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Orthodontic Management of an Adult Patient

OFFICIAL PUBLICATION OF ORTHODONTIC ASSOCIATIONS IN THE WEST AFRICAN SUB-REGION

"DENTISTRY'S FIRST SPECIALTY JOURNAL IN SUB SAHARAN AFRICAN"

Orthodontic Management of an Adult with Severe Spacing, Bimaxillary Proclination and a Supernumerary Tooth

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Abstract

A report of the orthodontic treatment of a young adult female who presented with Angle's class I malocclusion on skeletal pattern 3, severe upper and lower anterior segment spacing, bimaxillary proclination and a supernumerary tooth as an incidental finding. An 18-year-old female patient presented with the complaint of "too much spaces in her teeth". Orthodontic assessment revealed a case of Angle's class I malocclusion on skeletal pattern 3 complicated by Increased overjet of 8mm, proclined upper and lower central incisors, decreased overbite, severe upper arch spacing, moderate lower arch spacing, incompetent lip seal. An unerupted supernumerary tooth was also identified in the lower right quadrant.

The treatment objectives were to extract the supernumerary tooth, correct the proclination of upper and lower incisors, correct overjet and close spaces in the upper and lower arches. Her treatment was carried out with fixed appliances using Roth 0.022 prescription appliances and lasted for 24 months. The set out objectives for her treatment were achieved with a marked improvement in the overall esthetic appearance of the patient. One-year post treatment, the patient was still on retention, has a stable occlusion with no signs of relapse.

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ORIGINAL ARTICLE

Introduction

In the permanent dentition, spacing occurs where the sum total of the mesio-distal width of the teeth present in the arch, are less than the total length of the arch. It is a dental malocclusion characterised by interdental spaces and lack of proximal contact. Spacing in the dental arch can be classified as mild, if the spaces are less than 3mm; moderate spacing where spaces are between 3-6mm and severe spacing in the presence of spaces more than 6mm.[1]

Generalised spacing refers to spacing occurring in both the anterior and posterior segments of the arch, in contrast to localised spacing where only two to four teeth are involved. The causes of generalised spacing may be hereditary, acquired or even functional. Localised spacing is usually due to local factors, such as missing teeth, supernumerary teeth, microdonts, retained primary teeth, sucking habits, periodontal disease and hypertrophic upper labial fraenum.

The prevalence of spaces in the permanent dentition varies from 10-33% of population with higher prevalence of spacing in the upper arch than in the lower arch.[2–4] The presence of spaces in the arch present stagnation areas that can lead to accumulation of plaque and calculus, increasing the risk of dental caries and periodontal disease and consequently, tooth mobility and tooth loss. Proclination of the incisors predisposes the affected incisors to trauma due to its forward position on the arch.[5,6]

These malocclusions, severe spacing and bimaxillary proclination, in addition to their poor influence on oral tissues, are unaesthetic with a negative impact on individuals physical, psychological and social life, thus adversely affecting the quality of life of young people.[7,8] This has been noted to be improved following orthodontic treatment.[9]

This report highlights a case of severe upper and lower arch spacing and bimaxillary proclination, treated with fixed appliance therapy in a young adult with stable results.

Diagnosis

An 18-year-old female undergraduate presented to the orthodontic unit of the University College Hospital Ibadan with the complaint of "too large spaces in her teeth" which she noticed about 7 years prior to presentation. She was previously treated unsuccessfully with upper and lower removable appliances. Patient admitted to not using the appliances faithfully as they were uncomfortable. She had no known systemic illness nor allergies.

Extra oral examination revealed a symmetrical face, normal Temporomandibular joints, a convex profile and an incompetent lip seal evidenced by a Jackson's score of 2/0 (Fig 1)

Intra oral examination showed the presence of all permanent teeth except the third molar in all quadrants as well as a normal tongue and labial frenae. Patient had an Angles Class I molar relationship and a Class II incisal relationship. Overjet was recorded as 8mm while the overbite was observed to be decreased. There was also a lower midline shift to the Right and Proclined upper incisors. The tooth bone relationship was noted as severe spacing in the upper arch, and moderate spacing in the lower arch (Fig 2).

