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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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EVALUATION OF DENTAL CHANGES AFTER MINI-IMPLANT ASSISTED RAPID MAXILLARY EXPANSION IN YOUNG ADULTS: CBCT STUDY

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Abstract.

Objectives: This study was carried out to evaluate dental changes in young adult patients with maxillary transverse deficiency by the MSE II appliance, via cone beam computed tomography (CBCT).

Materials and Methods: A total of 24 patients (12 females and 12 males) with transverse maxillary deficiency were treated with MSE II (Biomaterials Korea, Inc., Seoul, Korea). They were aged 17 to 22. The MSE II device is composed of a central expansion screw and four tubes that guide the mini-implants. Mini implants measure 1.8mm in diameter and 13mm in length. The extended length of the mini-implants allows bicortical engagement of the palatal and nasal floor, reducing expansion force on the anchored teeth. Activation of the appliance varied with the patient's chronological age. We captured pretreatment CBCT scans (T1), and immediately post-expansion CBCT scans (T2). Measurements were performed to evaluate the dental effect after expansion.

Results: within the limits of this study there is a significant increase in intermolar and interpremolar distance (IMD-IPD) and a significant change in the buccolingual inclination of maxillary first molar and maxillary first premolar for both sides right and left., however, the study shows there is no significant difference between males and females in the result for measurements after expansion.

Conclusion: MARPE appliances, such as the MSE II, can be used to manage transverse maxillary deficiency in young adult patients while causing minimal dentoalveolar side effects.

Key words. MSE II, Transverse maxillary deficiency, dental inclination, cone beam computed tomography.

Introduction.

Maxillary transverse deficiencies, found in 21% of children and 10% of adults, is a typical orthodontic finding]1[. For expanding the maxilla and resolving the transverse discrepancy in children, RPE is a useful orthodontic technique. The rapid transverse force applied to the maxillary teeth causes the midpalatal suture to become disturbed and separated. This enhanced cellular activity results in sutural bone remodeling]2[. RPE's ability to respond to palatal expansion is less successful in adults because of the zygomatic buttress's resistance and the midpalatal sutures' maturity. The RPE can cause unwanted side effects including arch expansion failure, bone dehiscence, root resorption, marginal bone loss, and inability to produce complete skeletal expansion in adults]3[.

The therapeutic technique known as surgically assisted RPE (SARPE) aids in overcoming the zygomatic buttress and bony plates' greater resistance in adults]4[. SARPE, however, has been shown to have a number of disadvantages, including high cost, surgical morbidity, and periodontal problems] 5[.

Mini-implant assisted RPE (MARPE) appliances can now be used to treat adults with maxillary constriction. These appliances can localize lateral forces to the midpalatal suture by using mini implants as anchorage] 6[. These devices have been reported to create resulting in less alveolar/dental tipping, and more skeletal expansion, while also providing more stability. Wilmes et al. suggested using the term hybrid expander for any device used for maxillary expansion that is both skeletally and dentally anchored]7[.

The maxillary skeletal expander (MSE) is a MARPE appliance design that has been reported in the literature since 2014]8,9,10[. In recent years, there have been several studies on the use and success of MSE in adult patients. Cantarella describes the zygomaticomaxillary complex moving downward and outward in the coronal plane, with the fulcrum located slightly above the frontozygomatic suture]11[. The aim of this pilot study was to evaluate the dental alterations in young adult patients with maxillary transverse deficiency by (MSE) appliance, using Cone Bean Computed Tomography (CBCT).

Materials and Methods.

A total of 24 patients were chosen for this prospective, uncontrolled intervention study from the Department of Orthodontics at Al-Ramadi Specialist Dental Center in Anbar City, Iraq (12 females and 12 males). All the patients were diagnosed with transverse maxillary deficiency by an orthodontist in a specialist dental center and all will get maxillary expansion by MARPE between April 2022 and February 2023. CBCT images were taken before treatment (T1) and immediately after maxillary expansion (T2). The same CBCT device and technician were used. In both (T1) and (T2), The study was approved by the University of Mosul's Research Ethical Committee and Scientific Committee/College of Dentistry under the approval number UoM. Dent/H.65/22.

