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Editorial

Systemic antibiotics and periodontal diseases

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Dr. Robert Genco once made the profound statement that we were 'at the end of the beginning of research into human periodontal diseases' (13th International Congress on Periodontal Research, Osaka Japan, 1992). Despite huge advances in the last 18 years, we still remain at the end of the beginning, rather than at the beginning of the end. Although a tremendous amount of effort has been expended over the past 30 years to elicit the causative agents of periodontitis, rarely has a single bacterial species been directly linked to periodontal diseases as its single etiologic factor.

Mechanical debridement remains the cornerstone of periodontal treatment. This is an absolutely essential step in any form of periodontal therapy and is often sufficient to control the progress of periodontal disease in a majority of patients. However, for some patients, mechanical instrumentation of the infected area is not sufficient to control disease progression. Failure to obtain a favorable response may be due to inadequacy of the host's immune response, the ability of the pathogen(s) to escape, either by invading gingival tissue or finding shelter in an unreachable site, limited access, instrument availability, operator skill, or a host of other possible factors. Nonsurgical scaling and root planing may remove subgingival Campylobacter rectus, but is frequently ineffective against Porphyromonas gingivalis, Prevotella intermedia, Bacteroides forsythus, staphylococci and enteric rods, and may not significantly reduce Actinobacillus actinomycetemcomitans[1]. Often, incorporation of an appropriate chemotherapeutic agent in conjunction with mechanical instrumentation provides an additional antimicrobial effect offering increased opportunity to control disease.

Antibiotics, defined, as naturally occurring or synthetic organic substances that, in low concentrations, inhibit or kill selective microorganisms, are particularly useful in combating severe periodontal infections. The wholesale misuse of these drugs has led to the emergence of resistant strains. Antibiotics are valuable and, in some instances, life saving drugs. They can only retain this position in both medicine and dentistry if used with care and prescribed appropriately.

Management of severe types of periodontitis should not rely solely on systemic antibiotics but upon a combination of mechanical debridement possibly in conjunction with surgery, subgingival administration of antiseptics by dental professionals and patients, patients' oral hygiene efforts and effective and safe systemic antibiotics in certain cases.

There is currently strong enough evidence to implicate three microorganisms as etiologic agents of periodontal diseases: A. actinomycetemcomitans, Porphyromonas gingivalis and Tannerella forsythia. Periodontitis can and does occur in the absence of any of the aforementioned three identifiable periodontal pathogens. Associative evidence has linked a number of different bacterial species with destructive disease like Prevotella intermedia, Fusobacterium nucleatum, Eikenella corrodens, Campylobacter rectus, Eubacterium nodatum, Peptostreptococcus micros, and various spirochetes. There is some recent evidence that implicates certain viral agents e.g. cytomegalovirus, Epstein–Barr virus, papillomavirus, and herpes simplex virus, may have a role in the initiation of periodontitis, most likely by affecting the host response to the bacterial challenge. Nevertheless, the primary host challenge and disease initiator continues to appear bacterial in nature.

Role of Systemic Antibiotics in Periodontal Diseases

Systemic antibiotics enter the periodontal tissues and the periodontal pocket via serum and can affect organisms outside the reach of cleaning instruments or topical anti-infective chemotherapeutics. Systemic antibiotic therapy can also potentially suppress periodontal pathogens residing on the tongue or other oral surfaces, thereby delaying subgingival recolonization of pathogens[2]. Systemic antibiotics may even be required for eradication of periodontal infections by A. actinomycetemcomitans and other pathogens. Actively progressing periodontitis

is virtually always associated with specific bacterial infections and often requires the adjunctive use of systemic antibiotic therapy. Single drug therapies with penicillins, tetracyclines, metronidazole or clindamycin have been used frequently in periodontal practice. However, since periodontitis lesions often harbor a mixture of pathogenic bacteria, drug combination therapies have gained increased importance[3]. Valuable combination therapies include metronidazole–amoxicillin for A. actinomycetemcomitans and various anaerobic periodontal infections and metronidazole–ciprofloxacin for mixed anaerobic and enteric rod/Pseudomonas periodontal infections. The tetracyclines have the additional advantage of inhibiting collagenases.

