



Investigative Study

THE ORTHODONTIC DEVELOPMENT OF THE IMPLANT SITE: FORCED ORTHODONTIC EXTRUSION. HISTOMORPHOMETRIC ANALYSIS OF THE NEWLY FORMED BONE TISSUE

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ABSTRACT

The aim of this study is to investigate the quality of the newly formed bone resulting from forced orthodontic extrusion through histomorphometry analysis. Seven adult patients scheduled for the extraction of 9 unrecoverable dental elements were chosen for forced orthodontic extrusion. Endoral radiographic examinations and CBCT were conducted to evaluate bone volumes, specifically focusing on buccal cortical measurements (height and thickness), in accordance with three-dimensional implant-prosthetic planning. Biopsy collection was synchronized with implant placement one week after dental extraction. Histological assessments carried out over an average period of approximately six months indicated new bone formation. Trabeculae of immature bone were identified, displaying high cellularity, numerous rounded osteocytes, and partial coverage by thin layers of osteoid tissue. The newly formed tissue exhibited a decreasing apico-coronal maturation gradient, with trabeculae thinning towards the coronal region, where osteoid and fibrous connective tissue islands were more prominent. Forced Orthodontic Extrusion has demonstrated its efficacy in achieving volumetric increases in both hard and soft tissues at the pre-implant site. Additionally, it successfully attains adequate tissue harmony with adjacent teeth.

KEYWORDS: *orthodontic extrusion, bone, implant, prosthetics*

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CONSIDERATIONS ON THE TIMING OF ORTHODONTIC-SURGICAL PROCEDURES IN THE CORRECTION OF CLASS III SKELETAL MALOCCLUSIONS

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ABSTRACT

Class III malocclusions are characterized by a mesialized position of the mandibular component, a condition present in 1-5% of the Caucasian population. In more severe cases, the only solution is surgical treatment, preceded by an orthodontic phase to prepare for the intervention and concluded with a phase to finalize the occlusion. The method proposed in this study aims to reduce the duration of pre-surgical orthodontics to achieve a faster improvement in the patient's aesthetics, with significant psychological implications. Taking a sample of 15 patients previously subjected to orthodontic-surgical treatment to resolve Class III malocclusion, the surgical treatment performed *in vivo* was replicated on the initial models. After identifying dental precontact, the time required to resolve them during the pre-surgical phase was calculated. Based on the number, type, and extent of movements, a duration of approximately 5 months for the orthodontic preparation phase was predicted, with a reduction of about 9.4 months compared to the average time required for actual pre-surgical treatment. It is believed that the proposed method may represent a particularly advantageous therapeutic approach for patients with skeletal Class III proposed for surgical correction.

KEYWORDS: *class III malocclusions, orthodontic-surgical procedures, rapid maxillary expansion, Facemask treatment*



Original Article

FEM STUDY ON MAXILLARY EXPANSION

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ABSTRACT

The aim of this study was to compare the effects of two different Rapid Palatal Expanders (RPE) configurations on stress distribution and displacement on the maxilla and its adjacent craniofacial structures using the Finite Element Method (FEM). Cone-beam computed tomography data of a patient with maxillary transverse deficiency were rendered into a three-dimensional model of craniomaxillary structures. Data from a CT scan of a growing patient (9 years old) was used to create the solid model of the cranium. The expansion device used in the simulation was a Hyrax expansion device with bands located only on the first molar in the upper jaw and a 13 mm central screw. The expansion device was simulated either with the screw configuration at the level of the equator of the teeth or with the screw configuration high on the palate. Placing the appliance closer to the center of least resistance represented by the suture may affect not only the amount of millimeter diastasis of the suture but also the ability to achieve as much bodily expansion as possible while avoiding undesired tooth inclinations. More tooth movement is obtained in the equatorial configuration than in the central suture configuration, but the difference does not seem significant. In the second configuration, a greater tooth displacement than the sutural displacement is still obtained with the expander at the palatal level. Still, the ratio of the tooth displacement to the sutural displacement decreases, but only slightly. Varying palatal expander screw heights do not have a major effect on suture opening. The design pattern of the RPE device regarding screw height affects the distribution of displacements and stresses in the craniofacial complex, but this pattern has less effect in growing patients.

