

Longitudinal Outcomes of Bone Anchored Maxillary Protraction Treatment

2024 Research Aid Awards (RAA)

Dr. Christine Esposito

cnesposi@unc.edu
O: 215-208-3061

FollowUp Form

Award Information



In an attempt to make things a little easier for the reviewer who will read this report, please consider these two questions before this is sent for review:

- Is this an example of your very best work, in that it provides sufficient explanation and justification, and is something otherwise worthy of publication? (We do publish the Final Report on our website, so this does need to be complete and polished.)*
- Does this Final Report provide the level of detail, etc. that you would expect, if you were the reviewer?*

Title of Project:*

Longitudinal Outcomes of Bone Anchored Maxillary Protraction Treatment

Award Type

Research Aid Award (RAA)

Period of AAOF Support

July 1, 2024 through June 30, 2025

Institution

University of North Carolina at Chapel Hill

Names of principal advisor(s) / mentor(s), co-investigator(s) and consultant(s)

Christine Esposito, DMD (PI Resident), Jennifer Judd (Dental Student), Laura Jacox, DMD, MS, PhD (Co-Faculty mentor), Kelly Mitchell, DDS, MS (Co-Faculty mentor), and George Blakey, DDS (Co-Faculty mentor and Oral Surgery Co-investigator)

Amount of Funding

\$6,000.00

Abstract

(add specific directions for each type here)

See attached.

Respond to the following questions:

Detailed results and inferences:*

If the work has been published, please attach a pdf of manuscript below by clicking "Upload a file".

OR

Use the text box below to describe in detail the results of your study. The intent is to share the knowledge you have generated with the AAOF and orthodontic community specifically and other who may benefit from your study. Table, Figures, Statistical Analysis, and interpretation of results should also be attached by clicking "Upload a file".

FinalCephFigure (1).pdf

The final study cohort consisted of 45 BAMP+ patients and 39 controls. The treatment and control groups were well matched demographically, and there were no significant differences between BAMP+ and control groups in cephalometric measures at baseline T0. There were significant differences in age between the BAMP+ and control groups at each timepoint, with the BAMP+ group being 8-11 months younger. However, the groups were similar in skeletal age, as there were no differences in CVM stage at each timepoint. Intra-rater concordance correlation coefficients indicated high repeatability in cephalometric tracings.

Significant treatment changes occurred from T0 to T1 for the BAMP+ cohort; SNA and AN-Perp advanced 1.8°/1.73 mm more in the treatment group, indicating a more forward position of the maxilla at T1 compared to controls. BAMP treatment did not appear to affect or restrict mandibular growth, as indicated by significant increases in SNB in both groups and no significant differences between the two groups for change in SNB, BN-Vert or BN-Perp. Consistent with these findings, the BAMP+ group showed a slight improvement in ANB of 0.72°, while ANB decreased by -1.28° in the control group, for a total clinically significant difference of 2°. A similar pattern was observed for Wits in each group, with an improvement in the BAMP+ group towards Class I (+1.21 mm) and worsening in the control group towards Class III (-1.05 mm). OJ also increased 0.93 mm in the treatment group, but this change was not significant when compared to controls. Of note, change in bodily incisor position (U1-NA mm) was significantly different between groups, with a greater mean change in controls (+1.74 mm) compared to BAMP patients (+0.58 mm). There was also a significant increase in L1-NB (mm) in the BAMP+ group from T0 to T1, and an increase in U1-SN and U1-NA (°) in the control group over the same time period; however, when comparing these changes between groups, they were not significant. Of these statistically significant treatment effects, only the changes in ANB and Wits were found to be clinically significant between groups.

At T1, there were significant differences between groups in SNA, ANB, AN-Perp, U1-NA (mm), and Wits, with values indicating a less severe Class III malocclusion in the BAMP+ cohort (SNA: 82.8°, ANB: -0.34°, AN-Perp: 1.38 mm, U1-NA (mm): 5.93 mm, Wits: -4.88 mm,) compared to controls (SNA: 80.16°, ANB: -2.61°, AN-Perp: -1.65 mm, U1-NA (mm): 7.11 mm, Wits: -7.42 mm).

When comparing changes from T1 to T2 between the BAMP+ and control groups, significant differences were noted for ANB angle, BN-Vert (mm) and Wits. Changes in all three measures indicated greater worsening of the Class III malocclusion in the BAMP+ group (Change in ANB: -0.35° , Wits: -0.65 mm, BN-Vert: $+3.59$ mm) with slight improvement in controls (Change in ANB: $+0.44^\circ$, Wits: $+1.05$ mm, BN-Vert: -0.17 mm). Of these variables, only the changes in BN-Vert were found to be clinically significant. Nonetheless, BAMP patients finished orthodontic treatment at T2 with significantly different and less severe ANB (BAMP: -0.66° , Control: -2°) and AN-Perp values (BAMP: 1.97 mm, Control: -0.45 mm). Changes from T1 to T2 in overjet, incisor angulation and bodily position were non-significantly different between groups. However, at T2 U1-NA (mm) remained significantly greater in the control group compared to the BAMP+ group (BAMP: 6.42 mm, Control: 7.70 mm).