There is no single periodontal therapeutic regimen that will provide a beneficial response for all patients. It is very unlikely that there ever will be. Prescription of systemic antibiotic therapy in periodontics should be based upon scientific data and not upon personal biases. Empirical antibiotic therapy may be used for periodontal diseases with known microbial causes, such as acute necrotizing ulcerative gingivitis, which is caused by anaerobic organisms and can be cured by metronidazole, and early localized aggressive periodontitis, mostly involving A. actinomycetemcomitans, which can be controlled or eradicated by systemic metronidazole–amoxicillin combination therapy.

Wherever microbiological testing is unavailable, metronidazole–amoxicillin combination therapy (250–500 mg of each, three times daily for 8 days) may be a reasonable antibiotic first choice in periodontics. The metronidazole–amoxicillin combination is an appropriate choice in about 70% of advanced periodontitis patients[4]. However, the metronidazole–amoxicillin combination does not affect Pseudomonas or enteric gram-negative rods that inhabit approximately 14% of advanced periodontitis lesions. The combination of metronidazole and ciprofloxacin (500 mg of each, twice daily for 8 days) can cure anaerobic, enteric rod and A. actinomycetemcomitans periodontal infections and promote subgingival overgrowth of streptococci able to inhibit gram-negative pathogens[5].

The evidence seems to favor the use of metronidazole/amoxicillin. However, this is not a panacea for all patients. Metronidazole has a number of unpleasant side effects that are not well tolerated by some patients. Amoxicillin is definitely contraindicated in patients with penicillin hypersensitivities. Potentially pathogenic bacteria, such as E. corrodens, may be resistant to both metronidazole and amoxicillin. Other antibiotics clearly provide significant benefits for specific situations. Clindamycin-HCl remains effective against classic gram-negative anaerobic rods associated with periodontitis refractory to conventional therapy[6]. However, due to its propensity for severe adverse effects, clindamycin-HCl should only be prescribed following culture and sensitivity testing. Many microorganisms continue to demonstrate sensitivity to tetracyclines, particular doxycycline and minocycline. The use of subantimicrobial doxycycline as an adjunct to mechanical instrumentation with or without the adjunctive use of an antibiotic should be a consideration. The inhibition of the inflammatory process and the downregulation of matrix metalloproteinases may provide a quicker return to periodontal health[7].

Comprehensive treatment of periodontitis is very different from the treatment of most bacterial infections. It is important to realize that growth of bacteria in pure cultures is very foreign to the way that the vast majority of bacteria naturally grow. Growth of bacteria in the biofilm is very different than the growth of a single pure culture in a test tube or on an agar plate. The aggregation of bacteria in a biofilm impairs the diffusion or may even inactivate antimicrobial agents. High concentrations of the active ingredient are needed before a beneficial effect can be expected. Biofilm experiments indicate that the necessary minimum inhibitory concentrations of antimicrobial agents are at least 50 times (or even 210,000 times) higher than for bacteria growing under planktonic conditions[8].

The evidence available suggests that disadvantages and safety aspects of systemic antimicrobial use in the management of periodontal diseases significantly outweigh the benefits. Antibiotic prescribing should be the exception rather than the rule and, in the majority of cases, only considered after conventional therapies have been unsuccessful. Recommendations for periodontal anti-infective therapy will undoubtedly be continually revised along with the development of even better understanding of the pathogenic periodontal microbiota and the availability of new and more effective drugs to control or possibly cure periodontal infections.

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Original Article

Applicability of Bolton's tooth size ratio for Nepalese population

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Abstract

Objectives: To test the applicability of Bolton's method for use in Nepalese population and to compare the reliability of present values against those of most commonly used values.

Materials and methods: The sample consisted of 60 Nepalese males and 60 females (total 120 subjects) aged between 17 to 23 years. Subjects without any previous orthodontic treatment, fully erupted permanent teeth, and with no dental anomalies were included in this study. The measurements of mesio-distal widths of teeth were made on dental cast using digital caliper. Sample *t* test was used whenever necessary and the mean, range, and standard deviation were calculated for the anterior ratio and overall ratio. The measured values were compared with Bolton's original values.