KEYWORDS: *rapid palatal expanders, finite element method, FEM, maxillary expansion, maxillary deficiency*

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Original Article

PREOPERATIVE SIMULATION ACCURACY EVALUATION IN ORTHOGNATHIC SURGERY

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ABSTRACT

The aim of this study was to assess Dolphin software precision in combined surgical-orthodontic treatment simulation using telerradiographs, considering both hard and soft tissues. Twenty patients (9 males and 11 females, average surgical age 24,8y) who underwent orthodontic-surgical treatment within the past 3 years were selected, with pre- and post-operative telerradiographs and accurate surgical reports. Dolphin software simulated surgical movements for splint creation on preoperative telerradiographs, while the postoperative ones were taken at the debonding. Cephalometric analysis compared treatment simulation and final telerradiographs, calculating mean, standard deviation, skewness, median, and kurtosis for 14 measurements. Wilcoxon signed-rank test was employed to assess differences, with a significance level of $p \leq 0.05$. In hard tissues, the upper incisor showed significant proclination ($+2.4^\circ$), while sagittal measurements showed minor non-significant deviations. Verticality assessments indicated a slight reduction (SN/Md - 1.3°) and less than expected Mx/Md angle (-0.6°). Soft tissues generally exhibited non-significant variations, with notable changes in lower lip length (-1.9mm) and nasolabial angle ($+6.9$). Dolphin software simulations are accurate overall but can be influenced by various factors. Notable changes include upper incisor proclination and alterations in the chin, lower lip dimension, and nasolabial angle. Standard deviations emphasize critical evaluation due to interindividual variability.

KEYWORDS: *telerradiograph, Dolphin software, cephalometric, analysis, surgery*

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Retrospective Study

SURGERY FIRST: PROPOSAL OF A NEW METHOD TO IDENTIFY AND QUANTIFY TRANSITION OCCLUSAL INTERFERENCES

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ABSTRACT

This study proposes a new method for the clinical practice to identify occlusal interferences that would make the “Surgery First” an unpredictable approach in its outcomes. According to the ABO certification, 29 patients with Class III skeletal malocclusion were selected. All the models were scanned using 3Shape TRIOS® by the same operator. The models were imported into a SAM 2P articulator. The surgery-first approach was virtually simulated to eliminate occlusal interferences. The quantity and type of movement were calculated assuming the use of F22 aligners (Sweden & Martina, Due Carrare, Padova). Linear Regression Analysis was used to determine the association between the continuous variables, treatment duration, and gender and age. The sample included 29 patients (19 females and 10 males) aged between 21 and 48 years. The analysis shows only a weak significance of the duration of the pre-surgical phase (COP) in relation to age and gender combined. Considering the duration of COP, post-surgical phase, and the combination of both, nothing statistically significant is highlighted. This study shows a virtual decrease in the times of pre-surgical therapy by 2.8 months, ranging from 0 to 4.9 months. The protocol previously described is a valuable tool for the orthodontist; it is evident that the set-up provides an essential device for the 'Surgery First.' However, further studies are necessary to validate this method statistically.

KEYWORDS: *occlusive interference, surgery, class III, pre-surgical orthodontics, post-surgical orthodontics*

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Case Report

AESTHETIC EVALUATION OF THE INFLUENCE OF TORQUE ON THE COLOR OF UPPER INCISORS

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ABSTRACT

In cases of dental malocclusions with retroclined incisors, a darker smile may result since central incisors reflect less light. The purpose of this article is to assess if the degree of inclination of the four upper incisors can lead to changes in the brightness and color of the teeth and to evaluate the possibility of obtaining statistically significant data regarding the brightness of the lateral incisors using data from central incisors. A total of 40 subjects aged between 23 and 33 were selected. Three consecutive photos were taken for each individual at three different angles (0, 15, -15), referencing the Frankfurt Plane, to simulate torque movements of the anterior teeth. The photos in JPEG format produced integer RGB working data converted to CIE Lab* space with a standard CIE 2-degree observer. The selected area for color detection was at the center of the clinical crown of each tooth. When the head is inclined upward, all L*, a*, and b* change significantly in the overall transition from -15 to +15 for central incisors (L* from -15 to +15 50.293 vs 66.955 P<0.0001; a* from -15 to +15 0.896 vs 0.244 P<0.0001; b* from -15 to +15 2.239 P<0.0001) as for the lateral incisors, L* and a* change significantly in the overall transition from -15 to +15 (L* from -15 to +15 42.887 vs 59.386 P<0,0001; a* from -15 to +15 1.542 vs 0.881 P<0,0001), while b* does not vary significantly (b* from -15 to +15 2.345 vs 0.687 P<2.2387). The ANOVA statistical test confirmed the presence of statistically significant relationships between L*c, b*c, and lower -15° to predict L*1 values. The results have confirmed the significant relationship between brightness, color, and proclination/retroclination of upper incisors and how orthodontic treatment can bring about significant changes in perceived color, especially in Class II Division 2 cases. Transitioning from -15 to 0 degrees emphasizes the possibility of an additional beneficial effect in treating this malocclusion.