The Included criteria: Patients with maxillary transverse deficiency depending on Andrews's analysis of six elements]12[. Young adult patient ages ranged from 17 to 22 years (males and females), absence of craniofacial syndromes, and no prior orthodontic treatment, were enrolled in the present study.

The excluded criteria: Patients with developmental deformity. Patient with cleft lip and palate or patient with nasal surgery. In case of the existence of medical comorbidities such as congestive heart disease, pulmonary disease, and neurological disorders.

Appliance design: The expansion device that was used is MSE type II (BioMaterials, Korea) as shown in Figure (1). The MSE appliance consists of a central expansion jackscrew which is available in three sizes (8mm,10mm, 12mm), and four arms soldered to orthodontic bands on the anchor teeth to facilitate it placing the appliance in position. Also has four parallel holes welded to the jackscrew (1.8 mm in diameter) These holes serve as guides for the placement of the mini

Figure 1. *The MSE II appliance consists of (1) Ratchet Wrench Driver, (2) an MSE expander, (3) Mini Hand Driver, (4) Short Engine Blade (Shaft), (5) Micro Implant (M.I.), (6) Activation Key, (7) Safety Leashes.*

implants. these 4 mini implants were Ø1.8 mm in diameter and 13 mm in length. The longer mini-implant to enabling bicortical engagement between the palatal and nasal floor. also, to reduce the force transferred to the anchored teeth during an expansion (OAS-T1511, Biomaterials Korea Inc.)]9[.

CBCT machine: The cone beam computed tomography apparatus used in this study was Vatech i3D Co., Ltd, Korea. The scanning was at single jaw used for all patients at 90 kV, 10mA, with voxel size 0.5mm, and the exposure time was 10 seconds. The software used for picture capture was (Acquisition Interface), which was built and developed, especially for the Vatech i3D.

The treatment procedure and laboratory Fabrication:

First visit: A full explanation of the processes to the patient, including all the information and technical limits, as well as a reminder that the procedure may fail. after that, the Separator elastics are initially applied to the permanent maxillary first molars on both sides.

Second visit: The separators were removed, and bands were placed on the first molars. An alginate transfer impression was made, and regular plaster was poured. Separator elastics were returned to the molars. Also, improved oral hygiene.

Laboratory procedures: First, based on the width of the palate, the greatest size that could be accommodated in the palatal vault while still allowing for close adaptation to the surface of the tissue has been used to choose the suitable size of MSE II (8, 10, or 12 mm). The appliance was positioned between the maxillary first molars, which permitted lateral force against the pterygomaxillary buttress bone, which acts as the main cause of resistance during skeletal maxillary expansion [13]. The lateral arms were shaped to follow the palatal shelves contour and soldered to molar bands. The central jackscrew expander was tight on the palate, and the arm that supported it was approximately 2 mm distant from the palate's side wall [9]. After that, finishing and polishing as shown in figure (2).

Third visit: Separators are removed, topical anesthetics are placed on the palate, the appliance is cemented by GIC (Takayama, Japan), and the vertical position in relation to the palate is checked. Local infiltrative anesthesia is given through mini implant holes, then self-drilling mini implant placement using a manual ratchet key for precise assessment of torque levels (Biomaterials Korea®, Seoul, South Korea), Before beginning the activation protocol, a CBCT was performed (T1), instructions about hygiene and activation, prescription of analgesic drug of choice for two days (optional), and no need for an antibiotic if the patient has good general health.

