INDIAN JOURNAL OF DENTAL EDUCATION

The **Indian Journal of Dental Education** (ISSN 0974-6099) published quarterly, is dedicated to the dissemination of new knowledge and information on all fields of dentistry. The **IJDE** publishes original peer-reviewed articles that examine all phases of dental treatment, reports on unusual and interesting case presentations and invited review papers. The aim of this journal is to convey scientific progress in dentistry for the benefit of the dental health of the community. The journal serves valuable tool for helping clinicians, general practitioners, teachers and administrators involved in the prevention and treatment of dental disease.

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Indian Journal of Dental Education

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Editorial

New science in dental education

Advances in all aspects of science and discovery continue to occur at an exponential rate, leading to a wealth of new knowledge and technologies that have the potential to transform dental practice. This "new science" within the areas of aeronautic dentistry , cell/ molecular biology, genetics, tissue engineering, nanotechnology, and informatics has been available for several years; however, the assimilation of this information into the dental curriculum has been slow. For the profession and the patients it serves to benefit fully from modern science, new knowledge and technologies must be incorporated into the mainstream of dental education. The continued evolution of the dental curriculum presents a major challenge to faculty, administrators, and external constituencies because of the high cost, overcrowded schedule, unique demands of clinical training, changing nature of teaching/assessment methods, and large scope of new material impacting all areas of the educational program. Additionally, there is a lack of personnel with adequate training/experience in both foundational and clinical sciences to support the effective application and/or integration of new science information into curriculum planning, implementation, and assessment processes. Nonetheless, the speed of this evolution must be increased if dentistry is to maintain its standing as a respected health care profession. The influence of new science on dental education and the dental curriculum is already evident in some dental schools. Discussion of the rationale, goals/objectives, and outcomes within the context of dissemination of these models should help other dental schools to design approaches for integrating this new material that are appropriate to their particular circumstances and mission. For the profession to advance, every dental school must play a role in establishing a culture that attaches value to research/discovery, evidence-based practice, and the application of new knowledge/technologies to patient care.

Balwant Rai
Editor-in-Chief

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Dental education and oral health problems in India

Jasdeep Kaur

ABSTRACT

How will the new era signify dental practice of occupational safety, dental health education and its challenges? At present, the dental profession is confronted by an outburst of technology, population explosion, problems in dental health care delivery systems. As a result, dentists find it increasingly difficult to meet their responsibilities to patients and society. In such conditions, reaffirming the fundamental and universal principles and values of dental professionalism, which remain principles to be pursued by all oral physicians becomes important. This paper reviews dental education in India and challenges in oral health owing to issues such as lack of awareness, lack of oral hygiene, quackery etc.

Key Words: Dental education, curriculum, history, India, infrastructure, street dentistry, quackery

INTRODUCTION

India is thickly populated and has diverse climate. The size The total area is 3,287,590 sq km (1,269,345 sq mi), including 222,236 sq km (85,806 sq mi) belonging to Jammu and Kashmir; of this disputed region, 78,932 sq km (30,476 sq mi) are under the de facto control of Pakistan and 42,735 sq km (16,500 sq mi) are held by China and population is 1,065,070,607(July 2004 est). The demographic condition has considerable influence on dental health education. Hence it's advisable to assess adequacy and efficiency to provide dental care to population growing in diversity and mass. An enhanced armamentarium with high delivery costs does not ensure the deliverance of a certain standard of dental care. The options of dental management is often dictated a patient's wishes and affordability rather than by wholesome dental need. India consists of twenty nine states, and the principal unit of administration in a state is a district, which is further divided into community development blocks. There are 2,424 such blocks in India, each of which caters to a population of 80,000 to 1, 20,000. India is expected to have third largest population by 2013.

Current Population of India

1,065,070,607 (July 2004 est.)

Population Density of India

324 persons per square kilometer

A latest survey of national consumer usage and attitudes towards dental education of population was conducted across 150 cities; it discovered that dental problems in India are due to the low awareness levels and poor oral hygiene habits in people. The Survey showed that people do not correlate dental health with satisfactory oral care but associate dental problems with lifestyle associated reasons like 'improper eating habits' and 'being born with bad teeth', a perception high-flying in rural areas. The Survey also established that majority of population did not use any modern oral care products, the figure being higher in rural areas. In the urban areas usage of the modern oral care products was comparatively higher. In the rural areas people still use non-dentifrice

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products such as Neemstick (Datun), charcoal and ash due to lack of awareness. Also, in rural areas rarely people visit for regular dental checkup in contrast to urban population, where frequency of visits for regular checkup is higher. The survey also noticed that poor oral hygiene and low awareness result in a myriad of dental problems across the country especially in the rural countryside. The survey also found that more than half are unconcerned about preventing or curing the oral diseases. Study has shown that oral diseases can best be prevented through early detection and primary prevention. This means that people necessitate getting the basics oral health measures – brushing twice daily and visiting a dentist twice a year. Inculcating awareness about oral health at an early age proves to be advantageous later in life. The survey noted the lack of concern in the rural areas towards oral problems.

HEALTH INFRASTRUCTURE IN INDIA:

Indian dental health infrastructure insights the dental industry in terms of dental appliances, equipments, consumerable products. This also analyses the aspects that force the growth of the dental industry, challenges faced by the dental companies and the critical factors that will determine the success of these companies in the future. Dental Council of India plays major role here. Dental Council of India is a Statutory Body incorporated under an Act of Parliament viz. The Dentists Act, 1948 (XVI of 1948) to regulate the Dental Education and the profession of Dentistry throughout India and it is financed by the Govt. of India in the Ministry of Health & Family Welfare (Department of Health) through Grant-in-aid. The General Body of the Dental Council of India representing various State Governments, Universities, Dental Colleges, Central Government, etc. The Council is financed mainly by grants from the Govt. of India, Ministry of Health & Family Welfare (Department of Health) though the other source of income of the Council is the 1/4th share of fees realized every year by various State Dental Councils under section 53 of the Dentists Act, Inspection fee from the various Dental Institutions for Inspecting under Section 15 of the Dentists Act, 1948 and application fee from the organization to apply for permission to set up new Dental College, opening of higher Courses of study and increase of admission capacity in Dental Colleges under section 10A of the Dentists Act, 1948 as amended by the Dentists (Amendment) Act, 1993.

HISTORY OF DENTAL EDUCATION IN INDIA

Dental education in India has come a long way from the first dental college, the R. Ahmed Dental College, established by Dr. Rafidin Ahmed in Calcutta in 1928. The college, which initially offered a one-year course and subsequently restructured to four years in 1935, was a pioneering effort towards setting up a dental institution of merit along modern scientific lines. Dental education in India has shown an exponential growth in the last two decades, with the number of dental institutions growing 10 times over 200 institutions in 2007 year and over 23,000 dentists graduating every year in India.

EMERGENCE OF DENTISTRY IN INDIA

Dentistry in India is no more constrained to extracting out decayed tooth or filling up discolored teeth. There is an increasing curiosity among the youth to take up dentistry as a chosen area of profession. Education: A sizable number of dentists from India flow to US, UK, Finland, Australia, New Zealand, UAE, Saudi Arabia, and Africa both in search of job as well as for higher education. At the same time, a large number of students from US and Canada, though mostly Non-Resident Indians, fly in to study dentistry in Indian institutions, which provide them, as they believe, quality education. Lastly, there is the need for an apparent vision. The immense dental capital for dentistry in India should be appraised and projected for the next ten years. This may be channelized to carve out one of

the finest dental education system and patient care system in the world that is capable of competing with other nations effectively.

BACHELOR OF DENTAL SURGERY IN INDIA:

The new curriculum of Bachelor of dental surgery in India is competency-based, with emphasis in imparting basic skills essential to the practice of dentistry. The didactic program me teaches relevant knowledge and skills necessary to train a competent general dental practitioner. The duration of Bachelor of dentistry course is five academic years including one year of paid compulsory rotatory internship in a dental institute. There are four examinations, viz, First, Second, Third and Final. The First examination is held at the end of First year, the Second examination at the end of second year, the Third examination at the end of third year and the Final examination at the end of the fourth year.

POST-GRADUATION IN DENTISTRY IN INDIA

Master of Dental Surgery (MDS) is offered in nine specialties with course duration of three to five years in Oral-medicine, Prosthodontics, Endodontics, Conservatives, Oral-surgery, Pedodontics, Community Dentistry, Orthodontics, and Peridontics. Numerous Deemed Universities all over India also offer short- term courses such as M.Sc. and MPH (Master of Public Health) after BDS. All courses are however subject to recognition by the Dental Council of India. Programmed outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge and behavior that students acquire. Candidates achieve a high degree of clinical proficiency in the subject matter and develop competence in research. Dentistry has become very interdisciplinary. It has expanded its collaborations with the primary goal being educational and the secondary ones including knowledge of human behavior, skills in patient management, assessment and diagnosis and treatment planning.

CHALLENGES

There are over 200 dental teaching institutions in India, mushrooming out over thousands of dentists every year. Institutions are recognized by dental Council of India.