Available radiographs, the Cephalometric x-ray and tracing confirmed a retrognathic maxilla, class 3 skeletal pattern, upper and lower incisor proclination (bimaxillary proclination) with a tendency to open bite (Fig 3). The orthopantomogram showed the presence of a supernumerary tooth located on the lower right quadrant between the first and second premolar (Fig 4)

Her pretreatment study models were also made and articulated as shown in Fig 5 and a problem list was drawn up as follows:

- Angle's class I malocclusion on skeletal Pattern 3 complicated by:
- Severe spacing in upper arch
- Moderate spacing in lower arch
- Increased overjet = 8mm
- Proclined upper incisors
- Bimaxillary Proclination
- Incompetent lip seal
- Unerupted Supernumerary in relation to 45, 44

Treatment Plan

Extraction of Supernumerary teeth.

Correction of inclination of upper and lower incisors.

Correction of Overjet

Closing spaces in upper and lower arches

Improve the lip competence

Plan for Appliance:	Fixed appliance therapy using Roth 0.022 Prescription appliance.
Plan for Space:	Utilize available spaces.
Plan for Anchorage:	Simple anchorage using standing teeth.
Plan for Retention:	Upper Hawley's retainer.
Plan for Time:	24 Months

Treatment progress (Figure 6)

Set up appointment - Roth 0.022 Prescription attachments placed on
654321123456
654321123456
And 0.014 NiTi arch wires placed on upper and lower arches.
Review visits were set up to be done 6 weekly

6 weeks	UAW and LAW changed to 0.016 NiTi
12 weeks	UAW and LAW changed to 0.020NiTi
18 weeks	UAW changed to 0.018 X 0.018 NiTi; LAW changed to 0.017 X 0.025 SS.
24 weeks	UAW changed to 0.017 X 0.025 SS; Upper anterior segment retraction commenced using crimpable hooks and closed coil springs.
34 weeks	UAW and LAW changed to 0.019 x 025 SS. Elastic chain placed from 16 to 26
42 weeks	Upper Anterior segment retraction continued
50 weeks	Space closure continued in the upper arch using closed coil springs.
60 weeks	Space closure is almost complete. Elastic chain placed from 46 to 36
72 weeks	Debonding of appliance done and an Upper Hawley's retainer and lower fixed lingual retainer delivered.

Total treatment time – 18 months See Fig 6

mm that extended from the canine to canine.

Results

Extraction of Supernumerary teeth.	Achieved
Correction of inclination of upper and lower incisors.	Achieved
Correction of Overjet.	Achieved
Closing spaces in upper and lower arches.	Achieved
Improve lip competence.	Achieved
Pre-Treatment PAR Index	25
Post Treatment PAR Index	0
PAR Index Reduction/Percentage	25/100%

See Fig 7 and 8

Figure 1. Pretreatment extra oral photographs

Figure 2. Pretreatment Intraoral photographs

	Normal Values (Degrees)	Pre-treatmentValues (Degrees)	Interpretation
SNA	85.5±3.5	80	Retrognathic Maxilla
SNB	82.7±3.0	80	Normal Mandible
ANB	2 - 4	0	Class 3 Skeletal pattern
1FP	119 - 127	140	Upper incisor Proclination
1MP	96 - 104	109	Lower incisor Proclination
1/1	108 - 116	74	Bimaxillary Proclination
FMPA	24 - 28	38	Tendency to Open bite

Figure 3. Pretreatment Cephalogram and tracing values

Table 1

Pre-treatment Soft Tissue Analysis	Patient Values	Normal Values
Lower Lip H Line	10 MM	-1 TO 2MM
	8MM	2.54MM
Lower Lip E Line	13MM ANTERIOR	5.88MM
Nasolabial Angle	64^0	
Mentolabial Angle	103^0	

