

State-of-the-Art in Orthodontics and Gnathology

Giuseppe Minervini 

Multidisciplinary Department of Medical-Surgical and Dental Specialties, University of Campania Luigi Vanvitelli, via Luigi De Crecchio 6, 80138 Naples, Italy; giuseppe.minervini@unicampania.it; Tel.: +39-3289129558

In recent years, several novel diagnostic and treatment modalities have been introduced in orthodontics and temporomandibular disorders [1,2]. Researchers and clinicians are called to update themselves according to the developments occurring in these fields. New technologies and digital devices are able to accelerate the diagnostic process and increase the effectiveness in diagnosing dysfunctions in the orofacial region [3]. Furthermore, thanks to intraoral scanners, digital dental and skeletal models, facial scanning, cone beam computed tomography (CBCT), magnetic resonance imaging (MRI), digital smile design (DSD), photogrammetry, and artificial intelligence (AI), diagnoses are becoming increasingly accurate, particularly in complex cases with impacted teeth, dental transpositions, and orofacial disharmonies and anomalies [2]. In addition, patients are becoming increasingly demanding regarding treatment time and aesthetics [4]; thus, different methods such as corticotomy, pulsed light, mechanical vibrations to accelerate orthodontic movement, or an increase in the use of clear brackets and aligners are more common than in previous decades [5–7]. The objective of this Special Issue was to present the main evidence-based data on new developments and knowledge in diagnostic and treatment technologies in the orofacial field used in both children and adults. The articles published in this Collection have been met with great success in interdisciplinary fields, stimulating international authors to submit their original articles, reviews, or case reports based on various aspects of orthodontics, as well as on the diagnosis and management of temporomandibular disorders and orofacial pain [8–12]. Among the current highly debated topics, this Special Issue focused on multiple disciplines as follows: gingival recessions and periodontal status after orthodontic treatment; a rare case of impacted central incisors; predictors of analgesic consumption in orthodontic patients; a systematic review about different dento-skeletal class III treatment approaches; upper airway volumes evaluation, cephalometric values in JIA patients [8–12].

Specifically, the manuscript titled “Dento-Skeletal Class III Treatment with Mixed Anchored Palatal Expander: A Systematic Review” [8] aimed to determine the efficacy of using a mixed anchored palatal expander to treat Class III malocclusions, as well as to observe whether using a bone-anchorage device induces more maxillary advancement with fewer dental side effects. These treatment approaches are among the most currently used in the treatment of moderate-to-severe Class III malocclusions. This review was well conducted by following the more recent PROSPERO guidelines redacted for the International Prospective Register of Systematic Reviews (Centre for Reviews and Dissemination, University of York, York, UK). The authors concluded that combining tooth-borne and bone-borne appliances for rapid maxillary extension may be advised in treatment protocols for skeletal Class III patients to obtain more skeletal results while lowering maxillary dentition side effects [8].

Another publication of Nastri et al. [11] aimed to assess the gingival recessions (GR) and periodontal status in a group of young patients previously treated with non-extraction orthodontic treatments and retention, with a minimum two-year follow up after the end of active treatment. In particular, they selected data from patients with a previous non-extractive orthodontic treatment, and at least two years of storage and complete records



Citation: Minervini, G. State-of-the-Art in Orthodontics and Gnathology. *Appl. Sci.* **2022**, *12*, 12419. <https://doi.org/10.3390/app122312419>

Received: 19 November 2022

Accepted: 24 November 2022

Published: 5 December 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

were collected before and after treatment. Dental models were digitized with the 3Shape TRIOS[®] intraoral scanner, a new technology, and Viewbox4 software was used for the measurements. The following parameters were considered: inclination of the lower and upper incisors (IMPA and I^ˆSN) and anterior crowding (Little index). The follow-up periodontal clinical examination considered the following parameters: buccal and lingual GR (mm) of incisors and canines, probing score bleeding, plaque score and phenotype gingival. At the follow-up periodontal visits, patients had low overall oral hygiene with bleeding at probing in 66.6% and plaque in the anterior area in 76.2% of patients. From the total examined 240 teeth of the frontal sextants, only three patients showed GR, and the gingival phenotype was thick in 55% of cases. Based on the results, the non-extractive orthodontic treatment would appear not to affect the development of buccal or lingual recessions or the periodontal state after at least two years of post-orthodontic retention. A slight increase in the risk of developing buccal RBC was detected only in correlation with the presence of a fixed retainer and thin gingival phenotype, mainly in patients with gingivitis. Thus, this research will be extremely useful for clinicians in order to schedule periodical periodontal follow-up appointments, mainly in patients after orthodontic treatment, in order to motivate them to maintain better oral hygiene in adulthood [11].

