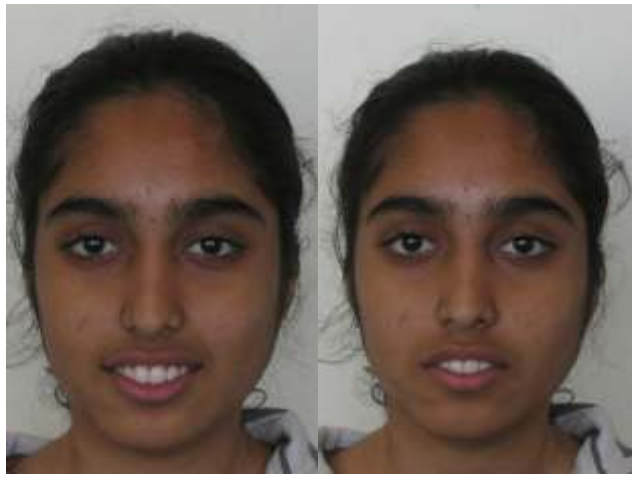
PRE TREATMENT INTRA ORAL PHOTOGRAPHS

PRE TREATMENT CEPHALOGRAM

TREATMENT PLAN

- A detailed review of Cephalometric, hand-wrist radiographs, model analysis and clinical records was done. Considering the patient convex profile and the amount of residual growth, left utilization of fixed functional appliance churro jumper was decided.
- Non-extraction treatment plan, unilateral churro jumper on the right side to correct the molar and canine relation and shift mandible to left side.

INTRA-ORAL PHOTOGRAPHS WITH UNILATERAL CHURRO JUMPER APPLIANCE



POST TREATMENT PHOTOGRAPHS

PRE-TREATMENT POST TREATMENT

PRE-TREATMENT POST FUNCTIONAL

POST TREATMENT

BIOMECHANICS OF BILATERAL CHURRO JUMPER

Used in the correction of Class II malocclusion.

- Intrusion and distalization of upper molars.
- Mesialization and intrusion of lower anterior teeth.
- Advancement of the mandible.
- lower arch is used as an anchoring unit.

BIOMECHANICS OF UNILATERAL CHURRO JUMPER

- Undesirable effects -asymmetry and occlusal cant.
- In order to overcome this and get the set treatment objectives utilization of simple measures like :
- -utilization of seating elastics of (4 ounces) on the opposite side of unilateral of churro jumper was done
- unilateral class II elastics (churro jumper side) and seating elastics on opposite side was placed to achieve a stable occlusion.

DISCUSSION

- The Churro Jumper furnishes orthodontists with an effective and inexpensive alternative force system for the anteroposterior correction of Class II and Class III malocclusions.
- Dr.Castañon accepted a challenge to improve the MPA introduced by Coelho. The resulting appliance is easily fabricated with materials commonly found in orthodontic offices and does not require any laboratory construction.
- The name was taken from a Mexican cinnamon twist. Although the Churro Jumper was conceived as an improvement to the MPA, it functions more like the Jasper Jumper.

CONCLUSION

- Whereas most therapies require a heavy investment , the Churro can be fabricated with a minimum of time, effort, expertise, and expense.
- Especially,the unilateral churro jumper can be used successfully for correction of class II subdivision malocclusion if operator can negate side effects by using simpler aids like seating and class II elastics desired results can be achieved.

- No appliance is universally applicable, but if clinicians are willing to undergo a learning curve, the Churro Jumper can provide them with a potent, versatile appliance for correcting a variety of malocclusions.

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