Further, graduated dentists set up their practice, they stumble on out that equipment, auxiliary and basic infrastructure costs are high. General mass awareness of the need for dental treatment is very low especially in rural, slum areas. Population's priorities and prospects also differ. Few grounds for this possibly is poor patient education on dental problems, fear of experiencing pain during treatment and the ever-increasing cost of treatment. The majority of dental problems in India are due to the low importance given to oral hygiene and impediment in treatment due to patients' negligence. Many dental camps are organized by government institutions, private practitioners; still the huge population suffers from mammoth of dental problems. Further, because of poor oral hygiene and chewing tobacco habits have increased incidence of gum diseases, major ones is oral cancer. The predisposing factors are always ignored by low income group in which the intake of smoke and smokeless tobacco is maximum and hence our country land with massive cases of oral cancer.

Another Important challenge faced by graduate dentists as well as population is Street dentistry, a form of quackery, is in practice in the rural and remote places of India. These street dentists or quakes often visit villages or cities with a bag consisting of some pliers, screwdrivers, dividers, self-acrylic materials, etc and offer quick relieving treatments at very low costs and attract uneducated or poor population who cannot afford dental treatments. Quackery is a disparaging term used to portray the deceptive falsification of the diagnosis and treatment of disease. It is the practice of unproven, ineffective dental science. Quack generally means as a "fraudulent or ignorant pretender to medical skill" or "a person who pretends, professionally or publicly, to have skill, knowledge, or

qualifications. This has greatly affected the Indian dental education standards, measures should be taken to prevent such practices in India.

ORAL HEALTH PROBLEMS IN INDIA

Oral health problems comprise Indian subcontinent's poor standards of oral and dental health. Oral diseases comprise oral cancer, periodontal diseases. Periodontal disease affects 90-95% of our population, and dental caries affects 60-80% of our children. Malocclusion of teeth is also common among 50% of school children. Consumption of tobacco products even among children is causing serious concern and is manifesting itself as oral submucous fibrosis—a precancerous condition. Oral cancer accounts for almost 40% of the total diagnosed cancer cases in India—considered to be one of the highest. Oral cancer is the sixth commonest cancer in the world. Its incidence is particularly high in India, especially in low income group where smoking and alcohol drinking are major risk factors and literacy rate is low. In India, chewing and smoking of tobacco products are available in various forms and accounts for high incidence of cancer. The World Health Organization (WHO) has estimated that 90% of oral cancers in India among men were attributable to chewing and smoking habits. About 48.2% of cancers in men and 20.5%, of cancers in women are related to tobacco, of which a major proportion is in the oral cavity, pharynx, larynx, esophagus (74.7%), while lung cancers account only for 15%,. Control of cancers of the head and neck, lung, cervix and breast which account for 50-55% of the cancer load in India will have a maximum measurable effect on the incidence of cancer. Oral squamous cell carcinoma develops through a multi-step process of genetic, epigenetic and metabolic changes resulting from exposure to carcinogens. The initial presence of a precursor subsequently developing into cancer is well-established in oral cancer. Oral leukoplakia and submucous fibrosis are two major known precursor lesions. Only 8-10% of these lesions ultimately turn into malignancy. Ability to clinically predict malignant transformation is limited and routine histopathological diagnosis has limited its prognostic value. The presence of epithelial dysplasia is one of the important parameters used in prognostication of leukoplakia. However, there are limitations for its use such as, the diagnosis is essentially subjective, all lesions exhibiting dysplasia do not eventually become malignant and some may even regress, and carcinoma can develop from lesions in which epithelial dysplasia was not diagnosed in previous biopsies. Therefore, it is necessary to develop awareness and basic dental education among general population for predicting the malignant potential of pre-malignant lesions and its preventive measures. Alcohol use is another high-risk activity associated with oral cancer. There is known to be a strong synergistic effect on oral cancer risk when a person is both a heavy smoker and drinker. Their risk is greatly increased compared to a heavy smoker, or a heavy drinker alone. Though, oral cancer occur at a site which is accessible for clinical examination and amendable to diagnosis by current diagnostic tools, the nitty-gritty of the problem is that majority of the cases report late to the dental health care facility and ignored by general mass population due to lack of awareness especially in rural countryside.

HEALTH PROMOTIONS IN INDIA

Health Promotion can be well thought-out as the grouping of educational, organizational, economic and environmental supports for behavior conducive to health. Dental Health Promotion is the development of enabling individuals and mass communities to increase control over the determinants of dental health and thereby improve their oral health. Health promotion represents a mediating strategy between people and their environment, combining personal choice and social responsibility for creating a wiser and healthier future (WHO 1984). (The determinants of health are not always under an individual's control and may be categorized as biological, environmental, lifestyle, and health care services - see Ashley and Allen, in Burt and

Eklund). More of educational camps and free regular dental checkups should be planned in rural areas imparting basic necessity and measures to clean oral cavity and various demonstrations should be carried out to make illiterate population learn techniques of cleaning.

CONCLUSION

Dentistry faces severe problems on the subject of accessibility of its treatments to all. The major missing connection grounds this unfortunate condition in a country like India is the nonexistence of a primary health care approach in dentistry especially in rural areas. This might be attributable to significant geographic imbalance in the distribution of dental colleges; hence lack of awareness in general population, also a great variation in the dentist to population ratio in the rural and the urban areas which further accounts this problem. The Government and Indian dental council should put forward a strong policy to culminate dental education. This might play a vital role in creating a better, healthier India.

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Evaluation of commercially available biodegradable tetracycline fibers therapy in chronic periodontitis

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ABSTRACT

The purpose of the study was to compare the clinical efficacy of tetracycline impregnated fibrillar collagen in conjunction with scaling and root planing to scaling and root planing alone in the treatment of chronic periodontitis. The study was conducted in a split mouth design. Thirty five patients having at least two non adjacent sites in different quadrants with periodontal pockets e" 5mm and with bleeding on probing at initial visit were treated with both scaling and root planing plus tetracycline fibers or with either scaling and root planing alone. Baseline and follow up measurements included plaque index, gingival index, probing pocket depth and clinical attachment level. Both treatment modalities were affective in improving clinical parameters over three months observation period. The combined antimicrobial and mechanical debridement therapy has shown better results as compared to scaling and root planing alone. Application of tetracycline in modified collagen matrix following scaling and root planing might be beneficial in treatment of chronic adult periodontitis and improving periodontal parameters for 3 months duration.

INTRODUCTION

Periodontal disease belongs to a group of inflammatory disorder whose pathogenesis is not well defined, although it is known that the interaction of host defense mechanisms and etiologic agents is an important determinate of the onset and progression of the disease. There is well documented evidence that bacteria and their products found in dental plaque comprise the primary etiologic agents responsible for periodontal disease[1,2,3].

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The primary aim of non surgical as well as surgical treatment regimen is the removal of etiologic factor (i.e. plaque and calculus). Non surgical therapy i.e. scaling and root planing may not always result in the complete elimination of etiologic factor because of poor access to the base of deep periodontal pocket and anatomical complexities which may occasionally limit the efficiency of root planing. It has also been suggested that residual bacteria in the dentinal tubules and soft tissues may repopulate the scaled teeth[4].

Tetracyclines have been used extensively in the treatment of periodontal disease since many years. Tetracyclines are semi-synthetic chemotherapeutic agents which are bacteriostatic in action and hence are effective against rapidly multiplying bacteria. Tetracycline and its derivatives have been used systemically as well as locally in the treatment of periodontal disease. Local drug delivery avoids most of the problems associated with systemic therapy by limiting the drug to its target site with little or no systemic uptake.

Tetracycline have been incorporated into a variety of delivery systems (non resorbable or bio resorbable) for insertion into periodontal pockets. These include hollow fibers (Goodson et al 1979) ethylene vinyl acetate copolymer fibers (Goodson et al 1983), ethyl cellulose fibers (Friedman and Golomb 1982), acrylic strips (Addy et al 1982), collagen preparations (Minabe et al 1989) and hydroxypropylcelluslose films (Noguchi et al 1984)[5].

Recently , new biodegradable local drug delivery system, Periodontal Plus AB™ (Advanced Biotech Products, Chennai, India) i.e. tetracycline impregnated fibrillar collagen that contains 25 mg pure fibrillar collagen containing approximately 2mg of evenly impregnated tetracycline HCI, has been introduced for the treatment of gingival and periodontal diseases.

The present three months study was designed to clinically compare the efficacy of tetracycline from modified collagen matrix used as combination therapy with scaling and root planing alone in the treatment of chronic periodontitis.

MATERIALS & METHODS

A total of 35 human subjects comprising of both sexes (Male : Female = 16:19), aged between 35to 60 years were selected from the Out Patient Department of Periodontics at the D.A.V. (C) Dental College and Hospital, Yamunanagar, Haryana (India). All the 35 subjects completed the 3 month follow up study.

STUDY POPULATION., INCLUSION CRITERIA

1. Patients who had not undergone any surgical or non-surgical periodontal therapy in the past 6 months.
2. Patients who had not taken antibiotic therapy in the past 6 month.
3. Patients able to follow verbal or written oral hygiene instructions.
4. Patients having 2 nonadjacent teeth separated by atleast 1 tooth with e" 5mm periodontal pocket that bleed on probing at the initial visit.

EXCLUSION CRITERIA

1. Patients with a history of using anti-microbial mouthrinses within 2 months of the baseline visit or on routine basis.
2. Patients having history of allergy to tetracycline or cyanoacrylate adhesive.
3. Pregnant woman or nursing mothers.
4. Patients with periodontal packets in which the depth of the pockets corresponded to the apex of the tooth as in probable endodontic – periodontic conditions.
5. Medically compromised patients.
6. Teeth with furcation involvements.

35 subjects with a total of 70 sites were selected. The selected sites were randomly divided into test group and control group.

