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## **AAO Foundation Final Report Form** (a/o 2/9/2021)

Type of Award

Research Aid Award

Name of Principal Investigator

Ryan Kearney

Institution

University of North Carolina

Title of Project

Investigation into Long-Term Stability of Anterior Openbite Correction with Clear Aligners

Period of AAOF Support

07-01-2021 to 06-30-2022

Amount of Funding

\$5,000

- **Summary**

Anterior Open Bites (AOB) are one of the more challenging cases to treat and retain in the field of orthodontics. Previous literature outlines these difficulties, but there is not enough evidence supporting long-term stability of treatments to properly inform AOB patients on informed consent, outcomes, and reasonable expectations of non-surgical aligner treatment.

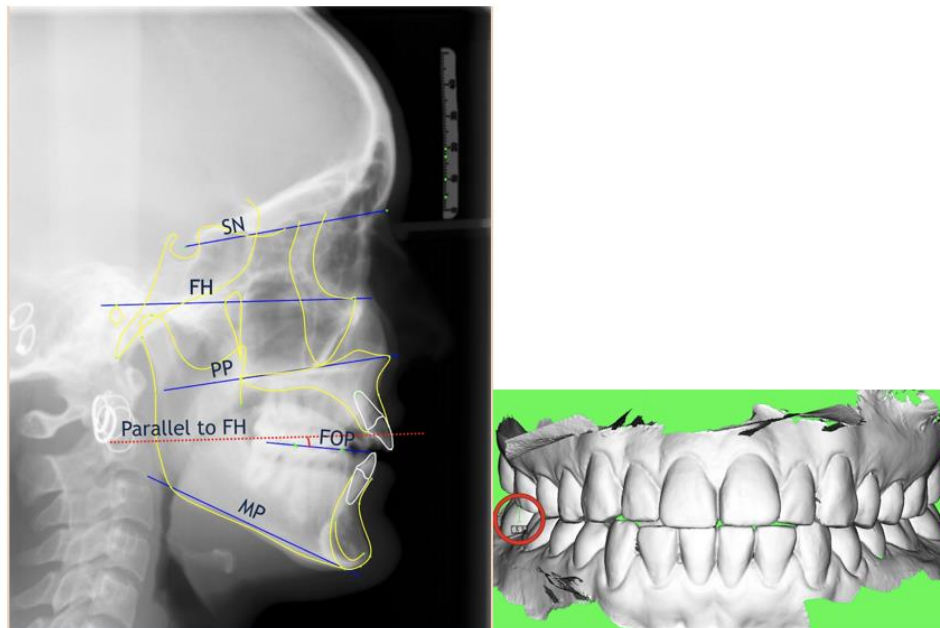
This study assessed long-term records of two private practice offices. A few unforeseen hurdles were encountered that weren't fully understood until records analysis was completed. Both providers had multiple variations of cephalometric and CBCT machines over the past 10 years and thus created issues with accurate superimpositions to determine which teeth were actually being extruded or intruded. Therefore, the focus shifted to using the validated Photographic Open Bite Severity Index (POSI), seen in Figure 1, to grade severity of the AOB pre-treatment and verify complete closure of the AOB at treatment end and during the retention phase. We still used angular measurements to determine effects of treatment.



**Fig 1:** The Photographic Open Bite Severity Index (POSI)

- **Outcomes**

There was great variability in the front center intraoral photo, because not all intraoral center photos were taken in Natural Head Position (NHP). Therefore, we standardized patient intraoral scans and oriented them to the closest verifiable orientation of NHP: Frankfort Horizontal (Figure 2). This method was used for both scoring initial AOB and verified closure of AOB at conclusion of treatment.