The paper of Malcangi et al. [9] described a rare case of orthodontic-surgical treatment. In particular, they described a case of inclusion of both maxillary permanent central incisors. This situation negatively affects facial appearance, phonation, and mastication function. As a consequence, early diagnosis is essential to avoid complications and failures. Various reasons for the inclusion were identified, but supernumerary teeth were the leading cause. Early causes of removal and the rapid expansion of the palate show a great chance of success with the spontaneous eruption of the impacted elements; however, surgical orthodontic treatment is often necessary. The inclination of the teeth with respect to the midline and the root maturation degree establishes prognosis and therapeutic times. In this clinical case, a 9-year-old boy showed two impacted supernumerary teeth in the anterior maxillary region, hindering the eruption of the permanent upper central incisors. The impacted supernumerary teeth were surgically removed at different times. A straight wire multibracket technique associated with a fixed palatal appliance was chosen. The palatal appliance consisted of an osteomucosal resin support at the level of the retroincisal papilla. Subsequently, surgical exposure was performed using the closed eruption and elastic traction technique, bringing 11 and 21 back into the arch. The authors concluded that an early and accurate diagnosis supported by clinical and radiological examinations, such as OPG X-ray and CBCT, is crucial. It is essential to evaluate the predictive eruption factor that conditions the treatment plan, such as: patient age, history, compliance, distance from the occlusal plane, vertical position of non-erupted incisors, and inclination with respect to the midline. Complication during tooth eruption could negatively affect the occlusion development and the child's psychology. The early orthodontic interceptive treatment with the elimination of the obstacle and orthopedic expansion with RME is fundamental. In general, the surgical-orthodontic treatment of impacted incisors has a good chance of success, but it takes time. It is essential to inform patients and their parents of the risk of failure and increase in treatment times, especially when the impacted incisors are in a very high alveolar position [9].

With their paper "Predictors of Analgesic Consumption in Orthodontic Patients", Juloski et al. [12] analyzed the predictors of analgesics consumption and identified the predictive factors for the self-administration of analgesics in orthodontic patients after the initiation of treatment with multibracket fixed appliances. During orthodontic treatment, pain is a subjective experience influenced by several factors, and patients use analgesics at different rates to relieve this pain without any specific guideline. Thus, the correlations between orthodontic pain and analgesic consumption were investigated after the beginning of orthodontic treatment with fixed appliances, in order to predict them. In a diary, for seven days, the 286 patients who participated in this study recorded their pain intensity (using a 0–10 numerical rating scale), analgesic usage, pain localization, pain triggers, and

pain characteristics. Univariable analyses revealed the presence of potential predictive factors: age, gender, pain intensity, pain localization, pain while chewing, pain at rest, night pain, headache, pulsating pain, sharp pain, dull pain, and tingling. Multivariate analyses revealed that increasing age, increasing pain intensity, and the presence of a headache all increased analgesic consumption. Overall, the model explained 33% of the variability in analgesic requirement. Analgesic use has been shown to be predicted by age, pain intensity, and headache, and knowledge of these factors can facilitate clinicians in identifying orthodontic patients who will consume analgesics on their own. In the conclusion, the authors affirmed that age, intensity of pain, and headache are fair predictors for analgesic consumption [12].

The last paper, by Gibson et al. [10], evaluated the upper airway volumes and cephalometric values in juvenile idiopathic arthritis (JIA) patients compared to healthy controls. The temporomandibular joint (TMJ) is involved in 30–45% of patients with all JIA subtypes. These subjects may show altered craniofacial morphology such as micrognathia, retrognathia, hyperdivergent mandibular plane angle, and skeletal anterior open bite. These features are also associated with non-JIA pediatric patients with obstructive sleep apnea (OSA). The research included a group of 32 JIA patients and a group of 32 healthy subjects. A CBCT was requested from each patient, and the DICOM files were imported into Dolphin Imaging software to measure the upper airway volumes and the most constricted cross-sectional areas of each patient. The cephalometric images were exported from the CBCT data for each patient, and several cephalometric values were assessed. All measurements were compared between the JIA and control groups. For airway values, statistically significant differences were found in the nasopharynx airway volume, total upper airway volume, and the most constricted cross-sectional area, whereas the oropharyngeal airway volume did not show significance. In the cephalometrics, a statistically significant difference was found for the posterior facial height.

In conclusion, this study showed that there was a difference in the posterior face height, as well as a significant difference in total upper airway volume, nasopharynx airway volume, and most constricted cross-sectional area measurements between the JIA and control patients.

Specifically, 50% of JIA patients had an airway with a most constricted cross-sectional area of less than 100 mm², and 67% had an asymmetric airway form [10].