CBCT image: Prior begun with activation each patient was asked to take CBCT (T1) Image acquisition. The patient stood inside the CBCT unit and bit on the bite block presented with the machine, which was also covered by new, clear protective sheaths. The head position is adjusted from the positioning panel such that the region of interest is centered in the beam (the patient midline will coincide with the machine midline). The head of the patient was stabilized with head and chin rest in position so that the Frankfort horizontal plane (which is the plane coinciding with the highest point of the external auditory canal to the lowest point of the lower margin of the orbit) is parallel to the floor. After that adjustment, the required field of view by the technician from acquisition interfere software (upper jaw 5*5 cm, parameters were selected of 90 Kv,10mA and exposure time 10 sec.)

The patient has been told that the machine would rotate during the scan, and this is a normal thing.

Activation protocol: The activation protocol varied depending on the patient's chronological age, as recommended by Moon et al. as shown in Table (1).

CBCT analysis: The CBCT images were analyzed by using Ez3D-i-3D software program. To decrease measurement errors resulting from nonstandard head positions, all images were oriented using a standardized procedure. the horizontal axis parallels the palatal plane (ANS-PNS), as seen in Figure (3A), and the vertical axis was aligned parallel to the nasal septum, as shown in Figure (3B). The angle of slicing would be changed as a result]14[(Table 2).

CBCT measurement:

Intermolar distance (distance between mesiolingual cusps of maxillary first molars): In the coronal slice, the mesiolingual cusp and palatal root apex of the maxillary first molar could be seen for the first time when the transverse section moved from the mesial to the distal side as shown in Figure (3C and D).