TEST GROUP

included 35 sites treated with local drug delivery and scaling and root planing.

CONTROL GROUP

included 35 sites treated with scaling and root planing alone (without local drug delivery).

CLINICAL PARAMETERS RECORDED

1. Plaque Index (**Silness and Loe 1964**)[6] at baseline, 1month,

   2months and 3months post therapy.
2. Gingival Index (**Loe and Silness 1963**)[7] at baseline, 1month,

   2months and 3months post therapy.

3. Probing Depth measurement from gingival margin to base of

   pocket using William's graduated probe at baseline, 1month,

   2months and 3months post therapy.

4. Clinical Attachment Level measurement from cemento-enamel

   junction as a reference point to the base of pocket with William's graduated probe at baseline, 1month, 2months and 3months post therapy.

STATISTICAL METHODS

The baseline, 1month, 2months and 3months value were compared for changes that occurred over time i.e. changes in plaque index, gingival index, probing depth reduction and clinical attachment gain. Probabilities less than 0.05 ($p < 0.05$) were considered significant. Probabilities less then 0.001($p < 0.05$) were considered highly significant. The paired t- test and student t-test were utilized to evaluate and establish differences between baseline and 1, 2 and 3 months values of test and control sites.

TETRACYCLINE IMPREGNATED FIBRILLAR COLLAGEN

This product consists of 25mg of pure fibrillar Type-I collagen containing approximately 2mg of evenly impregnated Tetracycline HCI, USP/ IP. It is available as a strip containing four individually packed and separable sterile product packs. Just before placement, fibers were soaked with saline in a sterile dappen dish. Soaked fiber were placed at the prepared site and gently pushed inside the pocket, so that the material fills the depths and curves of the pocket. Hand pressure was applied for just a few minutes to encourage hemostasis and initial setting of the material inside the pocket. The site was sealed with cyanoacrylate adhesive to prevent ingress of oral fluids.

POST TREATMENT INSTRUCTIONS

1. Avoid chewing hard or sticky food.
2. No flossing on the treated site.
3. Do not disturb the area with tongue, finger or tooth pick.
4. To report immediately if the material is dislodged before the scheduled recall visit or if pain, swelling or any other complication occurs.

RESULT

The clinical finding at baseline, 1 month, 2 months and 3 months post operative are shown in table 1, 2, 3 and 4. At the start there was no significant difference between both treatment group for the plaque index, gingival index, probing Pocket depth and Clinical attachment level (p d" 0.001).

Table 3 and Graph 1 shows a gradual reduction in probing pocket depth both for test and control group, with more reduction in test group as compared to control group. Similarly more gain in clinical attachment level in the test group as compared to control group is evident from table 4 and Graph 2.

DISCUSSION

One essential goal of current periodontal therapy is successful management of the suspected bacterial pathogens to the extent that destruction of the periodontium is arrested. A number of different non-surgical and surgical therapies have been successful in achieving this goal. Mechanical debridement with or without surgical manipulations, to disrupt the subgingival flora and to provide clean , smooth and biological compatible roots surfaces, had been the therapy to treat periodontal diseases till the early 1970's. Mechanical therapy may however fail to eliminate the pathogenic bacteria because of their location within gingival tissues or in other areas inaccessible to periodontal instruments[8].

The present study was designated to access the clinical efficiency of tetracycline

impregnated collagen fibers by demonstrating then changes in plaque index and gingival index, changes in probing pocket depth and clinical attachment level. A total of 35 patients (Male: Female=16:19) were enrolled in this study. Two interproximal sites with pocket depth e" 5mm were selected in each patient in different quadrants.

Possible side effect of therapy including slight discomfort and gingival redness were evaluated. No treatment related adverse effects were observed in any patient. Garret et at 1999[9] also reported that treatment emergent adverse events constituted d" 1% of the entire study population with 0.2% of them showing allergic response.

In the present study significant reduction in plaque score from baseline to 3 months for both treatment group (p 0.001) was observed Similar observation were made by Minabe et al 1991[10], Heijl et al 1991[11], Mehta et. Al 2000[5] and Frisen et al 2002[12] who found low levels of plaque index scores in this study from baseline could be due to a greater attention to oral hygiene practice by all selected participants throughout the study.

Similarly gingival index also showed significant reduction in scores from baseline to 3 months for both treatment groups. Minabe at al 1991[10] and Mehta et al 2000[5] observed low levels of gingival index scores throughout the period of study.

Control of plaque and gingivitis is important in clinical studies because both vary in their association with periodontitis and both affect measured response to therapy, in this study, the reduction in plaque and gingival index may be due to thorough oral prophylaxis and proper home care by patients.

Since increased probing depth and loss of clinical attachment are pathogonomonic for periodontitis, hence pocket probing is a crucial and mandatory procedure in diagnosing periodontitis and evaluating the success of periodontal therapy. In the present study intra group observation showed highly significant ($p < 0.001$) reduction in probing depth from baseline to 3 months in both group.

On comparison, statistically significant differences was observed from baseline to 3 months between scaling and root planing alone and combination therapy. The results are consistent with the findings of Goodson et al 1991 [13], Minabe at al 1991 [10], Newman et al 1994 [14], Tonetti et al 1991 [15], & Mehta et al 2000[5]. These finding are in contrast with the result of Drisko et al (1995)[16] who observed no significant difference among the different regimens at any point in time. This could be attributed to the fact, that in Drisko et al 1995 [16] study tetracycline fibers were placed in non root planed sites and benefit of mechanical debridement was not obtained.

Newman et al 1994[14] quoted that patients tend to have approximately 1 mm reduction of probing depth on average, but in some cases, can have more dramatic effects, such as 2mm or greater. It was similar to the findings of this study.

Goodson et al 1991[13] also observed that probing depth reduction was higher in combination therapy than scaled sites. Heijl et al 1991[11] in their comparative study also observed that there was significant pocket depth reduction in the combination therapy than scaling root planing alone.

A significant gain in clinical attachment level was also obtained from baseline to 3 months in both the treated sites ($p < 0.001$) difference was observation were similar to that of Goodson et al 1991[13], Heijl et al 1991[11], Minabe et al 1991[10], Newman et al 1991[14], Drisko et al 1995[16], Kinane and radvar 1999[17].

On comparison, highly significant ($p < 0.001$) difference was observed between combination therapy and scaling and root planing alone. This finding is similar to that of Goodson et al 1991[13], Minabe et al 1991[10], and Newman et al 1994[14].

Minabe et al 1991[10], found gain of clinical attachment level around 2mm, and suggested that the local application of antibiotic using a local drug delivery in combination with root debridement may contribute to clinical attachment gain.

The finding of the study is in contrast with those of Drisko et al 1995[16] who found no

significant among the different regimens at any time point. This could be due to reason as mentioned earlier.

The higher efficacy of the modified collagen matrix and tetracycline over scaling and root planing, could be attributed to the availability of a modified collagen matrix to accelerate tissue restructuring, the sustained delivery of a potent drug (tetracycline) that eradicated periodontopathic microorganisms and the ability of tetracycline to inhibit bacterial collagenases.

The reduction of probing depth and gain of clinical attachment were significant in all treatment groups. These improvements might simply reflect a change in tissue composition of periodontal tissues, rather than a true gain of new attachment.

Armitage et al. and Spray et. al. have found that inflammation of the gingival tissue has a significant influence on the degree of probe penetration[5]. Improved gingival health may have contributed to the observed reduction of probing depth, presumably by decreasing the edematous swelling of the marginal gingiva and / or by decreasing the penetrability of tissue by the probe as a result of an increase of collagen content.

The crux of the present study clearly shows that mechanical debridement and locally delivered tetracycline work by two different mechanisms. Scaling and root planing removes some amount of bacteria without providing bactericidal activity whereas tetracycline does not remove any calculus deposits. Hence neither is the ideal control for the other. Together, locally delivered tetracycline therapy has a specific purpose of controlling localized infection, and scaling and root planning to remove calculus and other deposits, providing added benefits and the rate of new lesion formation is also decreased by the combination therapy.

CONCLUSION

1. Application of the tetracycline in modified collagen matrix following scaling and root planing might be beneficial in treatment of chronic adult periodontitis and improving periodontal parameters for 3 months duration.
2. Though the local drug delivery system used in the study is the safe and effective treatment modality, further clinical and microbiological studies are required to determine the effect of this treatment modality over long period.
3. Inspite of the proven additive benefits, the availability and cost associated with various controlled delivery devices (EVA fibers) have so far limited the application of tetracycline fibers. As this material is relatively cost effective and biodegradable, its use can be expanded in general population.