Thus, this Special Issue will be helpful in evaluating the most current and significant interdisciplinary diagnostic and treatment approaches currently available in orthodontics and TMD management in both young and adult patients.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Scribante, A.; Gallo, S.; Bertino, K.; Meles, S.; Gandini, P.; Sfondrini, M.F. The Effect of Chairside Verbal Instructions Matched with Instagram Social Media on Oral Hygiene of Young Orthodontic Patients: A Randomized Clinical Trial. *Appl. Sci.* **2021**, *11*, 706. [[CrossRef](#)]
2. Pasciuti, E.; Coloccia, G.; Inchingolo, A.D.; Patano, A.; Ceci, S.; Bordea, I.R.; Cardarelli, F.; Di Venere, D.; Inchingolo, F.; Dipalma, G. Deep Bite Treatment with Aligners: A New Protocol. *Appl. Sci.* **2022**, *12*, 6709. [[CrossRef](#)]
3. Sfondrini, M.; Butera, A.; Di Michele, P.; Luccisano, C.; Ottini, B.; Sangalli, E.; Gallo, S.; Pascadopoli, M.; Gandini, P.; Scribante, A. Microbiological Changes during Orthodontic Aligner Therapy: A Prospective Clinical Trial. *Appl. Sci.* **2021**, *11*, 6758. [[CrossRef](#)]
4. Scrascia, R.; Ciccù, M.; Manco, C.; Miccoli, A.; Cervino, G. Angled Screwdriver Solutions and Low-Profile Attachments in Full Arch Rehabilitation with Divergent Implants. *Appl. Sci.* **2021**, *11*, 1122. [[CrossRef](#)]
5. Sfondrini, M.F.; Pascadopoli, M.; Dicorato, S.; Todaro, C.; Nardi, M.G.; Gallo, S.; Gandini, P.; Scribante, A. Bone Modifications Induced by Rapid Maxillary Expander: A Three-Dimensional Cephalometric Pilot Study Comparing Two Different Cephalometric Software Programs. *Appl. Sci.* **2022**, *12*, 4313. [[CrossRef](#)]

6. Inchingolo, A.D.; Carpentiere, V.; Piras, F.; Netti, A.; Ferrara, I.; Campanelli, M.; Latini, G.; Viapiano, F.; Costa, S.; Malcangi, G.; et al. Orthodontic Surgical Treatment of Impacted Mandibular Canines: Systematic Review and Case Report. *Appl. Sci.* **2022**, *12*, 8008. [[CrossRef](#)]
7. Scribante, A.; Gallo, S.; Pascadopoli, M.; Canzi, P.; Marconi, S.; Montasser, M.A.; Bressani, D.; Gandini, P.; Sfondrini, M.F. Properties of CAD/CAM 3D Printing Dental Materials and Their Clinical Applications in Orthodontics: Where Are We Now? *Appl. Sci.* **2022**, *12*, 551. [[CrossRef](#)]
8. D'Apuzzo, F.; Nucci, L.; Strangio, B.M.; Inchingolo, A.D.; Dipalma, G.; Minervini, G.; Perillo, L.; Grassia, V. Dento-Skeletal Class III Treatment with Mixed Anchored Palatal Expander: A Systematic Review. *Appl. Sci.* **2022**, *12*, 4646. [[CrossRef](#)]
9. Malcangi, G.; Inchingolo, A.D.; Patano, A.; Coloccia, G.; Ceci, S.; Garibaldi, M.; Inchingolo, A.M.; Piras, F.; Cardarelli, F.; Settanni, V.; et al. Impacted Central Incisors in the Upper Jaw in an Adolescent Patient: Orthodontic-Surgical Treatment—A Case Report. *Appl. Sci.* **2022**, *12*, 2657. [[CrossRef](#)]
10. Gibson, M.; Cron, R.Q.; Stoll, M.L.; Kinard, B.E.; Patterson, T.; Kau, C.H. A 3D CBCT Analysis of Airway and Cephalometric Values in Patients Diagnosed with Juvenile Idiopathic Arthritis Compared to a Control Group. *Appl. Sci.* **2022**, *12*, 4286. [[CrossRef](#)]
11. Natri, L.; Nucci, L.; Carozza, D.; Martina, S.; Serino, I.; Perillo, L.; D'Apuzzo, F.; Grassia, V. Gingival Recessions and Periodontal Status after Minimum 2-Year-Retention Post-Non-Extraction Orthodontic Treatment. *Appl. Sci.* **2022**, *12*, 1641. [[CrossRef](#)]
12. Juloski, J.; Vasovic, D.; Vucic, L.; Pajevic, T.; Gligoric, N.; Mirkovic, M.; Glisic, B. Predictors of Analgesic Consumption in Orthodontic Patients. *Appl. Sci.* **2022**, *12*, 3390. [[CrossRef](#)]

Short Biography of Author

Dr. Giuseppe Minervini graduated in Dental Medicine in July 2016 with honors. During his undergraduate course, he attended the “Rey Juan Carlos Alcorcon” in Madrid (Spain) between September 2013 and June 2014 for the Erasmus project. He received his Postgraduate Diploma in Orthodontics in December 2020 from the University of Campania, Luigi Vanvitelli, Naples, Italy. Dr. Minervini is currently a PhD student in Biochemistry and Biotechnology at the University of Campania, Luigi Vanvitelli, Naples, Italy. He visited the scholar Tweed Study Course in 2019 at Charles H. Tweed International Foundation, Tucson, Arizona. He is Subject Expert in Dental Materials and a tutor in the Orthodontics Dentistry School at the University of Campania Luigi Vanvitelli, Naples, Italy. He is also Executive Guest Editor for several Special Issues and a member of the SIDO, EOS. Dr. Minervini has published several articles and posters (h-index: 12) as an author or co-author. He has received several awards and distinctions. His research interests include biomedical and biomaterials application for the craniofacial, oral and temporomandibular area, dentofacial orthopedics, orofacial pain, temporomandibular joint disorders, prosthesis, oral pathology, orthodontics, and teledentistry.