Results: The mean anterior "6" ratio for Nepalese subjects was found to be 79.46 with a standard deviation of 2.60. The values ranged from 68.75 to 89.17. The mean overall "12" ratio for Nepalese subjects was found to be 92.42 with a standard deviation of 1.80. The values ranged from 85.93 to 98.68.

Conclusion: Mean anterior tooth width ratios between Nepalese male and female samples were statistically significant but mean overall tooth width ratios between Nepalese male and female were not statistically significant. These findings suggest that a large number of Nepalese subjects presenting for orthodontic treatment possess a Bolton's tooth size discrepancy that may influence treatment goals and results.

Key words: Tooth size ratio, Bolton's analysis, Digital caliper

Introduction

Prediction of accurate space has prime role in diagnosis and treatment planning in Orthodontics. According to Proffit and Fields[1], space analysis should be done accurately before any Orthodontic treatment. Tooth size discrepancy is defined as a disproportion among the sizes of individual teeth[1]. In order to achieve optimal occlusion, ideal intercuspation, normal overjet and overbite, maxillary to mandibular tooth width ratios must be proportional in size. Bolton[2] in 1958 evaluated 55 cases with excellent occlusions and developed Bolton's tooth size ratio for six anterior teeth and the overall ratio for twelve teeth.

Similarly many authors have evaluated factors associated with differences in the tooth width ratios. The relationship between malocclusion type and tooth size proportions has been reported[3-8].

Since differences in tooth size have been reported with ethnic groups[9-12], most of the practitioners now disagree to apply the methods developed from the different ethnic groups.

The Bolton's tooth size ratio develops from white population (Caucasians), so its reliability is still questionable when applied to different ethnic groups[13,14].

So, it's necessary to test the applicability of Bolton's tooth size ratio for Nepalese population to make accurate diagnosis and treatment planning.

The objectives of the present study were to:

1. Determine the Bolton's ratios for Nepalese subjects.
2. Determine the sexual differences in tooth size between Nepalese males and females.

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3. Compare the ethnic difference in tooth size between Nepalese and Caucasians.

Materials and methods

The samples for this study were collected from the CODS, Universal College of Medical Sciences, Bhairahwa, Nepal. A random sampling technique was used. The subjects were informed appropriately and informed consent was obtained. The samples included dental impressions obtained from the students of the dental and medical sciences. Total 120 subjects were selected (60 males and 60 females). In spite of the ethnic diversity in the Nepalese population, we considered there was low error in sample selection, because the students selected for medical studies came from different parts of Nepal.

Inclusion criteria were, native Nepalese with Nepalese phenotypical characteristics such as brown skin color, black hair and eye color ranging from brown to black, age ranging from 17-23 years and all permanent teeth erupted(except third molar). Exclusion criteria were subjects with proximal or occlusal wear, interproximal caries or restorations, crowding, spacing or diastema, any cross bite, any over retained deciduous tooth, missing permanent tooth, deep carious tooth, any hypoplasia or dental anomalies and any past history of orthodontic treatment[15,16].

The alginate impressions were made by the well trained dentists of CODS, Universal College of Medical Sciences, Bhairahwa, Nepal. The impressions were poured using dental plaster. Starrett digital caliper (0-150mm, 799A-6/150, Starrett tools (Suzhou) Co. Ltd., China) providing measurements to ± 0.01mm was used to measure the mesio-distal dimension of all teeth. The teeth measured included the mandibular and maxillary permanent incisors, mandibular and maxillary permanent canines, mandibular and maxillary first and second premolars, mandibular and maxillary permanent first molars. All measurements were made by single investigator. Maximum 10 pairs of casts were measured per day to avoid errors by eye fatigue. All measurements were done directly from unsoaped plaster models. Maximum mesio-distal width of each tooth was measured and recorded to 0.1mm. All measurements were taken perpendicular to the long axis of the tooth with the caliper beak entering the interproximal area from the buccal or occlusal side[15]. Repeated measurements were performed to minimize the possible errors. Intra-examiner reliability was predetermined at 0.2mm as mentioned by Bishara et al[11]. Bishara[11,17] recommended that measurements that varied by 0.2mm or less to be averaged and re-measurement was done for measurements that varied more than 0.2 mm and the three measurements were averaged.