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Table 1

Mean values of plaque index at baseline, 1 month, 2 months and 3 months post operatively (test site & control site)

Time interval	Test site		Control site	
	Mean±SD	Difference from baseline	Mean±SD	Difference from baseline
Baseline	2.49±0.32	-	2.46±0.31	
1 month	1.61±0.43	0.88±0.32**	1.88±0.36	0.58±0.21**
2 month	1.06±0.43	1.43±0.37**	1.33±0.40	1.13±0.38**
3 month	0.67±0.41	1.81±0.41**	0.94±0.40	1.51±0.44**

** = Pd" 0.001 – Highly Significant

Table 2

Mean values of gingival index at baseline, 1 month, 2 months and 3 months post operatively (test site & control site)

Time interval	Test site		Control site	
	Mean±SD	Difference from baseline	Mean±SD	Difference from baseline
Baseline	2.42±0.26	-	2.43±0.28	
1 month	1.47±0.42	0.95±0.33**	1.92±0.25	0.51±0.19**
2 month	1.09±0.36	1.34±0.32**	1.53±0.25	0.90±0.26**
3 month	0.63±0.39	1.79±0.35**	1.15±0.27	1.28±0.28**

** = Pd" 0.001 – Highly Significant

Table 3

Mean values of pocket depth at baseline, 1 month, 2 months and 3 months post operatively (test site & control site)

Time interval	Test site		Control site	
	Mean±SD	Difference from baseline	Mean±SD	Difference from baseline
Baseline	6.83±0.85	-	6.71±0.95	
1 month	5.23±1.00	1.60±0.55**	5.69±0.99	1.03±0.38**
2 month	4.29±1.04	2.54±0.61**	5.29±0.78	1.43±0.50**
3 month	4.14±1.08	2.69±0.71**	5.14±0.73	1.57±0.65**

** = Pd" 0.001 – Highly Significant

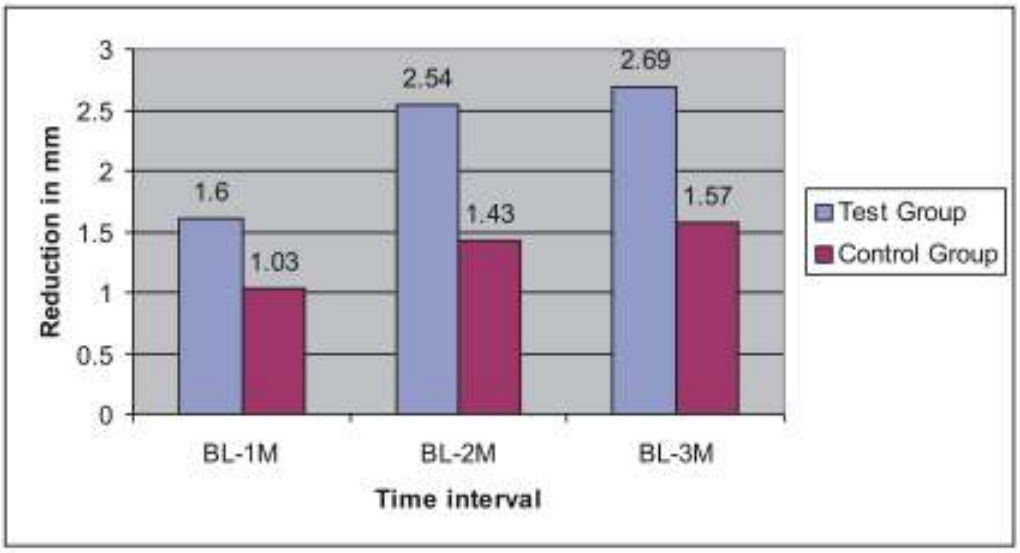
Table 4

Mean values of clinical attachment level at baseline, 1 month, 2 months and 3 months post operatively (test site & control site)

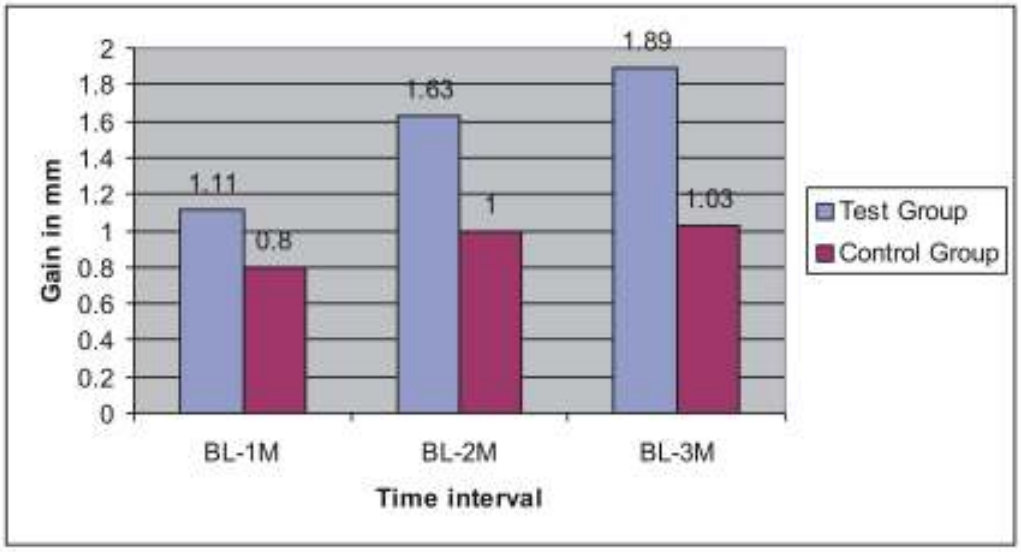
Time interval	Test site		Control site	
	Mean±SD	Difference from baseline	Mean±SD	Difference from baseline
Baseline	7.31±1.10	-	7.29±1.04	
1 month	6.20±1.23	1.11±0.47**	6.49±0.88	0.80±0.47**
2 month	5.69±1.32	1.63±0.77**	6.29±1.10	1.00±0.42**
3 month	5.43±1.21	1.89±0.63**	6.26±1.06	1.03±0.51**

** = Pd" 0.001 – Highly Significant

Graph 1: mean pocket depth reduction at different time interval



Graph 2: mean clinical attachment gain at different time interval



Submental intubation in indicated cases of oral and maxillofacial surgery: A technical note

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Gautam Dendukuri**

ABSTRACT

Securing an airway in oral and maxillofacial surgeries is an important part of management for both the surgeon as well as the anaesthetist. Intermaxillary fixation (IMF) is required intraoperatively in most of the surgical procedures and oral intubation significantly impedes this. In certain cases nasal intubation is also contraindicated. In these circumstances, Submental intubation helps in avoiding potential complications associated with nasal intubation and tracheostomy and at the same time allows an unobstructed surgical field in management of not only trauma cases but also in orthognathic surgeries and rhinoplasty. In this paper, the use and the technique of submental intubation is discussed.

Key Words: Submental intubation, intermaxillary fixation

INTRODUCTION

Airway management is challenging in complex craniomaxillofacial traumas and other maxillofacial surgical procedures and requires good communication between the maxillofacial surgeons and the anesthetists[1].

Achieving dental occlusion is important for most oromaxillofacial procedures. Oral intubation interferes with assessment of occlusion and intermaxillary fixation, and nasotracheal intubation is contraindicated in complex craniofacial and panfacial trauma cases because of associated complications such as leakage of cerebrospinal fluid, meningitis, potentially creating communication between nasal cavity & anterior cranial fossa or the tube can be passed intracranially in patients with skull base fractures[2].

With conventional endotracheal intubation, precise introperative assessment of the changes to the nasolabial complex and assessment of midlines cannot be made accurately during orthognathic procedures and adjunctive procedures such as simultaneous rhinoplasties cannot be carried out without changing the tube[3].

Tracheostomy remains an excellent procedure for establishing a formal surgical airway to ensure a free operative field. But this procedure may involve a significant risk of iatrogenic complications like haemorrhage, pneumothorax, tracheal stenosis, internal emphysema, damage to recurrent laryngeal nerve, tracheoesophageal fistula and scarring[4].

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In 1986, Hernandez Altemir described an alternate way of endotracheal intubation in maxillofacial trauma patients called submental endotracheal intubation[5]. This technique provides a secure airway, an unobstructed intraoral surgical field, and allows maxillomandibular fixation while avoiding the drawbacks and complications of nasotracheal intubation and tracheotomy[1].The purpose of this study is to discuss the versatile use and technique of submental intubation in oral and maxillofacial surgery.

SURGICAL PROCEDURE

Initially oral endotracheal intubation (Fig.1) is done using flexometallic endotracheal tube using standard general anesthesia technique. Throat pack is given and connector is checked for proper fit into the tube so that it can be easily removed and reattached in the next step.

The submental skin is prepared with aqueous betadine (Povidone Iodine) solution and the site is draped. Antibiotics are given intravenously in all cases. Damage to facial vessels is avoided by identifying the inferior border of the jaw in the submentosubmandibular area. This area is near the junction between the 1/3rd anterior and 2/3rd posterior part of the mandible. A 1.5 cm paramedian skin crease incision is made in the submental region just one finger's breadth medial to the lower border of the mandible after infiltration of local anesthesia subcutaneously (Fig.2). A closed curved artery forcep is introduced through the submental skin incision (Fig.3) to dissect a tract bluntly through the subcutaneous tissue, platysma, deep cervical fascia, and mylohyoid muscle remaining close to the lingual aspect of the mandible in order to avoid injury to the submandibular duct and the lingual nerve located medial to the incision.

During dissection it is important that the width of the submental access should be sufficient to pass the tube without any interference. A good parameter is that the internal planes should be dissected in such a way as to ensure the same size of the skin incision through out.

The mucosa of the floor of the mouth is then penetrated (Fig.4) lateral to the submandibular duct opening. The endotracheal tube is then disconnected from the breathing circuit and the connector removed. The pilot balloon is grasped with an artery forceps and pulled out gently. With the forceps in tract, and stabilizing the tracheal end of the tube, the proximal end of the tube is pulled out gently through the tract (Fig.5).

The connector and breathing system are reattached. At this position, the position of the tube is reassessed and any adjustments if required are made. The tracheal tube now lies in the floor of the mouth between the tongue and the mandible (Fig.6). After ensuring bilaterally equal entry of air in the lungs, the endotracheal tube is positioned with skin suture (Fig.7).

