

Novel Device Designed and Fabricated to Orienting Jaw Models in Natural Head Position

Rakesh Kumar¹, Dr. Akash Saxena², Kishore Mishra³, Dr. Mukesh Kumar⁴

¹M.Tech Student, Department of Computer Science & Engineering, Compucom Institute of Technology and Management, Jaipur, Rajasthan, India

²Principal, Department of Computer Science & Engineering, Compucom Institute of Technology and Management, Jaipur, Rajasthan, India

³Assistant Professor, Department of Computer Science & Engineering, Compucom Institute of Technology and Management, Jaipur, Rajasthan, India

⁴Associate Professor, Department of Dentistry, All India Institute of Medical Sciences (AIIMS), Kalyani, West Bengal, India

ABSTRACT

Proper diagnosis is very important in orthodontic applications aiming to correct the irregularities in the teeth, the relationships of the jaws models, malocclusions, and the positions of the jaw bones on the facial skeleton. Gypsum models are continually used in dentistry for treatment planning, diagnosis, appliance fabrication as well as comparison of treatment outcome. Regularly, the diagnostic jaw models are mounted arbitrarily on a flat base, which may not or may represent the actual orientation of the jaw in face. Facebow with articulators are usually used to orient and mount these jaw models in an orientation corresponding to actual orientation of that particular jaw in that face. The long time, high cost, specialized technique as well as training are the factors restricting the use of Facebow with articulators on regular basis. The current innovative design is cost effective, simple to use and time saving equipment which can be fabricated in office, institute and may be used for orientation transfer and mounting of these jaw models on its base.

Keywords - Jaw models, Facebow, Orthodontic, OrJiN, Deep Learning

INTRODUCTION

Orthodontic diagnosis is a challenging undertaking since it necessitates a complete simultaneous evaluation of various facial components from various angles. Orthodontics is the speciality of dentistry that engages with correction of teeth and jaw [1]. The forwardly and irregular placed tooth are aligned and brought in a more acceptable position using various brackets. Wire combination along with some other accessories like springs as well as elastics. The non-surgical correction of jaw bones are also carry out in growing subjects with jaw bones disharmony, using various fixed or removable orthopaedic appliance to achieve a harmonious dento-facial skeletal structure and its relationship to cranial base.

ORTHODONTIC

Orthodontics is a dentistry specialty that addresses the prevention, diagnosis, management, correction of mal-positioned teeth and jaws, and misaligned bite patterns. Orthodontic diagnosis involves a clear understanding of relationship to cranial base and dento-facial skeletal system. The diagnostic process in orthodontic defines any discrepancies of teeth or jaw bones in all the three planes of spaces [2].

Diagnostic aids are the tools that helps in treatment planning and diagnosis. Facial extraoral and intraoral photographs, x-rays and dental models are the most common diagnostic tools practiced universally for orthodontic treatment planning and diagnosis. In recent decades, the arrival of 3D technology for imaging science has increased the diagnostic accuracy, but the affordability and availability of these high end machines and technologies remains questionable for routine dental practice in developing countries like India.

Customarily, these plaster dental models are produced with a model base, that not only adds aesthetics but also prevent the model from rolling while working on it. These bases are formed either with freehand or using rubber base former. Earlier, the angulation and thickness of these bases are given extra weightage in numerous scientific literature, vis-a-vis the orientation of these dental casts on the model base has remained a neglected issue in routine dental as well as orthodontic practice [5].

As a result widely the routine dental models are seen with teeth level parallel to the floor on its model base. Though some educators orient it manually while making the base, but that again depends on his or her visualization of the patient, as well as is never accurate, and may lead to mis-diagnosis.

Oriending Jaw Models In Natural Head Position

OrJiN (Oriending Jaw models In Natural Head Position) novel device is fabricated and designed to orient the jaw models on its base, corresponding to its spatial orientation in all the 3 planes of space and in natural head position [4]. The exact orientation of jaw models on its base, in all the 3 planes of space as well as corresponding to its orientation in face, is utmost important for precise treatment planning and diagnosis and accurate fabrication of dental appliances. A scientific approach for orienting jaw models corresponding to its orientation in face is done by using semi or fully automatic articulators and face-bow transfer [3]. The high cost, specific training, sensitivity of the articulators as well as availability to general dentists are the major facts for its very limited use especially in routine dental or orthodontic practice.

