Effect of Positional Plagiocephaly on Dental and Mandibular Alignment

Alyssa Davis, MS; Lisa Abernethy, MS, L/CPO; Baylor College of Medicine-Orthotics and Prosthetics;
Lisa.Abernethy@bcm.edu

Creation Date: December 2025; Date for Reassessment: July 2026

Clinical Question: Does the presence of positional plagiocephaly affect dental alignment and symmetry, and if so, does cranial remolding orthosis treatment resolve it?

Background: Cranial remolding orthoses (CROs) are used to treat and correct the head shape of infants with cranial asymmetries such as plagiocephaly.[1,2] Since the Back to Sleep campaign in 1994, head shape abnormalities such as plagiocephaly and brachycephaly have become much more prevalent.[3] Some side effects of plagiocephaly and brachycephaly might include dental and facial asymmetries.[3,4]

Examples of dental asymmetries are malocclusions (misaligned bite), mandibular deviation from midline, and asymmetries of the chin. Though there are a significant number of studies that have been published about CROs, very few have looked at their connection to dental malocclusions and asymmetry.

Search Strategy: All searches were performed on October 9th of 2024. Web of Science was searched using the search times cross referenced with the topic, PubMed was searched using the title and abstract, EmBase was searched using the title, abstract, and keywords, OVID was searched using the MP function (title, abstract, key words, synonyms, etc.), and Ebsco was searched using the abstract.

Databases Searched: Web of Science, PubMed, EmBase, OVID, and Ebsco, JPO, CINNAHL
Search Terms: {(Plagiocephaly OR brachycephaly) AND (Dental OR orthodontics OR mandible) AND (Cranial remolding orthosis OR helmet)}

Inclusion/Exclusion Criteria: The inclusion criteria were full text available, English publication available, cranial remolding orthosis as intervention, objective measurements taken and results provided relating to the mandible, and positional plagiocephaly or brachycephaly. The exclusion criteria included craniosynostosis and repositioning as only intervention.

Synthesis of Results: A total of seven studies met the inclusion criteria, five of which included a comparative group. Three longitudinal studies with sample populations of 28, 63, and 100, (two with a non treated control group) investigated dental effects and found DP might be associated with a higher prevalence of occlusal abnormalities in primary dentition, especially malocclusion and deviation of midline. [5–7]According to Nevaste, Sasaki, and Moon who looked at 16, 123, and 48 DP patients, DP is associated with an asymmetric face and mandible, where mandibular deviation was associated with contralateral cranial flattening.[4,8,9]
Furthermore, Moon found that mandibular asymmetry was correlated with severity of CVA. St. John did not find significant displacement of the temporomandibular joint, however they did find auricular displacement correlated with the severity of cranial asymmetry.[10]

Clinical Message: In conclusion, the studies noted a pattern where the ipsilateral plagiocephaly side matched mandibular asymmetry. However, some limitations were noted. All the studies used different measurements making it difficult to accurately compare the results. Some of the measurements used did not have any correlation with plagiocephaly and none of the studies included before and after intervention comparisons. Further research is needed prior to drawing a definitive conclusion.