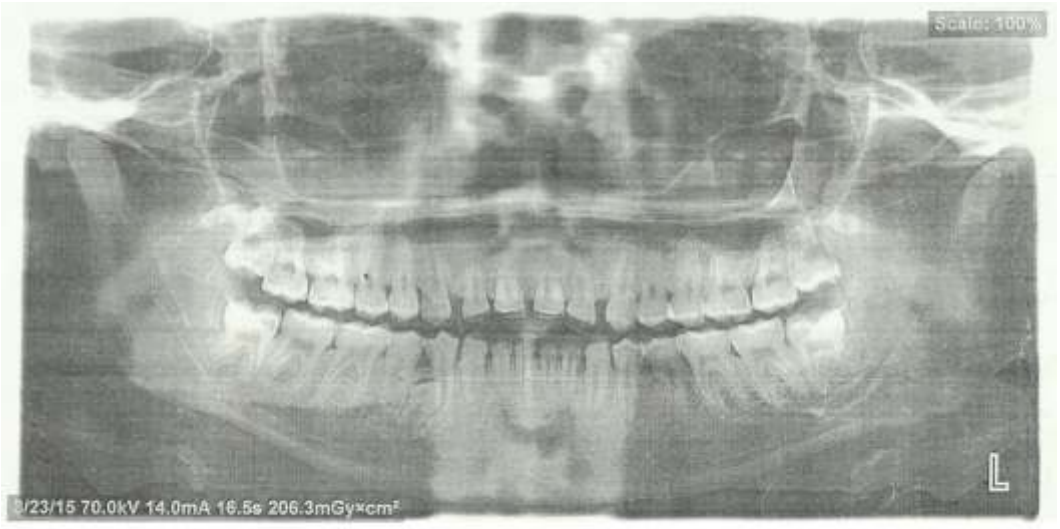

Figure 4. Pretreatment OPG

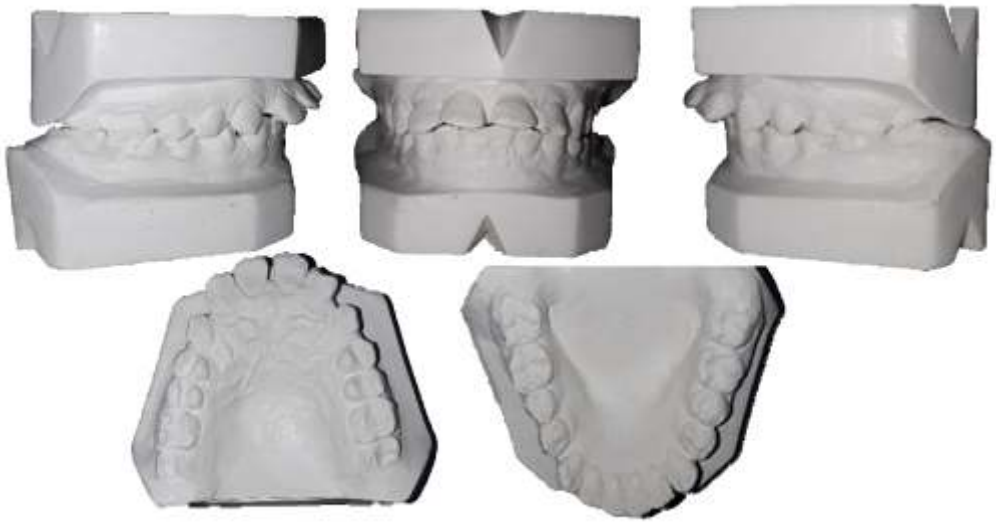

Figure 5. Pretreatment study models

Figure 6. Mid treatment photographs

Figure 7. Post-treatment extra oral photographs

Figure 8. Post-treatment intraoral photographs

	Normal Values (Degrees)	Pre-treatment Values (Degrees)	Post-treatment Values (Degrees)	Interpretation
SNA	85.5±3.5	80	78	Retrognathic Maxilla
SNB	82.5±3.0	80	80	Normal Mandible
ANB	2 - 4	0	-2	Class 3 Skeletal pattern
U1FP	119 - 127	140	130	Upper incisor Proclination
L1MP	96 - 104	109	108	Lower incisor Proclination
INTERNCISAL	108 - 116	74	93	Bimaxillary Proclination
FMPA	24 - 28	38	30	Tendency to Open bite