**Fig 2:** Traced ceph and adjusted model for FH-FOP

Patients exhibiting AOBs are being treated successfully with aligners. AOB aligner treatment is executed by some variation of incisor extrusion and molar intrusion. It is commonly believed the bite block effect of aligners creates posterior molar intrusion due to the violation of molar freeway space causing the masseteric and secondary muscles to be in a strained position causing intrusion. Interestingly, when patients were separated based off the presence or absence of bite blocks in their aligners, both groups had patients who exhibited a decrease in their SN-MP angle from pre-treatment to post-treatment cephalometric radiographs. This indicates for some AOB patients, the thickness of two aligners in their mouth violates the freeway space, and for others, the presence of additional bite block thickness is needed. Other patients regardless of the presence of bite blocks did not give their freeway space violated to allow posterior intrusion.

Most patients in the study were stable in the retention phase. Retention of each patient varied, but all patients had a lower 3-3 lingual bonded retainer at the L3s with an overlay Essix retainer. For maxillary retention, patients had either an Essix retainer or a bonded palatal U2-2 or U3-3 with an overlay Essix retainer. Over 25% of patients had relapse of their AOB exhibited by reopening of the AOB at the maxillary lateral incisor.

Contrary to cephalometric radiographs, intraoral photos are hard to capture with the patient in NHP. Many ways dependent on staff or doctor preference can be done to help standardize these photos to be captured in NHP. The best suggestion to have repeatable NHP intraoral center photos is to capture the intraoral center photo by cropping an extraoral frontal photo (with cheek retractors) where NHP can be assessed more readily.

	Pre-Treatment Ceph		Post-Treatment Ceph		Treatment Changes
	Mean	SD	Mean	SD	
ANB	3.0	2.9	3.0	2.9	0
PP-FH	-5.0	3.3	-4.7	3.6	0.3
FOP-FH	6.4	4.4	5.3	5.0	1.1
MP-FH	27.1	5.2	27.0	5.6	0.1
PP-SN	-0.9	4.8	-1.6	5.0	0.7
FOP-SN	18.6	6.1	16.8	6.8	1.8**
MP-SN	38.1	6.7	37.2	7.0	0.9*

Table 1

- **Impact**

The support from the AAOF has allowed an immensely valuable study to be completed in an ever-growing popular orthodontic treatment modality, namely aligners. Not only does this study contribute to the aligner treatment literature, but it highlights the importance of obtaining reproducible, accurate longitudinal records.

Respond to the Following Questions:

1. *Were the original, specific aims of the proposal realized?*

The study allowed an intricate and detailed examination of aligner treatment outcomes from multiple providers. The primary aim to quantify the stability of AOBs using POSI index provided substantial long-term data supporting the stability of AOB closure when determined by the POSI. The secondary aim focused on patient and radiographic factors contributing to the stability of AOB treatment provided both some answers and also created additional questions. The data supports the maxillary lateral incisor being the most relapse prone tooth for maintaining positive OB. While studying the radiographic factors and relapse outcomes using the POSI index, two things became apparent: (1) Retention radiographs are rarely taken and are needed for the most conclusive results to determine true stability from orthodontic treatment; (2) There needs to be guidance for providers to obtain standardized radiographs for use in longitudinal research studies.

2. *Were the results published?*

We plan to submit a manuscript to the *Angle Orthodontist*. The first draft of the manuscript is currently being reviewed by the study team prior to submission.

3. *Have the results of this proposal been presented?*

The goal is to present this study at the IADR 2023.

4. *To what extent have you used, or how do you intend to use, AAOF funding to further your career?*

I am very grateful to the AAOF for the funding which was paramount to allow me to answer my research question in this real-world private practice study. This proved to be such a valuable experience as part of my education as a resident and aided my validation of being involved in academics as a clinical instructor and researcher. It also has allowed me to realize that as a clinician, it is still possible to answer clinical questions as they arise in a methodical and robust manner. My hope is to continue work with the AAOF as my career develops and help students and residents like myself be involved with the AAOF to help guide their careers and research. Thank you!

Accounting for Project;

All funds are spent.