The mean, range, standard deviations were calculated for the size of teeth. The Bolton anterior ratio and the Bolton overall ratio were calculated and tabulated.

Results

The results are summarized in Table 1 to 3. Table 1 reports the mean, range, and standard deviation of the anterior and overall ratio in the Nepalese male and female subjects.

Table 1 suggests there was significant difference between sexes for the anterior ratio (*P*=0.0089), but there was no significant difference for overall ratio (*P*= 0.88)

The combined male and female anterior ratio and overall ratio were calculated and tabulated in Table 2.

The mean anterior “6” ratio for Nepalese subjects was found to be 79.46 with a standard deviation of 2.60. The values ranged from 68.75 to 89.17. The mean overall “12” ratio for Nepalese subjects was found to be 92.42 with a standard deviation of 1.80. The values ranged from 85.93 to 98.68 (Table 3).

Table 1: Tooth size ratio of male and female in the Nepalese population

Ratio	Male				Female				P
	Range		Mean	SD	Range		Mean	SD	
Anterior Ratio	73.70	89.17	80.44	3.52	68.75	87.05	78.48	4.47	0.0089*
Overall Ratio	85.93	98.68	92.46	2.72	86.60	97.54	92.38	2.89	0.8808

SD, Standard deviation; *significant P value (P <0.05)

Table 2: Tooth size ratio male and female combined for Nepalese population

Ratio	Range		Mean	SD
Anterior Ratio	68.75	89.17	79.46	2.60
Overall Ratio	85.93	98.68	92.42	1.80

Table 3: Parameters obtained in the present study compared to the Bolton parameters

Ratio	Range				Mean		SD	
	Nepalese		Caucasian		Nepalese	Caucasian	Nepalese	Caucasian
Anterior Ratio	68.75	89.17	74.5	80.4	79.46	77.2	2.60	1.65
Overall Ratio	85.93	98.68	87.5	94.8	92.42	91.3	1.80	1.91

Discussion

The Bolton sample was obtained from 55 subjects with excellent occlusion; 44 were orthodontically treated[2]. In present sample, all subjects were untreated and some had mild malocclusions. Therefore, a direct statistical comparison between groups is disputable.

Although in some studies the reported differences with Bolton's ratios were statistically significant, the clinical relevance is questionable. Originally, Bolton[2] suggested that a ratio greater than 1 SD from his reported mean values indicated a need for diagnostic consideration. More recently, a clinically significant tooth width ratio discrepancy has generally been defined as 2 SD outside Bolton's published mean ratio[3,4,12].

By using the above definition, an anterior ratio below 73.9 or above 80.5 and overall ratio below 87.5 or above 95.1 would be considered as clinically significant. High prevalence rate of an anterior tooth size discrepancy more than 2 SD above Bolton's mean was found for Nepalese subjects (Table 3). Although the mean values of Nepalese subjects in this study and those of the Bolton study are nearly same, the ranges and standard deviations of the Nepalese subjects significantly larger. Similar findings were found by Crosby and Alexander[3].

If cases with ratios greater than 2 SD away from Bolton's values truly represent a significant discrepancy, then a large number of Nepalese subjects present with relative tooth sizes that could potentially cause problems in attaining an optimal occlusal relationship.

Conclusions

Mean anterior tooth width ratios between male and female samples were statistically significant but mean overall tooth width ratios between male and female were not statistically significant. These findings suggest that a large number of Nepalese subjects presenting for orthodontic treatment possess a Bolton's tooth size discrepancy that may influence treatment goals and results. In both the overall ratios and the anterior ratio, the range and standard deviation were varied in the present study than in Bolton's study.

Thus it is probably necessary to do precise space analysis based on our own data to make an accurate diagnosis and treatment plan for orthodontics in Nepalese population. Although such an analysis may appear to be time consuming, the benefits would seem to outweigh this minor inconvenience by allowing more efficient diagnosis of problems, more specific treatment planning, and good success rate in achieving optimal occlusions.

Limitations

Further studies based on larger sample size, are required to confirm the applicability of the results of the present study.

Further study is required to test the applicability of Bolton values on Nepalese population having different types of Angle's malocclusion.

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