At the end of the procedure, the stay sutures are removed and both the endotracheal tube and the pilot cuff are reversed intraorally. No attempt is made to close the intra oral incision and is left to heal secondarily. Cutaneous wound is sutured with prolene 5-0.

RESULTS

In the past one year 8 patients with panfacial trauma were benefited from submental intubation. Out of 8 patients 6 were male and 2 female and age range from 21 to 45 years (mean 33 years).

In all the patients submental intubation permitted simultaneous reduction and fixation of all fractures and intraoperative control of the dental occlusion without interference from the tube during the operation.

During the procedure no additional difficulties in passing the tube through the floor of the mouth were encountered and there was no major complication. The airway was never compromised and there was no significant oxygen desaturation in any patient during the procedure. Total duration of procedure was approximately 10-12 minutes.

Fig.3: Introducing curved artery forceps for blunt dissection

Fig.4: Intra oral penetration of curved artery forceps

Fig.5: Endotrachal tube and cuff pulled out extraorally

Fig.6: Endotracheal tube in the floor of the mouth

Fig.7: Securing the tube with suture in submental region

No motor or sensory deficit was found. Normal healing in the mucosa of the floor of the mouth observed. No bleeding or infection in the area was reported. No damage to salivary duct was noted. The scar has normally been well accepted by the patients.

DISCUSSION

Submental intubation was first described as an alternative route for oral and nasal intubation, especially in cases of major facial trauma. Ever since it was first described by Altemir[5]way back in 1986, the technique of submental intubation has undergone various modifications and found new indications. Although use of submental intubation has been reported in severe maxillofacial injuries by many authors[6], a few have described its use in the management of dentofacial deformities. Nyarady et al [7]described its use in 13 patients undergoing orthognathic surgery.

Contraindications to this technique are infection at the site of incision, disrupted laryngotracheal anatomy and a restricted retromolar space to allow suctioning [8]. Submental intubation is generally contraindicated where more long term control of the airway is required or when a more permanent airway is required.e. gun shot injuries[9].

The original Altemir's technique has been modified by several authors. The main change has been avoidance of subpeeriosteal dissection on the lingual aspect of the mandible[2]. This technique of extraperiosteal dissection in close

contact with lingual surface of mandible is now used universally[10].

Other modifications include the use of 2 endotracheal tubes[2,11], the choice of either the midline[,6] or submandibular[,12] approach instead of the latero submental approach. While using another tube, during dissection of the submental passage, and intubating with a submentally passed tube only after removal of the original orotracheal tube is awkward and potentially dangerous. This can lead to damage of the second tube during difficult manipulation[2,13]and , therefore ,a necessity to reintubate. It negates one of the main advantages of the technique: avoidance of intraoperative reintubation. The midline approach can traumatize the Wharton's duct, interferes with attachemment of the genioglossi and geniohyoid muscles, and snug placement of the tube in paralingual groove might also be compromised. Injury to the mandibular lingual perforating vessels, which are present in the midline in 98%of the instances[,14],could lead to bleeding. In all our cases we used only one tube and latero submental approach.

The advantages of using submental intubation include many. It is a method of securing the airway without interference with the intraoperative field and maxillomandibular fixation. It is technically easier, less time consuming, and accompanied by lower morbidity than tracheostomy[10]. In all our patients with panfacial truma, this has been used successfully.

In orthhognathic surgeries, the main advantage of Submental intubation is minimal distortion of the nasolabial soft tissue. This allows accurate assessment and measurement of the changes in the soft tissues of the nose and upper lip as a result of maxillary movement. It also allows the accurate placement of the cinch suture to produce the desired aesthetic result, simultaneous orthognathic surgery and rhinoplsty procedures without need to change the endotracheal tube[3].

The morbidity associated with submental endotracheal intubation seems to be very low. Reported complications include detachment of pilot ballon[,15], or its damage during externalization[,16], damage to the cuff of the tracheal tube[,2], infection of the submental wound[,1,2], abscess formation in the floor of the mouth[,13], salivary fistula[,2], trauma to the submandibular and sublingual glands or canals[,1], mococele formation[,17], damage to the lingual nerve[,1], and hypertrophic scarring[,13]. All these complications are relatively rare and avoidable with meticulous technique.

In our cases, we did not encounter any of these complications.Some caveats must be considered to make submental intubation a successful technique with minimal morbidity. At every step a good communication is required between the anesthetist and the oral and maxillofacial surgeon. During submental intubation it is mandatory to hold the endotracheal tube in position firmly to prevent accidental extubation. To avoid injuries to the salivary glands, canals and other vital structures, blunt dissection with the hemostat should be in close approximation to the medial border of the mandible[1].

CONCLUSION

Submental intubation has been proven effective in terms both of results & of surgical time required, in addition to reducing stress for patient & for the surgeon. It is an extremely useful technique with very low morbidity and should be given due consideration to replace tracheostomy in selected cases of maxillofacial trauma and orthognathic surgeries where nasotracheal and oral intubation are otherwise impossible / contraindicated.

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Forces on dental implants: Review of literature

Rajnish K. Singhal
Mohit Kamra

ABSTRACT

A major problem in implant biomechanics is to unravel the biologic significance of the nonuniform stresses around implants,and to determine when the stress in bone around an implant exceed danger limits. Implant biomechanics should familiarize the clinician with key issues to be taken into consideration when using oral implants.It should also provide some analytical and computational tools that will help clinician do better case planning and evaluation.It should also help clinician understand the biomechanical reasons for success verses failure of implants.

Key words*:* Implant, forces, peri-implant tissue.

INTRODUCTION

Implant system has the structural function of guaranteeing the optimal distribution and transmission of occlusal loads from prosthetic over-structures, to the peri-implant bone tissue, through the different implants. Therefore, the evaluation of the efficiency of prosthetic systems from a biomechanical point of view is important.

The success or failure of an implant is related to factors of various nature: clinical, chemical and bio-chemical, or mechanical. As far as mechanical aspects are concerned non-physiological stress-strain states in the bone tissue may induce bone resorption, thus raising the risk of failure. Failure of implant components may occur due to overloading or fatigue .In order to asses the biomechanical performance of an implant and therefore to evaluate the risk related to the clinical practice, it is necessary to fully understand the mechanics of forces and their biological effects.Forces physiological or Non-physiological acting on the living system control the outcome of any surgical procedure **(1,2).** Application of mechanical principles in the study of living organisms is Biomechanics.

STRUCTURE OF PERI-IMPLANT TISSUE

Peri-implant Ligament

The peri-implant ligament functions in a manner similar to periodontal ligament but differs from it in some anatomic respects.The fibrocollagenous periimplant tissues demonstrate unique orientations and bone interactions that are specific to implant design and condition of functional loading.

These fibrocollagenous structures are oriented in the implant –to-bone three-

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dimensional space following patterns of biomechanical strain distribution.

The mobility of implants tends to be lower than in elastic mobility phase of teeth.

ROLE OF FIBRE LENGTH

Collagen exhibits viscoelasticity ,a force applied to a longer fibre is more dissipated than when the same force is applied to a shorter fibre.The design of the implant,including controlled dimensions of struts and vents,shortens fiber length to promote an osteostimulatory effect. Bulkier implants,such as some root form configurations,cannot stress tangential fibers if they do form,diminishing the osteostimulatory effect as tension is dissipated within excessively long fiber lengths.

In case of smaller-diameter smooth bone pins,collagen fibers are short,but they cannot be stressed in function because the pins smooth interface allows slippage.Pseudoligaments or scar tissue can also form, leading to possible failure.This is the cause of failure of early bulky implants fabricated of vitreous carbon and aluminium oxide,and the smooth tantalum pins used in 1960s and 1970s, which could not promote osteostimulation **(1).**

EFFECT OF OCCLUSAL FORCES ON PERI-IMPLANT LIGAMENT FIBRES

Bone exhibits a piezoelectric effect (1), in response to applied force. Deformation on the aspect of the implant alveolus closest to the implant interface exhibits net compression, creating a negative charge,while net tension is observed at the outer aspect of deformed trabeculae,creating a net positive charge.

A difference of electric potential is produced between areas of net compression and tension.

The resulting bioelectric environment enhances differentiation and proliferation of pluripotential cells into osteoblasts, osteoclasts, and fibroblasts. During healing cells remove debris,lay down a new collagenous network and calcify it to form bone.A very dense bone captures the stress closer to the crestal region.A very soft bone allows the stress to be transmitted farther along the implant interface .Softer the bone the farther the stress pattern apical progression,thus in weaker bone the crestal bone loss may include a major portion of the implant body.

CELLULAR RESPONSE TO LOADING FORCES

There are many openings of various sizes in the cribriform plate within the alveolus. Periodontal membrane contains and is bathed in fluids,compression of the ligament forces fluids through internal openings in cribriform plate and into the marrow spaces beyond creating a hydraulic damping effect.