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Evidence Table

	Nevaste-Boldt, 2023	Sasaki, 2020	Kunz, 2019	Kluba, 2016	Moon, 2014	Lee, 2008	St. John, 2002
Population	Total: 24; ULC group: 8, mean age 1.4 years (2 female, 6 male); DP group: 16, mean age 1.5 years (4 females, 12 males)	Total: 129, mean age 25 years (96 female, 33 male)	Total: 63; DP Treated: 32, mean age 6 months; DP Untreated: 13, mean age 5.9 months; No DP Control: 18, mean age 5.9 months;	Total: 100; Treated: 50, mean age 3.6 years (male, 29; female, 21). Untreated: 50, mean age 3.3 years (male, 30; female, 20)	Total: 78 mean age pretreatment 8.5 months; DP Group: 48 (17 female, 31 male); Control: 30 (12 female, 18 male) mean age at scan 14.4 months	Total: 28 (14 male, 14 female); Mean age at start 6.7 months; mean age at follow up 5.6 years	Total: 27, mean age 6.2 months (11 female, 16 male); Post treatment: Treated: 10, mean age 11 months (4 female, 6 male)
Study Design	Retrospective cross-sectional comparative	Retrospective cross-sectional	prospective cross-sectional with a control group	prospective cross-sectional with blinded significance testing with a control group	Retrospective cross-sectional with control	prospective cross-sectional with blinded significance testing	Prospective cross-sectional with control
Intervention	None	None	Cranial Remolding Orthosis	Cranial Remolding Orthosis	none	Cranial Remolding Orthosis	Cranial Remolding Orthosis
Comparison	DP and Unilateral Lambdoid Craniosynostosis(ULC)	None	Untreated and health control group	Untreated control group	Healthy control-no DP	No control group	Untreated and Treated groups
Outcome Measures	CT scans. The sagittal discrepancy of the Co. The symmetry of ANS was measured rom coronal plane and the symmetry of Pgn was measured from the axial	CT scans were performed for 3D reconstruction. CVAI: cranial vault asymmetry index; CI: cephalic index; VRL, Me angle: index of facial asymmetry;	Scoliosis of the face, asymmetries of the chin, mandibular deviations of the midline, the existence of lateral crossbites, and the maximum opening of the mouth.	CVAI, overjet, overbite, Deviations of the midlines either in the maxilla or mandible, Inclined occlusal plane, deviation on mouth opening, cross bite,	The relative differences in 22 measurements were used to determine the degree of asymmetry in the orbits, nose, ears, maxilla, and	CVA, OTDA (orbitotragial depth asym), cranial base asym, overbite, overjet, permanent first molar relationship, dental midline coincidence, crossbite, open bite,	Hand measurements. Ramal height (condylion-gonion), body length (gonion-gnathion), and condylion-gnathion. Gonial

	Nevaste-Boldt, 2023	Sasaki, 2020	Kunz, 2019	Kluba, 2016	Moon, 2014	Lee, 2008	St. John, 2002
	plane. Side-to-side mandibular bone lengths were measured from sagittal plane. The length of the mandibular bone was measured as the distance from the most posterior part of mandibular the condyle to the most anterior point of the mandibular symphysis.	FOP angle: index maxillary deviation. þ: VRL, Me angle with right-sided displacement and upper right FOP angle. e: VRL, Me angle with left-sided displacement and upper left FOP angle.		edge to edge bite, malocclusions classes II & III	mandible: relative difference(RD)= 100 (ipsilateral measurement-contralateral measurement)/[(ipsilateral measurement+contralateral measurement)/2] (%).	and oral habits	angle was calculated from the law of cosines: $C^2 = A^2 + B^2 - 2AB \cos c$. The position of the temporomandibular joint was accepted as corresponding to auricular position and measured from tragion to subnasal.
Key Findings	In all ULC and PPP children, the ANS, which is considered the bony maxillary midpoint, was shifted towards the affected side. In PPP children, the mandibular length was shorter on the affected side in 11 children of 16.	There was a correlation between CVAI and facial asymmetry, with right head slant accompanied by mandibular deviation to the left (type 1) and left head slant accompanied by mandibular deviation to the right (type 2). There was a correlation between mandibular asymmetry and temporal muscle volume, in which type 1 was associated with increases in left temporal muscle volume, while type 2 was associated with increases in right temporal muscle	The untreated group had higher incidences of scoliosis of the face, asymmetries of the chin, and mandibular deviations of the midline than the treated group. The incidence of lateral crossbites was almost the same in both groups. Overall, 75 per cent of the lateral crossbites of all the infants with positional plagiocephaly (treated and untreated groups) were located on the contralateral side of the posterior flattening of the head.	Deviations of the midlines either in the maxilla or mandible were distinctively more often observed in DP group. Children of the DP group showed more often abnormalities in almost every criterion that have been checked. No differences existed between both groups concerning the presence of an open bite. A class III malocclusion was observed in one more child of the control group. None reached statistical	Infants with DP had significantly more asymmetry in the mandible and nasal structures. Mandibular values had significant asymmetry in the DP group only. There was little deformity in the maxilla. The ipsilateral mandibular body was shorter than the contralateral side. Therefore, other measurements that included the mandibula also showed such	At the completion of therapy, the most improvement was seen in the measurement of CBA, followed by CVA and OTDA. However, in evaluating the long-term stability of molding treatment, OTDA tended to continue improving after the initial treatment, while CBA and CVA appeared to regress, although none of the changes reached statistically significant levels. In dental measurements, all the dental midline and chin deviations	Comparison of affected with unaffected sides, using a paired-samples *t* test, was not statistically significant for any of the mandibular dimensions, indicating that there was no primary mandibular deformity

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		volume.		significance.	discrepancy.	were toward the unaffected side with respect to occipital deformation	