KEYWORDS: dental malocclusions, color, aesthetics, torque brightness



Evaluation Study

SAGITTAL AND VERTICAL SKELETAL RELAPSE IN ORTHODONTIC CASES ASSOCIATED WITH BIMAXILLARY SURGERY

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ABSTRACT

The main purpose of the study is to assess the position of the two maxillary bones, recorded at five-time intervals, consistent for all patients in the sample, in the context of a combined orthodontic-surgical treatment. This allows us to examine the possible presence of skeletal relapse, both sagittally and vertically, in the short and long term following orthognathic surgery. The analyzed sample consists of 15 patients. The lateral cephalometric X-rays were performed at five distinct moments during their therapeutic journey. The patient sample for analysis was initially selected randomly and further narrowed down based on inclusion/exclusion criteria designed to ensure the greatest uniformity and scientific rigor possible in the obtained results. The orthodontic treatment did not bring statistically significant changes in the vertical and sagittal positions of the two maxillary bones. It did not reveal any significant influence regarding the invasiveness of surgery concerning skeletal relapse, both in the sagittal and vertical dimensions. The relapse occurred in a statistically significant manner, exclusively during the first year following surgery. We can conclude that a surgically guided positioning of bone fragments, respecting the ideal cephalometric values, does not influence relapse for the parameters we considered. Combined orthodontic-surgical treatments are an elective approach for addressing severe dento-skeletal disharmonies, exhibit a high level of stability with minimal relapses in both number and size in the immediate postoperative period, and excellent long-term stability with relapses deemed not statistically significant, neither in size and number.

KEYWORDS: *skeletal relapse, occlusion, orthognathic surgery, orthodontic-surgical treatment*



Original Article

PILOT STUDY ON THE HISTOLOGICAL ASSESSMENT OF THE REGIONAL ACCELERATORY PHENOMENON REACTION FOLLOWING MICRO-OSTEOPERFORATIONS

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ABSTRACT

The aim of this study is to evaluate in humans whether the Regional Acceleratory Phenomenon (RAP) resulting from micro-osteoperforations (MOPs) performed with Propel® can be histologically demonstrated, supporting the ability of this technique to accelerate orthodontic movement. The study included six patients (2 M, 4 F; aged between 23 and 74 years) with edentulous areas requiring implant rehabilitation. These edentulous areas were micro-osteoperforated with Propel®. 15-30 days later, a biopsy was performed in the stimulated areas and in non-stimulated control areas. Classical histological analysis, quantitative histological analysis, and histomorphometric analysis were performed on 12 bone biopsies (6 “stimulated” and 6 “non-stimulated”). Non-stimulated” samples revealed normal compact bone surrounded by normal lamellar structure without evidence of significant remodeling activity. “Stimulated” samples 1-3-4 showed increased irregularity in the lamellar structure, with no additional alterations; 2-5-6 exhibited marked bone structure remodeling with increased osteocytes, chronic inflammatory infiltrate, and neovascularization of intertrabecular spaces. In this pilot study conducted for the first time on humans, MOPs performed with Propel® induced the RAP reaction in 50% of the samples. Chronological age may influence the reactivity of the response to corticotomy.