The Mechanostat theory of Frost (3) has four Microstrain zones for cortical bone.They include –a) Pathologic overload zone. b) Mild overload zone.c) Adapted window d) Acute disuse window. In mild overload zone ,an increased bone remodeling response occurs,which results in a reactive woven bone formation that is less mineralized and weaker.Greater stresses may cause the interfacial strain to reach the pathologic overload zone and may cause microfracture of the bone,fibrous tissue formation and/or bone resorption. *N*onaxial loads transmit greater stresses to the bone than axial load conditions leading to higher strain in bone. Therefore although the implant still exhibits rigid fixation clinically and osseointegration under the microscope,the interface bone may be more at risk of microdamage under prosthetic load because of the change in histologic structure.Clinical observations indicate occlusal overload is a factor in the amount of crestal bone loss during the first year. Initial bone density not only provides mechanical immobilization during healing but also permits better distribution and transmission of stresses from the implant-bone interface.The clinical success and longevity of osseointegrated dental implants as load-bearing abutments are largely controlled by the biomechanical factors under which they function. All restored implants function under stress, and mechanical stress is

a risk factor for implant-restoration complications and failure.

CONSIDERATION OF FORCES

Since stress equals force divided by the area over which the force is applied, the amount of force directly impacts the amount of stress. Several factors (since they are not the same for all patients) are to be considered, including bruxism, clenching, masticatory dynamics, crown height space, and arch position. Crown height represents a vertical cantilever and is next on the scale, followed by masticatory muscle dynamics.The position of the implant in the arch is also important, since implants in the posterior region will be subject to forces that are 3 times greater than those that occur in the anterior region. Each patient is unique, and the clinician should evaluate each patient, and each risk factor, individually. As an overall force factor risk increases, the chance for overload increases, and the overall treatment plan should be appropriately modified by increasing implant number and/or size.

IMPLANT POSITION AND NUMBER (2)

Canti-levers are a force magnifier and represent an important risk factor for complications in implant dentistry, including frequency of screw loosening, crestal bone loss, and fracture It is also suggested that longer edentulous spans be restored with implants in a staggered or offset position (tripod effect), or with the use of larger diameter intermediate implants.

Additional implants (besides the key positions) are also usually needed, with the total number of implants determined by patient force factors and bone density.

Splinted implants also decrease the frequency of abutment screw loosening and porcelain fracture. The amount of biomechanical stress to the system is reduced.This results in compressive forces rather than shear loads being applied to the porcelain and reduces the risk of fracture.

IMPLANT SIZE ,DESIGN AND CONTOUR.(4,5,6)

As a general rule, shorter implants have higher failure rates than longer implants following loading. Therefore, the initial treatment plan should include implants that are at least 12 mm in length. In general, less dense bone requires longer implants as compared to more dense bone.The surface area of an implant is directly related to the width of the implant. Wider root-form implants have a greater surface area than narrow implants (of similar design), resulting in greater potential contact area with bone. Bone augmentation to increase the width of available bone may be indicated to allow placement of wider implants when a patients force factors are greater than ideal.

Smooth sided tapered implant allows for a component of compressive loads to be delivered to the bone to implant interface.The larger the taper the greater the component of compressive load delivered to the interface.

Threaded implants have the ability to transform the type of force imposed at the bone interface through control of thread geometry.

Thread shapes in dental implant designs include square,V-shape,and buttress. Under axial loads to a dental implant , a V-thread face is comparable to the buttress thread when face angle is similar and has about a 10 times greater shear component of force than a square or power thread.

A reduction in shear load at the thread-to-bone interface reduces the risk of overload,which is important in D3 and D4 bone. Wider occlusal table favors offset contacts during mastication or parafunction.wider root-form implants can accept a broader range of vertical occlusal contacts while still transmitting lesser forces ,narrower implants are more vulnerable to occlusal table width and offset loads.load.

MEASUREMENT OF FORCES ON IMPLANTS

Methods used to analyze forces include 1) Analytical mechanics methods such as those of Skalak ,Brooke-smith. 2) Finite element models . 3) Experimental methods based on direct measurement of forces and movements on implants.

The application of engineering knowledge in dentistry has helped the understanding of biomechanics aspects related to osseointegrated implants. Several techniques have been used to evaluate the biomechanical load on implants comprising the use of photoelastic stress analysis, finite element stress analysis, and strain-gauge analysis. Photoelasticity provides good qualitative information on the overall location and concentration of stresses but produces limited quantitative information. The method serves as an important tool for determining the critical stress points in a material and is often used for determining stress concentration factors in irregular geometries. The application of strain-gauge method on dental implants is based on the use of electrical resistance strain gauges and its associated equipment and provides both in vitro and vivo measurements strains under static and dynamic loads. However, strain-gauge method provides only the data regarding strain at the gauge. Finite element analysis can simulate stress using a computer-created model to calculate stress, strain, and displacement. Such analysis has the advantage of allowing several conditions to be changed easily and allows measurement of stress distribution around implants at optional points that are difficult to examine clinically. All the 3 methodologies can be useful to evaluate biomechanical implant behavior close to the clinical condition (7).

FINITE ELEMENT ANALYSIS

FEM was first proposed in 1943 by R. Courant to obtain approximate solutions for vibrating systems. Dental biomechanics represents a field in which the use of FEM is particularly promising. FEM is currently applied with the aim of improving the design of materials, structures and manufacturing procedures, thus also improving clinical results in implantology (1). It analyzes the effect of load and how to modify load transfer by improving implant design.In a combined finite element model of an implant in bone,stress and strain under conditions of tension, compression,and shear can be calculated based on mechanical properties of each of the materials being modeled. Design improvements will reduce areas of stress concentration,more nearly achieve stress transfer homogenization (1) across the interface,affecting long term bone maintenance favorably at each point on the implant interface.

Interprertations (Finite element analysis)

In D1 bone most stresses are concentrated around the implant near the crest,and stress is of lesser magnitude.

D2 bone,with the same load sustains a slightly greater crestal stress and the intensity of the stress extends farther apically,along the implant body.

D4 bone exhibits the greatest crestal stresses, and the magnitude of the force of load on the implant proceeds farthest apically along the implant body.

Impact of a mass on osseointegrated fixtures. (Figure-1)

(8)

In case of an unprotected metallic fixed partial denture,the entire construction acts like a stiff unit,and it will therefore produce larger forces.Acrylic resin covering provides internal damping.

The duration of force becomes longer and peak force is comparatively less.This is shock absorbing action.

Impact loads are lowest with acrylic resin & increases with composite resin metal occlusals & porcelain.

A static occlusal load on occlusal materials results in a similar amount of stress on the crestal bone regardless of material type.

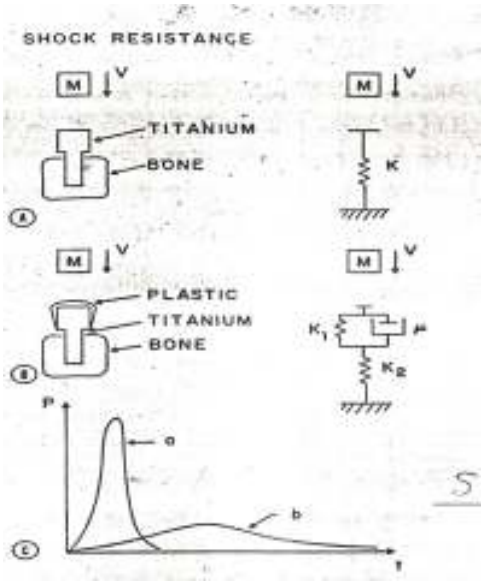


Figure 1: (Sketch showing A- impact of a mass M,at a velocity V onto a metallic fixed partial denture on fixtures that are osseointegrated with bone, System behaves like a spring with modulus K. B-Acrylic resin sheath is placed over metallic fixed partial denture.Softer spring K2 and dashpot μ representing acrylic resin. C-Qualitative sketch of force versuses time resulting from impact in cases A & B above. Impulse (area) for two cases is same, but peak force is much less in B *Curve b*.)

Hence clenching patients do not have a considerable amount of stress reduction when acrylic materials are used on occlusal surface instead of porcelain.

Acrylic prosthesis provides progressive bone loading, it may also reduce the impact force on the early implant to bone interface.

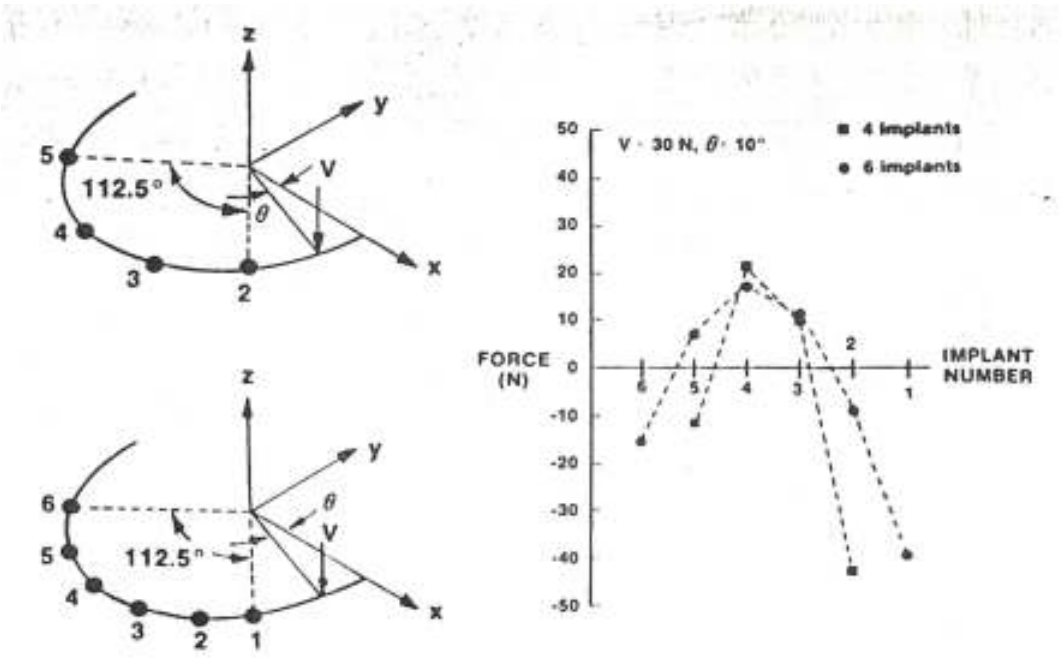
Forces on implants increase rapidly as the interimplant spacing decreases and the cantilever length increases,affecting the interfacial bone.