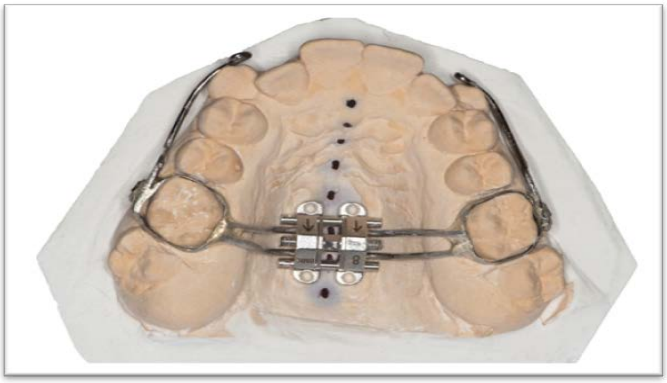

Figure 2. *Fabrication of MARPE (MSE II) In laboratory.*

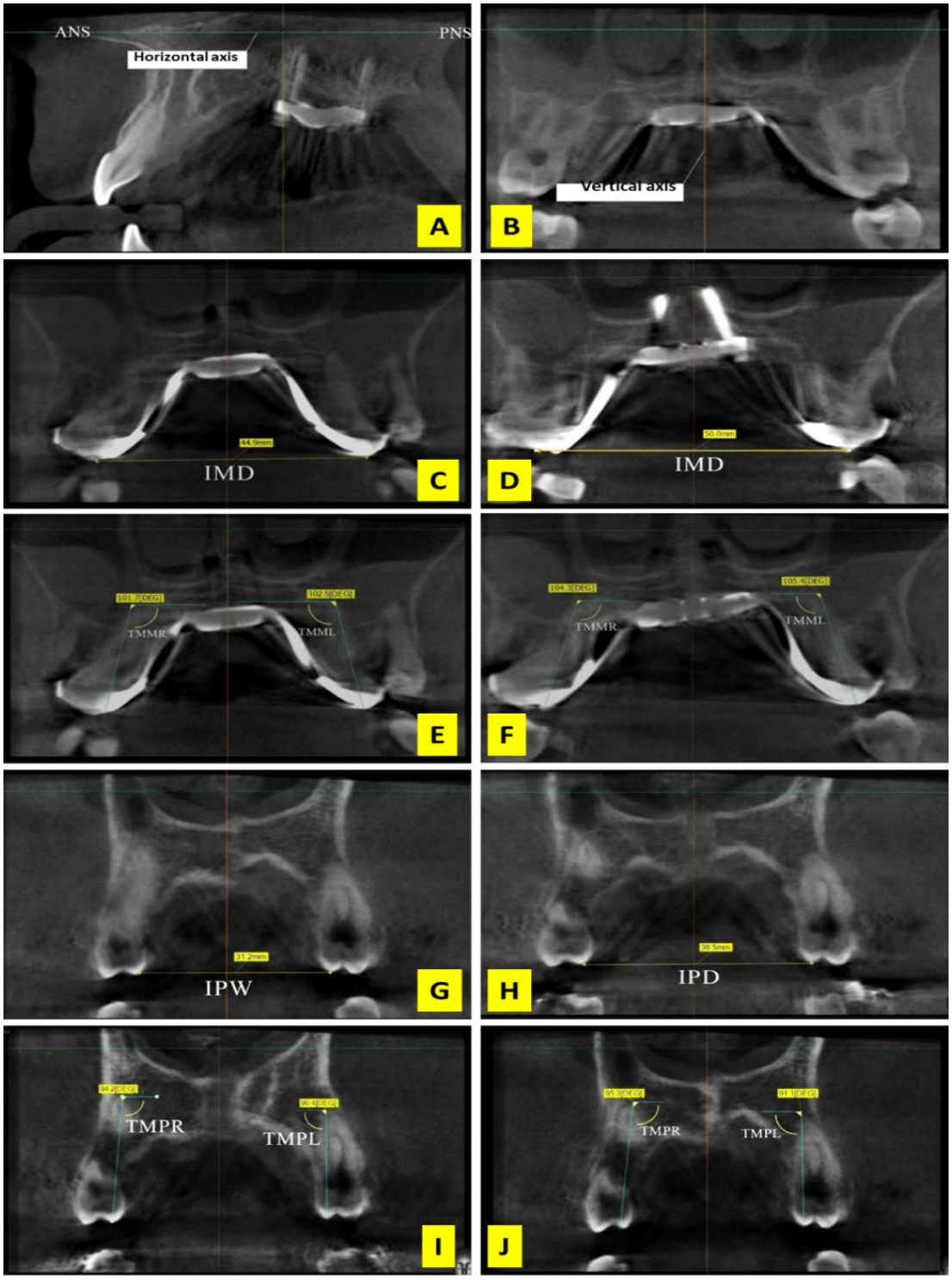

Figure 3. *Radiological study of the tested groups*
(A)CBCT image shows the horizontal axis parallel to the palatal plane (ANS-PNS)
(B)CBCT image shows the vertical axis parallel to the nasal septum.
(C) (IMD) Intermolar distance before expansion,
(D) (IMD) Intermolar distance after expansion.
(E) Buccolingul inclination (torque) of right and left maxillary first molars before expansion,
(F) Buccolingual inclination (torque) of right and left maxillary first molars after expansion.
(G) Interpremolar distance before expansion (IPD),
(H) Interpremolar distance after expansion (IPD).
(I) Buccolingual Inclination (torque) of right and left maxillary first premolar before expansion,
(J) Buccolingual inclination (torque) of right and left maxillary first premolar after expansion.

Table 1. *Activation protocol according to chronological age.*

Early teens	6X/ week (0.80 mm / week
Late teens	2X/ day (0.27 mm/day)
Early to mid-20's	4~6 X / day (0.53 ~ 0.80 mm/ day)
Older	Min. 4~6X / day
After Diastema	2X / day (0.27 mm/day)
* 6 Turns = 0.8mm (1 revolution)	

Table 2. *Landmarks evaluation.*

Landmark	Description
IMD	Intermolar Distance
TMMR	Torque of Maxillary first Molar Right
TMML	Torque of Maxillary first Molar Left
IPD	Interpremolar Distance
TPMR	Torque of Maxillary first Premolar Right
TPML	Torque of Maxillary first Premolar Left