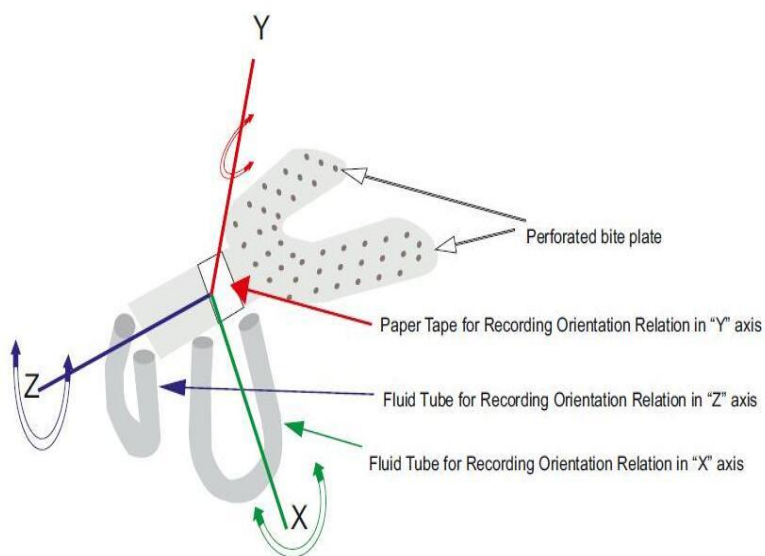


Figure 1. Schematic Diagram of OrJiN Design

Orjin Working Model



Figure 2. Appliance with Soft Wax

Description : Appliance with soft wax on perforated plate to record teeth indentation.



Figure 3. Patient with Appliance - Front View

Description : Patient with appliance in mouth and fluid level marked - Front View.

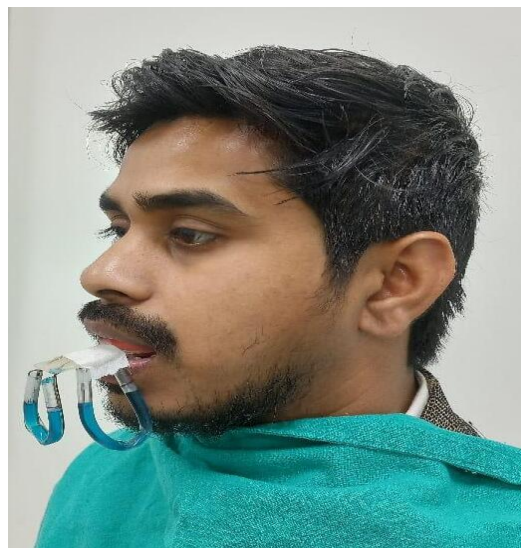


Figure 4. Patient with Appliance - Side View

Description : Patient with appliance in mouth and fluid level marked - Side View.



Figure 5. Dental Model Mounted with the OrJIN Appliance

Description : Dental model mounted with the OrJIN Appliance in place and maintaining the same fluid level as marked in patients mouth. For orienting the jaw model as in mouth.



Figure 6. Dental Model with Base – Model

Description : Dental model with base - model oriented on base in the same spatial orientation as in patients mouth.

Orjin Advantages

1. Cost effective
2. Easy availability of components
3. Easy fabrication
4. Non technique sensitive
5. No specific training required
6. Reusable
7. Autoclavable
8. Patient and operator friendly
9. Can be used for all routine cases.

Orjin Parts of Appliance

- i. Bite plate : Bite plates use an acrylic plane on either the posterior or anterior teeth to help reposition the jaw or prevent bruxism.
- ii. Modelling wax : Modelling wax aids in fabricating accurate wax patterns for crowns, bridges, as well as dentures.
- iii. Fluid tube : Rubber tubing is durable, flexible and chemical resistant. It is often used for applications involving gases, fluids or chemicals.
- iv. White tape : Easy Tape easily slides into even the tightest spaces between teeth. This makes it especially ideal for flossing beginners.

CONCLUSION

The dental model is simply available, cheapest and non-technique sensitive, 3D model readily available in all dental clinics worldwide. These plaster models are made for a significantly higher percentage of patients in routine dental practice and for all patients in Orthodontic practice. These models serves as the exact 3D replica of patients mouth in absence of the patient and are highly used for treatment planning, diagnosis, fabrication of various appliance and prosthesis too for comparison between the pre-treatment condition as well as post-treatment outcome.

REFERENCES

- [1]. Khanagar SB, Al-Ehaideb A, Vishwanathaiah S, Maganur PC, Patil S, Naik S, et al. Scope and performance of artificial intelligence technology in orthodontic diagnosis, treatment planning, and clinical decision-making - A systematic review. J Dent Sci. 2021;16(1):482– 92. doi:10.1016/j.jds.2020.05.022.
- [2]. Hung HC, Wang YC, Yu-Chih W. Applications of Artificial Intelligence in Orthodontics. Taiwanese J Orthod. 2020;32(2):3–3. doi:10.38209/2708-2636.1005.

- [3]. Hussain MA, Fatima S, Reddy KK, Ramya Y, Betha SP, Kauser A, et al. Artificial intelligence in orthodontics: A review. *Int J Health Sci.* 2022;6(S2):9378–3.
- [4]. Faber J, Faber C, Faber P. Artificial intelligence in orthodontics. *APOS Trends Orthod.* 2019;9(4):201–5.
- [5]. Bahaa K, Noor G, Yousif Y. The artificial intelligence approach for diagnosis, treatment and modelling in orthodontic. *Principles Contemp Orthod.* 2011;p. 451.