Forces acting on every abutment in a group of say four or six implants supporting a prosthesis can be analysed by method proposed by Skalak and Brooke-Smith

There is only a slight difference between using more implants as long as all implants are spaced out over the same arc . (Figure 2) (9)

Four implant distributed over the same arc as six implants.Magnitude of force on most distal abutments are similar in four and six implant cases,There is only a slight difference between four and six implant cases,as long as the four implants are spread over the same arc as six implants. The interimplant spacing in

Figure 2: Skalak model



four implant case is larger than in six implant case; this compensates for fewer implants, which would otherwise tend to increase the loading per implant.

Consequences of Biomechanical overload

* Early implant failure ,*Early crestal bone loss, *Screw loosening, *Component fracture,*Prosthesis fracture,*Peri-implant disease.

After successful surgical and prosthetic rehabilitation with a passive prosthesis,noxious stress and loads applied to the implant and surrounding tissues result primarily from occlusal contacts.Biomechanical overload leads to various sequelae which are detrimental to the successful functioning of the implant supported prosthesis.

Implant protective occlusion (IPO)

It is an occlusal scheme suggested to decrease overload on the implant supoorted prosthesis.It states that during maximum intercuspation and centric relation occlusion ,no occlusal contacts should be premature,especially on an implant supported crown.Only light axial occlusal contacts should be present on the implant crown.Implants are designed for long-axis loads.An axial load over the long axis of an implant body generates a greater proportion of compressive stress then tension or shear forces.IPO attempts to eliminate or reduce all shear loads to the implant-to-bone interface.The greater the angle of force ,the greater the shear component. Occlusal contact along an angled cusp results in an angled load to the crestal bone,the contact over an implant crown should be ideally on a flat surface perpendicular to the implant body.The goal of IPO relative to cantilevers is to reduce the force on the lever or pontic region compared with that over the implant abutments.No lateral load is applied to the cantilever portion and a gradient of force that gradually decreases the occlusal contact force along the length of the cantilever may be beneficial. Crown height with a lateral load may act as a vertical cantilever and a magnifier of stress at the implant-to-bone interface.An overcontoured restoration will act as a cantilever and increase stress within the framework during loading.

Any complex engineering structure will fail at its weakest link ,and dental implants are no exception.Thus all treatment planning decisions for IPO should be based on careful consideration of estabilishing occlusal and prosthetic schemes to protect the weakest component of the structure (2).

DISCUSSION

Various dental implant designs have been advocated to reduce bone loss of crestal regions and osseointegrated interfaces. Overloading may induce microdamage to the bone,which can trigger osteoclastogenesis, Sequentially epithelial tissues, connective tissues,and microorganisms can migrate into the defective area and cause severe bone loss,which decreases the implants bone support and increases risk of implant failure. The use of threaded implant may increase the contact area between the implant and the bone, decrease implant mobility at the time of implant placement, and help dissipate interfacial stresses. Stepped implant creates favorable load distribution by mimicking the natural root form. Tapered implant body redirects stresses , it directs stresses away from the crestal cortical bone while transferring it to the trabecular bone. Geometric discontinuity of threaded and stepped designs resulted in high stresses at the valley between pitches and stepped areas. Stresses increased nonlinearly on implant surfaces. High stress was primarily transferred through the implant surface of the valley of thread and the stepped areas,reducing the stresses in bone near the interface. These lower interfacial stresses in the bone may improve osseointegration and benefit the threaded implant with greater bone-implant contact. Although the inclusion of thread in implant design increases contact area, it does not decrease the peak bone stress. However the thread does depress the interfacial stresses of bone (4).

Frost demonstrated that the bone repair process, including modeling and remodeling, is accelerated as a consequence of trauma (including surgery) or other noxious stimuli. Crestal bone loss is related to implant design

,bacteria,biologic width of implant abutment to body connection,and the density of the bone. Bone turnover rate at the implant interface is affected by implant design,direction of load, and/or surface condition.The changes in the hydroxyapatite morphology, composition,and structure depend on the intensity of the stress values in the surrounding bone (3).

The close apposition of bone to the titanium implant is essential feature that allows a transmission of stress from the implant to the bone without any appreciable relative motion or abrasion.The absence of any intermediate fibrotic layer allows stress to be transmitted without any progressive change in the bond or contact between the bone and implant.The distribution of a vertical or lateral load applied to a fixed partial denture depends on the number, arrangement, and stiffness of abutment fixtures usedas well as the form and stiffness of the fixed prosthesis itself. Stiff fixed partial denture will distribute loads to several fixtures more effectively. A flexible prosthesis may be adequate if the strength developed by each fixture is able to carry the full load that is applied.Cantilevered ends of a fixed partial denture increase the loading on the first screw nearest the cantileverd end.Moderate overhangs may be tolerated if the fixtures are sufficiently strong. Shock-absorbing material like acrylic resin in fixed partial denture allows development of a stiff and strong substructure with adequate shock protection on its outer surface (8). The length of implant does not have much influence on the amount of stress because the stress value mainly depends on bending of the mandible.There is a strong increase in stress concentration when the height of the mandible is reduced,which is caused by a larger deformation of the lower jaw.The main stress peaks arise around the neck of the implant in the upper cortical layer (10).

Horizontal loads to implants cause high stress in cortical bone.Mechanically it is unfavorable because the margin of the bone has to react as an implant-supporting element.The development of crater like bone destruction is combined with a transfer of the load-supporting region to the better conditioned inner parts of the bone,but clinically periodontal problems often arise. A narrow and plain chewing surface is best to avoid strong horizontal loads to implants,with occlusal contacts within the implant diameter and free articulating movements without bruxism (11). Fibre Bragg grating (FBG) sensors have been used to measure strains at a mandible surface that are caused by static or impact loads on a dental implant. The measuring apparatus uses a fixed optical filter reference scheme and is able to detect dynamic signals with frequency components of up to 10 kHz. A dried implanted cadaveric mandible was used with strain gauges and FBG sensors placed at the outer surface in the direction of the longitudinal axis of the implant. The implants were loaded statically and dynamically and uniaxial strains recorded. The study demonstrates the ability of the FBG as a biomechanical sensor (12). Immediate loading of a just placed implant may induce implant failure to osseointegrate. Some patients can generate a biting force that can reach approximately 1300 Newtons (N) in the posterior jaws. It has been proposed that osseointegration would fail if an implant is luxated in bone more than 50 to 150 microns. Fibrous tissue, not bone, would form (13). The stepped cylinder implant connected to a screw-retained, internal hexagonal abutment produces greater stresses on the alveolar bone and prosthesis and lower stresses on the abutment complex. In contrast, the conical implant connected to a solid, internal, conical abutment furnishes lower stresses on the alveolar bone and prosthesis and greater stresses on the abutment (14). Strain in the bar increased significantly with increasing levels of misfit. Strain measurements induced at maximum torque are not necessarily indicative of the maximum strains experienced by the bar. The presence or absence of a microgap between the bar and the platform is not necessarily indicative of passivity (15).

An engineering approach to resolve biomechanical problems involves determining the nature of complications and then designing an approach to eliminate their underlying causes.Treatment planning should incorporate methods to reduce stress and minimize its initial and long-term effects.

SUMMARY

The most common implant complications, whether associated with the implant or prosthetic restoration, occur as a result of biomechanical stress. These complications include early implant failure, fracture of the prosthesis, abutment or prosthetic screw loosening, implant crestal bone loss, and problems with overdenture attachments.The treatment plan is altered when forces are greater or bone is less dense than usual to minimize the negative impact of stress on the implant, bone, and restoration.The goal is to decrease the amount of force, or increase the implant-bone surface area, to decrease the chance of implant-restoration complications.

A major problem in implant biomechanics is to unravel the biologic significance of the nonuniform stresses around implants,and to determine when the stress in bone around an implant exceed danger limits.It should provide some analytical and computational tools that will help clinician do better case planning and evaluation, help clinician understand the biomechanical reasons for success verses failure of implants,.Loading limits of bone as existing at the bone-implant interface should be understood.

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Subject Index

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Pain during root canal treatment: An investigation of patient modifying factors

Christopher Udoye

ABSTRACT

Objective: The study highlighted the effect of patient-related factors on levels of pain felt by subjects during root canal treatment, as well as the association between treatment duration and pain severity. Study design maxillary central incisors with either necrotic pulp or irreversibly inflamed pulp, with or without pre operative pain were studied in 160 subjects aged 18 years and above. Subject's age and gender, as well as pulp status and pre operative pain status were recorded. The procedure was done using a standard protocol visual analogue scale (VAS) was used to record the level of pain felt., **Results:** Those with irreversible pulpitis felt higher pain. None with necrotic pulp experienced intense pain, while those in the 51 -60^{+} year age band had severe, unbearable or intense pain. Mild pain was a common denominator in all age bands. Pain level increased with treatment duration., **Conclusion:** Supplemental local anesthesia should be employed in women and in teeth with irreversible pulpitis, while efforts should be made to accomplish procedures within a reasonable time.