Table 3. *Intra-examiner reliability by using Intraclass correlation coefficient test.*

	Before (T1)	After (T2)
	Interclass correlation	Interclass correlation
IMD	0.997	0.998
TMMR	0.995	0.997
TMML	0.976	0.995
IPD	0.99	0.986
TPMR	0.998	0.999
TPML	0.999	0.998
results expressed as meab±SD (95%CI) IMD=Intramolar distance, TMMR=Torque of Maxillary first Molar right, TMML= Torque of Maxillary first Molar left, IPD= Interpremolar Distance, TPMR= Torque of Maxillary first premolar right, TPML= Torque of Maxillary first premolar left		

The distance before and after the treatment was compared. The difference in values was termed "the intermolar distance" at the upper first molar] 15[.

Buccolingual inclination (torque) of maxillary first molars: The torque of the first maxillary molar was defined as the angle between the line from the tip of the mesiolingual cusp to the top of the palatal root and the line of the horizontal plane as shown in Figure (3 E and F).

On the coronal slice, the torque was measured at the time when the cusp and apex were observed for the first time as the transverse section progressed from the mesial to the distal position]16[.

Interpremolar distance (distance between palatal cusps of maxillary first premolars): In the coronal slice, the palatal cusp and palatal root apex of the maxillary first premolar could be seen for the first time when the transverse section moved from the mesial to the distal side as shown in Figure (3G and H)]15[. The distance before and after the expansion was compared.

Buccolingual inclination (torque) of maxillary first premolars: The torque of the first maxillary premolar was defined as the angle between the line from the tip of the palatal cusp to the top of the palatal root and the line of the horizontal plane as shown in Figure (3I and J). On the coronal slice, the torque was measured at the time when the cusp and apex were observed for the first time as the transverse section progressed from the mesial to the distal position] 15[.

Reliability of Measurement: Intra-examiner reliability was tested by comparing all measurements for 5 patients recorded from the first examination with the second examination repeated after 2 weeks by the researcher himself. After that, the method error was tested statistically by using the intraclass correlation coefficient as shown in Table (3), which was 0.95 for all variables measured in this study.

Statistical analysis: All measurements were tabulated in groups, and the statistical analysis was performed using the SPSS software program (version 20, SPSS Inc., Chicago, IL, USA)

1. ShapiroWilk test proved that the data was normally distributed.
2. Descriptive statistical analysis for all measurements (Before & After).
3. paired sample t-test was used to compare all the measurements Before and After.

Results.

Among 24 patients treated by MARPE in the present study,3 of them were excluded from the study as 2 patients exhibited failure of the opening of the midpalatal suture, and one of them suffer from severe inflammation around the mini-implant due to poor oral hygiene.

The Test of Normality Distribution for the Data: The normality test for all measurements (IMD, TMMR, TMML, IPD, TMPR, TMPL) before and after treatment is performed and shown in Table (4).

The Descriptive statistic for the data: The descriptive statistic for all measurements (IMD, TMMR, TMML, IPD, TMPR, TMPL) before and after treatment is performed and shown in Tables (5).

The Comparison Between the Before and the After for all data: The comparison between the before and after for all measurements by using paired samples t-test is shown in Table (6,7,8) and Figures (4).

Discussion.

Intermolar distance (distance between mesiolingual cusps of maxillary first molars): In this study the most significant changes after expansion occurred at the IM level, reflecting the combined skeletal and dental expansion, this finding agree with two studies with dental transverse maxillary expansion and found IM increase]17,18[. Compared to other studies using the MARPE device, this increase in IM width is relatively less. The most probable reason might be related to the MSE's design, particularly its bicortical engagement with long implants that provide greater skeletal anchoring [15[. Also, when Compared to SARPE, the IM increase produced by SARPE was statistically greater but did not differ clinically from MARPE]19[. According to Carlson et al., the play between the miniscrew and the insertion slot of the miniscrew may also be the cause of the crown tipping]9[.