Figure 9. Post-treatment Cephalometric x-ray and tracing values

Table 2

Pre-treatment Soft Tissue Analysis	Patient Values	Normal Values
Lower Lip H Line	10 MM	-1 TO 2MM
Upper Lip E Line	8MM	2.54MM
Lower Lip E Line	13MM ANTERIOR	5.88MM
Nasolabial Angle	64^0	
Mentolabial Angle	103^0	

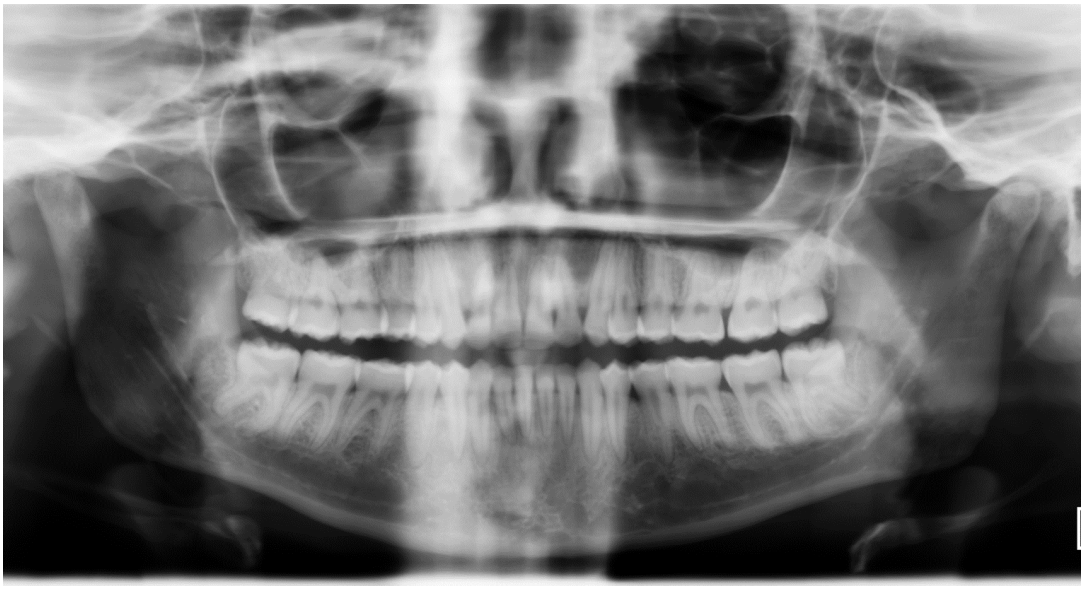

Figure 10. Post-treatment OPG

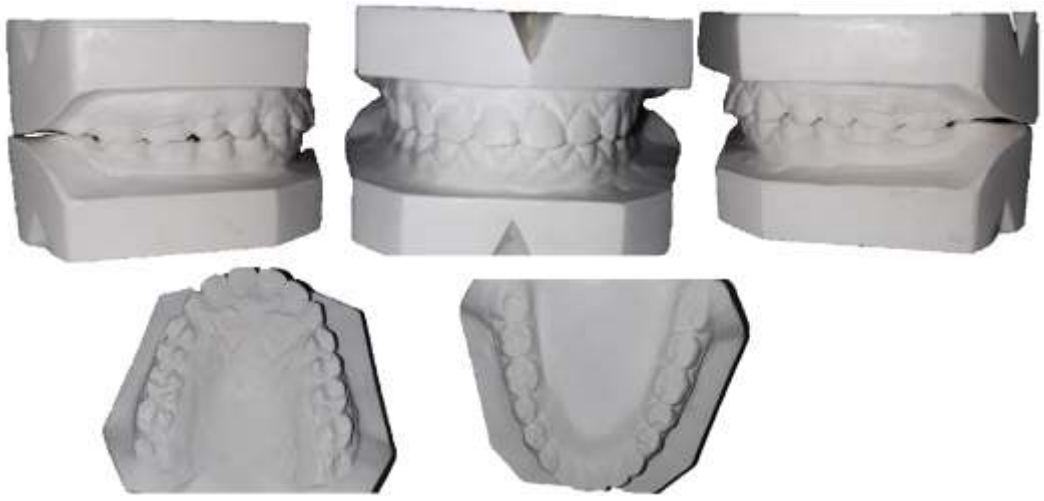

Figure 11. Post-treatment study models

Figure 12. Result comparison

Figure 13. Patient in retention

Figure 14. One year post-treatment

Discussion

A spaced arch, in the primary and mixed dentition, is necessary to provide adequate space on the arch to accommodate the larger, developing succedaneous teeth in the permanent dentition[10]. However, with full transition to permanent dentition the normal occlusion should have no spaces as indicated by Andrews' six keys to normal occlusion.[11] The presence of spacing in the permanent dentition is sometimes considered beautiful among Africans. Nevertheless, where the spaces are too large, their esthetic appeal is lost even to lay people. Proclined teeth equally have such an unaesthetic appearance. Thus it is not surprising that patients with these malocclusions would experience negative social effects such as bullying and taunting along with their negative psychological impacts.[12–14]

The unerupted supernumerary tooth found in the dental arch was an incidental finding and underscores the need to carry out pretreatment investigations such as radiography to exclude the presence of such otherwise undetected anomalies. An unerupted tooth can impede orthodontic tooth movement and can cause root resorption. Also, such impacted teeth are associated with odontogenic cysts[15] and have been implicated in odontogenic tumours.[16] Hence it is essential to exclude their presence or have them extracted prior to commencement of orthodontic therapy.

The orthodontic treatment for this case was carried out using fixed appliance therapy, bringing about effective resolution of her complaint . This would not have been possible with the use of removable appliances as was previously attempted in an earlier consultation. This brings to light the need for proper patient assessment and specialist orthodontic diagnosis; to produce the best possible treatment plan for each patient, bearing in mind the patient's age, stage of dental development, medical condition, and current socio-economic situation. The Roth prescription appliances used in treatment of this case, have lower torque values than other prescriptions available, for example the MBT and Damon prescription brackets. The outcome of treatment was esthetically pleasing, and the inclination of the upper incisors largely improved though it remained 3^0 higher than the cephalometric range for Nigerians. This may be because of the lower torque values of the