Key Words: Flare-up, root canal therapy, pain level, maxillary central incisor, visual analogue scale.

INTRODUCTION

Pain is legitimate report for the biology and psychology of a person [1]. Endodontic related pain may be pre intra or post operative in type. The work of Strindberg [2] opened window of reports on the factors that may affect endodontic outcome [3]. Pain perception is important to both the patient and the dentist [1]; similarly, managing the pain and its distress can be frustrating [4].

The level of pain felt by subjects may vary according to gender and age of the subject and the pulp status. On the other hand, subjects may also respond in different ways to very similar levels of stimulus intensity [5,6].

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Pain relief is the commonest reason for dental attendance [7]. Most subjects perceive root canal treatment (RCT) to be a very painful procedure. However, it is reported [8] that subjects who had experienced RCT are 5 times likely to describe the treatment as painless. The level of pain experienced by a subject may be subject dependent.

A pulp may be necrotic or irreversibly inflamed. Some authors [9,10] found no significant association between necrotic pulp or irreversibly inflamed pulp (Pulp status) and pain experienced during RCT. A local anesthetic may be ineffective in an irreversibly inflamed pulp. Jesk [11] showed that neural hypersensitivity and challenges for the nerve firbres may become resistant to anesthetic agents. Meechan [12] reported that in 80% of patients with irreversible pulpitis, the inferior alveolar block is ineffective. There is no consensus on the relationship between pain felt during root canal treatment and age [13]. However, Watkins et al [1] found that felt and anticipated pain levels decreased with

increasing age. It is noteworthy that data on progressive loss of sensitivity to nociceptive stimuli with age is inconclusive [14].

While Watkins found that mean levels of pain experienced did not differ between genders, Unruth et al [15] had a contrary report, with women feeling more pain than men. Furthermore, the report is corroborated by Liddell et al [16] who found a reduced pain threshold in women. There is statistically higher levels of mechanical allodynia in women with irreversible pulpitis [17].

Literature on the current subject is scanty. Most times the feeling of pain during RCT is inevitable. The successful management of such pain are both fundamental for practice building [7] and endodontic outcome. If a clinician could predict the level of pain a patient may experience during RCT, he/she would be able to put in place measured mechanisms to enhance patient's management. The purpose of the study was to highlight the effect of patient related factors, such as pulp status, subjects age and gender on levels of pain felt by subjects during RCT, and to investigate the association between length of treatment procedure pain and severity.

MATERIALS AND METHOD

One hundred and sixty subjects aged 18 years or above were randomly recruited from both hospital and private clinics. While the Research and Ethics committee of the University of Nigeria Technical Hospital approved the study, informed consent was obtained from subjects. Maxillary central incisors with necrotic pulp or irreversibly inflamed pulp, with or without pre-operative pain, were recruited. Others were teeth with closed apices and those that had no apical radiolucency. Also, teeth that neither responded positively to electric pulp test (EPT) nor bled when opened were included.

Subjects with either systemic diseases or under 18 years, as well as those on either antibiotics in the last one month or on analgesics in the last 24 hours were excluded from the study. Others were non functional teeth as well as teeth with massive calcifications

The following information were recorded; age and gender of subjects, pulp status (necrotic or irreversibly inflamed pulp) and preoperative pain status (painful or painforce). A periapical x-ray was used to assess the priaprical status of teeth.

The subjects were prepared in the usual manner. Following a standard protocol, teeth wee biomechanically prepared and sealed. The access cavity was restored with a light cured nano hybrid composite (Nanosit, Navodiska Dental, Sweden).

Subjects were given Visual Analogue Scale (VAS) evaluation sheet on which they ranked the highest level of pain they experienced during treatment. VAS is a horizontal line, 10cm in length. The numerical values of the pain levels were then converted to verbal scale of mild, severe, intense and unbearable pain descriptors.

Analysis of data was done with the SPSS for Windows, Version 6. Chi-square test (X^2) was used to assess independence of categorical variables. The critical level of significance was set at P£0.05, while the confidence interval was 95%.

RESULT

There were 160 participants (89 men and 41 women) whose ages ranged from 18 to 61 years. Except for mild pain, subjects with irreversible pulpitis (IP) those with necrotic pulp (NP). Most subjects (20 or 90.9%) with IP had felt higher degrees of pain than severe pain whereas no subject with NP had intense pain ($p = 0.002$) (Table 1).

Table 1: Intra Operative Pain By Pulp Status

Pulp Status	Intra Operative Pain Level (%)				Total
	Mild	Severe	Intense	Unbearable	
Necrotic pulp	10(58.8)	- (0)	2 (9.1)	1 (33.3)	13(27.1)
Irreversible pulpitis	7 (41.2)	6 (100)	20 (09.9)	2(66.7)	35 (72.9)
P-value	df = 3;x^2 =14.57; p = 0.002*				48 (100)

No subject in the 51 – 60+ year age band had severe, unbearable or intense pain. Unbearable pain was seen in the 21-30 and 31-40 year age bands. Mild pain was common in all age bands. Similarly, excluding the 41 -50 and 51 – 60+ age bands, all other pain degrees thought association is not statically significant (p = 0.49) (Table 2). More women suffered the 3 worse pain levels most (P = 0.054) (Table 3).

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Table 2: Intra Operative Pain by Age

Age (Years)	Intra Operative Pain (%)			
	Mild	Severe	Intense	Unbearable
18 – 20	2 (11.8)	4 (18.2)	3 (50.0)	- (0)
21 – 30	5 (29.4)	4 (18.2)	2 (33.3)	1 (33.3)
31 – 40	6 (29.4)	7 (31.8)	1 (16.7)	2 (66.7)
41 – 50	3 (17.6)	7 (31.8)	- (0)	- (0)
51 – 60+	1 (5.9)	- (0)	- (0)	- (0)
P – Value	df = 12; X^2 = 11.52; P = 0.49			

Table 3: Intra Operative Pain by Gender

Gender	Intra Operative Pain (%)			
	Mild	Severe	Intense	Unbearable
Male	10 (58.8)	9 (40.9)	- (0)	1 (33.3)
Female	7 (41.2)	13 (59.1)	6 (100)	2 (66.7)
P – Value	df = 3; X^2 = 6.44; P = 0.054*			

As pain level increased, treatment duration increased while percentage of people who suffered worsening pain decreased. This is not applicable when intense when intense pain is considered(Table 4).

Table 4: Intra Operative Pain by Duration of Treatment and Percentage of Subjects

Pain Degree	Treatment duration (Minutes)	% of Subjects who experienced pain
Mild	42	22 (37.9)
Severe	45.8	6 (10.3)
Intense	46	17 (29.3)
Unbearable	47	3 (5.2)
df = ;	X^2 = ;	P =

DISCUSSION

The study of pain or its effect on a treatment outcome is usually frustrating; this is because human pain has many dimensions, including emotional and sensory aspects. Though pain perception is important to both patients and clinicians [23], perception may vary among subjects as people can express different emotional responses to very similar levels of stimulus intensity [6,18].

The present report agrees with that of Segura Egea et al [13] that there is statistically significant relationship between pulp status and pain level experienced during RCT. However, the above two reports disagree with others [9,19] that had contrary findings. Segura Egea et al [13] found more pain in teeth with IP and acute apical periodontitis. This implies that a more profound anaethesia is required. Jeske [11] showed that neural hypersensitivity are challenges for the control of such pain as nerve fibres may become resistant to anaesthetic agents.

Earlier reports to explore the effects of aging on pain experienced during treatment is inconclusive. The current study's finding of mo statically significant association between age and pain experienced during RCT is in agreement with that of Segura Egea et al [13]. However, watkins et al reported that anticipated and experienced pain levels significantly decreased with advancing age. Age related decrease in pain is not thought to be attributable to changes in the physiological pain system [22]. It was believed that prior experience with RCT could not account for this age effect[18]. Rather Gibson et al [20] showed that stoicism increases with age and potentially accounts for the lower pain reports. It is further reported that experienced pain levels increase in the final months of life [21].

There are discrepancies in the literature on pain reports between men and women [22]. The current study found a statistically significant association between gender and pain experienced during RCT, with more women experiencing more pain. Other reports had pointed out differences in pain perceptions between men and women [15]. However, it is undoubtful that inconsistencies on degrees of pain degree [23]. It is thought that the perceived pain differences among genders may be due to the type of stimuli [24]. In theirs, Unruth et al [14] found that women anticipated higher pain levels than men, while Liddell et al [16] reported an actual reduction of pain thresholds in women.

The finding of worsening pain in procedures that lasted shorter in the current study agrees with Segura Egea's report [13]. According to the latter's report [13], percentage of people who did not feel pain decreased as the length of the procedure increased. This may be due to progressive decrease in the effect of anaesthsia. It may also be due to the increasing anxiety suffered by the subject as the intervention period is extended.

CONCLUSION

Except for age, the level of pain felt by subjects during RCT is significantly correlated with gender and pulp status. Furthermore, the experienced pain levels increased with treatment duration. Clinicians should be prepared to make use of supplemental local anaesthesia in women and in teeth with IP. All treatment must be accomplished within reasonable time period.

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