Buccolingual inclination (torque) of maxillary first molars: The buccal inclination of the right and left maxillary first

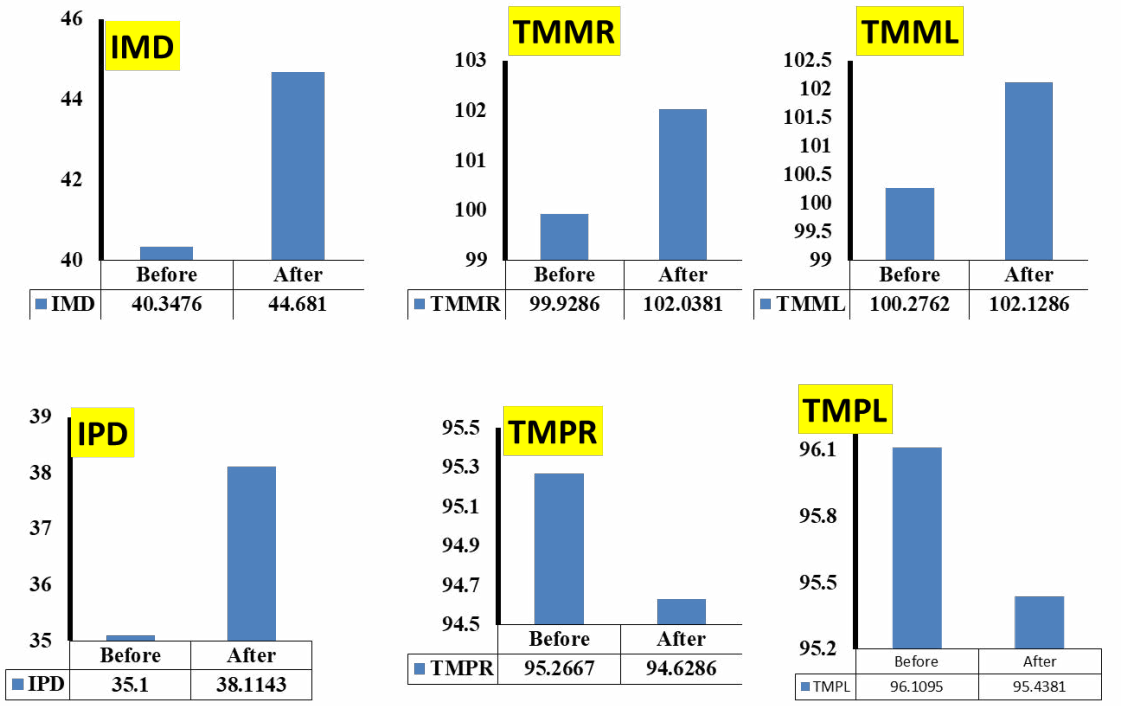

Figure 4. *Comparison between studied group before and after tested parameters, comparison between IMD before and after treatment; comparison between TMMR before and after treatment; comparison between TMML before and after treatment; comparison between IPD before and after treatment; comparison between TMPR before and after treatment; comparison between TMPL before and after treatment.*

Table 4. *The Tests of Normality.*

Test	Paired Test	Sample	Statistic	df	Sig.
IMD	Before	Male	0.158	11	0.200
		Female	0.147	10	0.200
	After	Male	0.126	11	0.200
		Female	0.204	10	0.200
TMMR	Before	Male	0.132	11	0.200
		Female	0.165	10	0.200
	After	Male	0.133	11	0.200
		Female	0.129	10	0.200
TMML	Before	Male	0.187	11	0.200
		Female	0.188	10	0.200
	After	Male	0.184	11	0.200
		Female	0.177	10	0.200
IPD	Before	Male	0.086	11	0.200
		Female	0.183	10	0.200
	After	Male	0.173	11	0.200
		Female	0.207	10	0.113
TMPR	Before	Male	0.218	11	0.149
		Female	0.301	10	0.111
	After	Male	0.207	11	0.200
		Female	0.230	10	0.144
TMPL	Before	Male	0.228	11	0.114
		Female	0.219	10	0.190
	After	Male	0.212	11	0.230
		Female	0.207	10	0.200