Roth brackets or the torque in the brackets not being expressed fully; thus, one may consider the use of bracket prescriptions with higher torque values in future. This is important as appropriate torque of the maxillary central incisors is necessary to establish an esthetic smile line, maintain class I incisal relationship and prevent loss of arch length.[17,18]

In orthodontics, clinical "torque" refers to the correct buccolingual inclination of teeth.[19] It is the 3rd key to normal occlusion which Andrews describes as "the angle formed by a line perpendicular to the occlusal plane, and another line drawn parallel to and tangent to the long axis of the clinical crown of a tooth at its midpoint".[20] Furthermore, in orthodontic biomechanics, torque refers to the interplay or torsion of a rectangular arch wire within the bracket slot.[21] When a smaller sized arch wire is inserted into a bracket slot, it can rotate clockwise or anticlockwise- this degree of freedom is known as 'play'; and it increases as the arch wire size decreases. On insertion of rectangular wires, the arch wire contacts the walls of the bracket slot and undergoes further torsion or twisting. This generates a moment or force couple through which the torque programmed into the bracket is expressed.[22]

The higher the value of the torque programmed into the bracket at manufacture, the more the moments are expressed and the better bucco-lingual position the tooth will assume, when the archwire slot is fully engaged with a rectangular wire. It is worthy to note that the effective torque expressed by a bracket is not only affected by the 'play' between the archwire and bracket slot, but also by other factors such as variation in tooth anatomy, variations in the bracket base, inaccuracies in the bracket slot and arch wire dimensions, mode of archwire ligation, and the stiffness of the wire.[17,23–26]

At the end of the treatment for this patient, all set out objectives were achieved. However, there was a residual mesial rotation of the lower right first molar, as a result of loss of anchorage on the lower arch. Though a lower lingual holding arch was not used for this patient, it should be prescribed and used to prevent loss of anchorage in patients with bimaxillary proclination, as its treatment has a high anchorage demand. Lower lingual holding arches are made of 1.0mm hard stainless steel wires soldered onto the lower molar bands.