Definitive treatment modalities differed between BAMP+ and control groups for non-surgical treatment only, with 55.17% of the control group having camouflage treatment with extractions, compared to only 21.05% in the treatment group. There was no significant difference in extraction patterns between groups. Of the BAMP+ group, 15.56% were treated with orthognathic surgery, compared with 25.54% of controls ($p=0.2512$). There was a greater number of two-jaw surgeries in the BAMP+ group, but the difference was not statistically significant. The mean observation time from initial records to treatment end was about five years in both groups; total comprehensive treatment time was also similar between groups, averaging around 2.5 years.

Over the entire study period (T0-T2), significant positive treatment effects of BAMP were observed for SNA, ANB and AN-Perp when comparing changes between groups. The BAMP+ group had about a 1° greater improvement in SNA and ANB and 1 mm greater improvement in AN-Perp over the control group. There was also a significant change in upper incisor position, measured at U1-NA (mm). The upper incisors were advanced 1.32 mm more in the control group than the BAMP group. All of these changes initially occurred over the BAMP treatment phase (T0-T1); in some instances, the magnitude of change was slightly reduced during comprehensive treatment.

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

Bone anchored maxillary protraction (BAMP) is a well-tolerated treatment for Class III orthopedic effects during adolescence. BAMP aims at improving Class III skeletal relationships with minimal dentoalveolar compensations, in hopes of reducing orthognathic surgery. Our aim was to evaluate short and long-term effects of BAMP on measures of tooth and jaw positions and definitive treatment outcomes in Class III patients treated with (+) and without (-) BAMP during adolescence.

Patients treated with BAMP ($n=45$) in adolescence were compared to an adolescent Class III control group ($n=39$), prior to comprehensive treatment. Lateral cephalograms were used to quantify skeletal and dental relationships at initial records (T0, before BAMP or growth observation), along with initial (T1) and final (T2) comprehensive records. Patients were categorized by their definitive treatment modality- surgical, with one-jaw and two-jaw subcategories, or camouflage, with extraction and non-extraction subcategories.

Data indicates BAMP+ patients had improvements in skeletal measures including SNA ($p=0.0002$), ANB ($p<0.0001$) and Wits ($p<0.0001$) compared to controls after Phase I treatment. From T1-T2, changes in ANB ($p=0.0172$), Wits (0.0037) and BN-Vert ($p=0.0488$) indicate a greater worsening of Class III malocclusion in the BAMP+ group, suggesting additional growth. At comprehensive treatment conclusion, BAMP+ patients had a higher ANB ($p=0.0366$) and AN-Perp ($p=0.0431$) than controls, while controls had greater upper incisor protrusion ($p=0.0109$). There was no difference in the prevalence or type of orthognathic surgery. Among patients treated with orthodontic camouflage, controls (55.17%) were more likely to require extractions than BAMP+ patients (21.05%, $p=0.0039$).

There is modest improvement in maxillary position associated with BAMP, with limited effect on dentoalveolar outcomes. BAMP did not influence comprehensive treatment modality (surgical vs. camouflage); however, controls with camouflage were over twice as likely to require extractions compared to BAMP+ patients. Our findings suggest BAMP may reduce extractions with limited effect on orthognathic surgical need.

Were the results published?*

No

Have the results of this proposal been presented?*

No

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

AAOF funding enabled us to carry out this longitudinal retrospective study, which will provide practitioners with new data to consider when evaluating treatment options for Class III growing patients. AAOF funding had a significant impact on my orthodontic training and will continue to do so as I begin my career in private practice. Although I will no longer be in an academic environment, I hope to stay involved in research by utilizing my clinical experiences to inspire future projects that further the orthodontic specialty.

Accounting: Were there any leftover funds?

\$0.00

Not Published

Are there plans to publish? If not, why not?*

Yes, manuscript was reviewed and requires minor revisions prior to publication. We are currently revising for submission to AJODO based on reviewer comments.

Not Presented

Are there plans to present? If not, why not?*

The project was presented at the UNC Adams School of Dentistry Research Day in March 2025 and the AAO annual session Resident Poster Presentation in April 2025.

Internal Review

Reviewer comments

Reviewer Status*

File Attachment Summary

Applicant File Uploads

- FinalCephFigure (1).pdf