IMD: Intermolar Distance, TMMR: Torque of Maxillary first Molar Right,
TMML: Torque of Maxillary first Molar Left, IPD: Interpremolar Distance,
TPMR: Torque of Maxillary first Premolar Right,
TPML: Torque of Maxillary first Premolar Left
All values are non-Significant, the value at $p > 0.05$,
i.e., these experiments are normally distribution.

Table 5. *The Descriptive statistic for all the data (IMD, TMMR, TMML, IPD, TMPR, TMPL) before and after.*

Test	Paired Test	N	Minimum	Maximum	Mean	Std. Deviation
IMD	**Before**	21	34.00	45.20	40.3476	3.03474
	After	21	39.20	50.10	44.6810	3.02698
TMM R	**Before**	21	96.50	104.30	99.9286	1.95350
	After	21	97.30	105.50	102.0381	2.00885
TMM L	**Before**	21	97.20	104.20	100.2762	1.79886
	After	21	98.90	105.90	102.1286	1.93343
IPD	**Before**	21	26.70	40.90	35.1000	3.09322
	After	21	26.90	43.40	38.1143	3.20114
TMP R	**Before**	21	91.00	100.30	95.2667	2.67625
	After	21	90.40	100.00	94.6286	2.67921
TMP L	**Before**	21	92.20	103.60	96.1095	2.90498
	After	21	91.80	102.80	95.4381	2.86033

IMD: Intermolar Distance, TMMR: Torque of Maxillary first Molar Right,
TMML: Torque of Maxillary first Molar Left, IPD: Interpremolar Distance,
TPMR: Torque of Maxillary first Premolar Right,
TPML: Torque of Maxillary first Premolar Left.

Table 6. *The Comparison between Before & After of the measured parameters for the studied groups.*

		Mean	N	Std. Deviation	Std. Error Mean
IMD	Before	40.3476	21	3.03474	0.66223
	After	44.6810	21	3.02698	0.66054
TMMR	Before	99.9286	21	1.95350	0.42629
	After	102.0381	21	2.00885	0.43837
TMML	Before	100.2762	21	1.79886	0.39254
	After	102.1286	21	1.93343	0.42191
IPD	Before	35.1000	21	3.09322	0.67500
	After	38.1143	21	3.20114	0.69855
TMPR	Before	95.2667	21	2.67625	0.58401
	After	94.6286	21	2.67921	0.58465
TMPL	Before	96.1095	21	2.90498	0.63392
	After	95.4381	21	2.86033	0.62417

IMD: Intermolar Distance, TMMR: Torque of Maxillary first Molar Right,
TMML: Torque of Maxillary first Molar Left, IPD: Interpremolar Distance,
TPMR: Torque of Maxillary first Premolar Right,
TPML: Torque of Maxillary first Premolar Left
Paired Samples Statistics

Table 7. *The Correlations between Before & After of the measured parameters for the studied groups.*

Paired Samples Correlations				
		N	Correlation	Sig.
IMD	Before & After	21	0.947	0.000**
TMMR	Before & After	21	0.816	0.019**
TMML	Before & After	21	0.911	0.001**
IPD	Before & After	21	0.879	0.000**
TMPR	Before & After	21	0.995	0.000**
TMPL	Before & After	21	0.995	0.000**