The retention protocol employed ensured that the alignment achieved at the end of treatment remained. This means that the teeth were moved to a neutral zone on the arch. A position whereby the tooth is in equilibrium with the forces from the tongue and cheeks/lips. This will ensure stability of the movement achieved and prevent relapse as shown in Fig 14, 1-year post debonding. Long term follow-up of the patient will be required as this will ensure compliance with the use of retention appliances and detect relapse early to mitigate against it .

Conclusion

This case report describes the successful treatment of a patient with Angle's class I malocclusion on skeletal pattern 3, severe upper and lowers anterior segment spacing, bimaxillary proclination and a supernumerary tooth as an incidental finding; using Roth '022 prescription fixed appliance orthodontic therapy.

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- Use 1 side of standard size 21.6x27.9 cm A4, white bond paper, with margins of at least 2.5 cm on each side.
- Double-space throughout including title page, abstract, text, acknowledgements, references, tables and figure legends. Start each of these sections (in same order) on a new page, numbered consecutively in the upper right hand corner, beginning with the title page.
- Use at least 12 point font size (Times New Roman or Arial).
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- All manuscripts should be accompanied by a signed statement by all authors regarding authorship, responsibility, financial disclosure and
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Each manuscript should be accompanied with a structured abstract (divided into background, methods, results and conclusions) in no more than 250 words. Four to five key words to facilitate indexing should be provided in alphabetical order along with the abstract. The text should be divided in sections on introduction, methods, results, discussion and conclusion.

Acknowledgment section may be included where necessary. Number of tables and figures should be limited to the very relevant ones and may be compressed if necessary. The typical text length for such contributions is 2500-3 500 words (excluding title page, abstract, tables, figures, acknowledgments and references).

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Short accounts of original studies are published as brief reports. The text should be divided into sections, i.e., abstract, introduction, methods, results and discussion.

Abstract should be of 100-150 words highlighting the aims, methods and main results along with 3-4 key words.

The text should contain no more than 1500 words, 3 illustrations or tables and up to 20 references, preferably recent publications.

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Authors submitting review manuscripts should include a structured abstract of around 200 words describing the need and purpose of review, methods used for selection, extraction and synthesis of data, and main conclusions.

Clinical cases highlighting uncommon malocclusion condition, orthodontic treatment techniques are published as case reports. Single case reports are usually not accepted, unless some new or unusual aspect regarding aetiopathogenesis, diagnosis or management is brought out that adds to the existing body of knowledge. The text should not exceed 1000 words and is divided into sections, i.e., abstract, introduction, case report and discussion. The number of tables/figures should be limited to 2. Ten recent references are acceptable. A maximum of 3 or 1 author is permitted from the principle and each of the associated departments respectively. Thus, case reports from only one investigative department can have a maximum of 3 authors.

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Such letters should be received within 6 months of the article's publication. At the editorial board's discretion, a letter may be sent to authors! experts for comments and both letter and reply may be published together. Letters may also relate to other topics of interest to orthodontists and others, and/or useful clinical observations. Letters should not be more than 400 words. The number of authors should not exceed 2, including the authors' reply in response to a letter commenting upon an article published in this journal.

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occur for other reasons, such as personal relationships, academic competition and intellectual passion. If any of the authors have accepted reimbursement for attending symposium, a fee for speaking, fee for organizing educational reach, funds for a member of the staff of consultation fees from an organization that may in: way gain or lose financially from the result of the study, review, editorial or letter, a competing interest would be deemed to exist. If any of the authors had been employed by an organization that may in any way gain or lose financially from the publication, or if any of them hold stocks or shares in such an organization, competing interest would be deemed to exist. If competing interest exists, the author(s) must disclose them while submitting the manuscript.

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The second page should carry an abstract in case of original article (250 words), review article (200 words), brief report (100-150 words), and case report (50 words), respectively. For original article and reviews, the abstract should be structured as detailed earlier. For brief reports, the abstract should state the purpose of the study, basic methodology, main findings (giving specific data and statistical significance) and key conclusion(s). Below the abstract, authors should provide 3-5 key words for indexing; terms from the Medical Subject Headings (MESH) list of Index Medicus should be used. The basic structure of a paper follows the well known acronym IMRAD, which stands for Introduction (what questions was asked), Methods (how was it studied), Results (what was found) and Discussion[4].