KEYWORDS: regional acceleratory phenomenon, RAP, micro-osteoperforations, Propel®, orthodontic tooth movement

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Original Article

EFFECT OF THE THERMOFORMING PROCESS ON THE THICKNESS OF ALIGNERS: AN EXPERIMENTAL *IN VITRO* STUDY

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ABSTRACT

The aim of this study was to assess the thickness of aligners manufactured through the thermoforming process and investigate how modifying some parameters during this process could impact the thickness of these devices. Two different thermoplastic materials (Zendura™ FLX and CA® Pro+) were thermoformed on a resin cast, representing the upper dental arch of an ideal patient, progressively modifying parameters such as temperature, heating time, and model height. Thermoforming was also performed on two models using a single sheet of thermoplastic material. The thickness of each aligner was compared with the thickness of aligner n° 1, produced with standard parameters recommended by the manufacturer. A thickness difference was considered clinically significant when exceeding a cutoff value of 15% of the thickness of aligner n°1. A Student's t-test was conducted to assess the significance of the mean differences between aligner n°1 and the others ($P < 0.05$). The thickness of all aligners is not uniform. Furthermore, thermoforming on a taller model and on two models simultaneously, the increase in heating time by 10" or a temperature increase of 10°C didn't produce any thickness difference exceeding the cutoff values for both materials. A decrease in heating time by 10" when using CA® Pro+ and a temperature decrease from 10°C to 60°C in Zendura™ FLX aligners induced clinically and statistically significant variations. Varying some parameters, such as temperature and heating time during the thermoforming process, can modify the final thickness of aligners.

KEYWORDS: *clear aligner therapy, thermoforming machine, aligner thickness*

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Original Article

EFFICACY OF THE MBT APPLIANCE IN A SAMPLE OF PATIENTS WITH CLASS I AND CLASS II MALOCCLUSION

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ABSTRACT

In this study, the objective was to explore the correlation between the ideal values Andrews defined and those obtained from patients treated with the MBT prescription. The sample comprised 48 pairs of plaster models from treated patients, half with class II elastics and half without. Utilizing a 3Shape R500 scanner, plaster models were converted into three-dimensional .stl files. Measurements, including the depth of the curve of Spee and intercanine and intermolar diameters, were performed using VAM software. Cephalometric assessments were conducted with Dolphin Imaging software. The orthodontic evaluation demonstrated the efficacy of the appliance prescriptions, revealing statistically significant differences between groups, particularly in torque, incisor position, and temporal variation of certain variables. The study concludes that appliance prescriptions effectively control orthodontic values compared to Andrews' ideals, with elastic management demonstrating good control of side effects and subtle statistical differences in third-order values.

KEYWORDS: *MBT bracket system, pre-adjusted edgewise appliance, Dolphin Imaging, occlusion, orthodontic treatment*

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Original Article

CHANGES IN THE ARCH SHAPE IN PATIENTS TREATED WITH ELASTODONTIC DEVICES

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ABSTRACT

Reformed devices made of elastomeric materials are widely integrated into contemporary orthodontic practices, showcasing documented success in the literature. Principally employed to address Class II Division 1 mandibular deficiencies, these devices play a key role in correcting the sagittal relationship between arches. They contribute to enhancing patients' profiles by fostering mandibular growth and resolving issues like oral breathing, finger or pacifier-sucking, and atypical swallowing. Comparative studies with established functional appliances such as Twin Block, Andresen's Activator, and Frenkel emphasize the effectiveness and viability of these preformed devices in the interceptive therapy of Class II malocclusions. Their advantages extend to both patient comfort and economic feasibility, rendering them a compelling alternative. Examining previous research, findings reveal comparable outcomes in the treatment of Class II Division 1 malocclusion with various functional appliances, indicating no statistically significant differences in the correction of Overjet, Overbite, and molar relationship. This study shifts the focus to the Equilibrator (Eptamed), a novel preformed device, diverging from the conventional emphasis on Class II malocclusion resolution. Instead, we investigate changes in arch shape and size during early and late mixed dentition in Equilibrator-treated patients. Through rigorous comparative analysis with an age- and gender-matched control sample devoid of orthodontic intervention, this study aims to elucidate the distinct impact of the Equilibrator on arch morphology. By exploring the broader implications of preformed orthodontic devices, particularly the Equilibrator, beyond conventional Class II malocclusion management, this research contributes a nuanced perspective to the existing literature.

KEYWORDS: *elastodontic devices, Class II mandibular deficiency, Equilibrator (Eptamed), Prefabricated Functional Appliances-Myobrace, (PFA)®*

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