** Highly Significant at $P \leq 0.01$.

molar was statistically significant in this study and ranged from 1.2° to 4.6° on the right side and 1° to 3.9° on the left side, which agrees with previous studies]15,18,20[. This change in buccal inclination cannot be due to dental tipping only. Cantarella et al. described the MSE expansion because of a skeletal rotation of the hemifacial structure with the fulcrum at the frontozygomatic suture]21[. This kind of skeletal rotation would affect the buccal inclination of the molars because the landmarks further away from the fulcrum would change more. Paredes et al. were the first to describe this concept]22[. Also, because the molars were the anchor teeth, the first molar might have tipped buccally as the micro-implants tipped or shifted laterally inside the palatal bone during expansion. The molars exhibited greater tipping than the PM, which can be related to the stabilizing wire being unable to transfer expansion forces to the molars. Also, may

Table 8. *The Comparison between Before & After for the upper and lower limits of the measured parameters for the studied groups.*

		Paired Differences			t	P value
		Mean	95% Confidence Interval of the Difference			
			Lower	Upper		
IMD	Before & After	-4.333	-4.784	-3.882	20.036	0.000**
TMMR	Before & After	-2.109	-2.656	-1.562	8.042	0.000**
TMML	Before & After	-1.852	-2.216	-1.488	10.606	0.000**
IPD	Before & After	-3.014	-3.721	-2.307	8.890	0.000**
TMPR	Before & After	0.638	0.519	0.756	11.257	0.000**
TMPL	Before & After	0.671	0.538	0.804	10.545	0.000**

** Highly Significant at P ≤ 0.01, Paired Samples Test
IMD: Intermolar Distance, TMMR: Torque of Maxillary first Molar Right,
TMML: Torque of Maxillary first Molar Left, IPD: Interpremolar Distance,
TPMR: Torque of Maxillary first Premolar Right,
TPML: Torque of Maxillary first Premolar Left

be the result of the buccal cortical bone's higher density in the maxillary first premolar areas]23[.

Interpremolar distance (distance between palatal cusps of maxillary first premolars): In this study, there was a significant increase in interpremolar distance, and the mean increase was 3.25 mm (1.82 mm–4.92 mm) which reflects the skeletal expansion. Several studies agree with the increase in IPD]15,17,20,24]. However, the amount of increase in IPD is less than IMD and this is related to the design of MSE in which the maxillary first premolar does not attach to the anchor wire. another cause may be related to the cortical bone around the premolar supplying more resistance during expansion, preventing buccal inclination]25[. Palatal tipping of the maxillary first premolar during expansion will decrease the IPD which agrees with another study]26[. When compared to SARPE, which revealed no difference in the dentoalveolar effects between premolars and molars]27[.

Buccolingual inclination (torque) of maxillary first premolars: The palatal inclination of the right and left maxillary first premolar was statistically significant in this study and ranged from 0.1° to 0.9 ° on the right side and 0.1° to 1.1° on the left side, which agrees with previous studies]26,28[. One probable reason for the palatal movement of the maxillary first premolars is the resistance force of the perioral muscles during expansion. The skeletal rotation by the MSE may have initially altered their inclination in the buccal direction, but the external force by the perioral muscles tilted them in the palatal direction, reversing and reducing the buccal inclinations of the first premolars. This effect appears to be greater in the anterior region and less severe in the posterior region]29[. Other studies disagree and report either no changes]16,30[or buccally inclined maxillary first premolar]18[.A buccal inclination of the maxillary first premolars was observed when Ngan et al. positioned the MSE device in various palatal locations and used bands on the first premolars to stabilize it.

Conclusion.

The following is the conclusion from the present study:

1. Increase in the IMD due to the buccal inclination of the maxillary first molar during treatment and skeletal expansion.
2. TMMR and TMML changed in buccal inclination because it was stabilized by the MSE, preventing uprighting.
3. Significant increase in the IPD during MSE II therapy
4. TPMR and TPML changed in the palatal direction, demonstrating that the teeth were uprighting, most likely due to perioral musculature and mastication forces.

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