Introduction

The introduction must clearly state the question that the author(s) tried to answer in the study. It may be necessary to briefly review the relevant literature.

Only cite those references that are essential to justify the proposed study.

Materials and Methods

The methods section should describe, in a logical sequence, how the study was designed (e.g., how randomization was done), carried out (e.g., how subjects were chosen or excluded, ethical considerations, accurate details of materials used, exact drug dosage and form of treatment, etc.) and data were analyzed (e.g., an estimate of the power of the study, exact test used for statistical analysis, etc.).

For standard methods, appropriate references are sufficient, but if standard methods are modified these should be clearly brought out.

Authors should provide complete details of any new methods or apparatus used (manufacturer's name and address in parentheses).

Ethics

When reporting experiments on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1964, as revised in 2000.

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Authors should describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results. When possible, they meet to quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Actual P values are provided rather than stating as just <0.05 or >0.05 etc. References for the design of the study and statistical methods should be to standard works when possible (with pages stated) rather than to papers in which the designs or methods were originally reported. Any general-use computer programs used should be specified and statistical terms, abbreviations, and most symbols be defined.

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This section should include only relevant, representative data and not all information collected during the study. Major findings should be presented clearly and concisely. Text, tables, and illustrations should be used sensibly while avoiding repeating in the text all the data depicted in the tables or illustrations and emphasizing or summarizing only important observations. Tables and figures should be restricted to those needed to explain the argument of the paper and to assess its support. It is necessary to cite the tables in the text and type them on separate sheets. It may also be useful to mention what the study did not find.

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Discussion ordinarily should not be more than one third of the total length of the manuscript. This section should include a summary of the major findings, their relationship to other similar studies, limitations of methods and implications of these findings in future research. Conclusions should be linked to the goals of the study. Unqualified statements and conclusions which are not completely supported by the data should be avoided. Authors should also refrain from making statements on economic benefits and costs unless their manuscript includes economic data and analyses.

Acknowledgements

In acknowledgements section, it is suitable to list all contributors who do not meet the criteria for authorship, such as a person who provided purely technical help, writing assistance, or a department head who provided only general support. Financial and material support should also be acknowledged.

Groups of persons who have contributed materially to the paper but whose contributions do not justify authorship may be listed under a heading such as "clinical investigators" or "participating investigators", and their function or contribution should be described, for example, "served as scientific advisers", "critically reviewed the study proposal", "collected data", or "provided and cared for study patients". A written consent is required from all the persons acknowledged, indicating their acceptance for the same.

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Journal Article

List all authors when 6 or less. When 7 or more, list only first six and add et al. Ngan P, Yiu C, Hu A, Hagg U, Ei SHY, Gunel E. Cephalometric and occlusal changes following maxillary expansion and protraction. Eur J Orthod 1998; 20: 237-254.

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Each table should be typed in double-space on a separate sheet of paper. Tables not submitted as photographs must be numbered consecutively (Arabic numerals) in the order of their first citation in the text, with a brief but self explanatory title for each.
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Statistical measures of variations should be identified such as standard deviation and standard error of the mean.
Be sure that each table is cited in the text. If data are used from another published or unpublished source, it is necessary to obtain permission and acknowledge them fully.

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Figures should be professionally drawn and photographed; freehand or typewritten lettering is unacceptable. Instead of original drawings, X-ray films, and other material, sharp, glossy, black-andwhite photographic prints of high quality are necessary, usually 127x 173 mm (5x7 in) but no larger than 203x254 mm (8x10 in) For color illustrations negatives or positive transparencies are provided, along with color prints. It is preferable to have the photograph in portrait form rather than in landscape form to fit easily into one column.
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Measurements of length, height, weight, and volume should be reported in metric units, i.e., meter(m), gram(g), or liter(l) or their decimal multiples.
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Only standard abbreviations are used in the text while avoiding abbreviations in the title and abstract.
The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement. Year, month, day, hour, minute and second should be abbreviated as yr, mon, d, h, mm, and s in tables respectively.

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