

NTrainer Clinical Evidence Overview

CLINICAL RESEARCH USING THE NTRAINER ON PRETERM INFANT POPULATION:

- **Patterned frequency-modulated oral stimulation (PFOS) in preterm infants: A multicenter randomized controlled trial.** Song D, Jegatheesan P, Nafday S, Ahmad KA, Nedrelew J, Wearden M, et al. (2019). PLoS ONE 14(2): e0212675. <https://doi.org/10.1371/journal.pone.0212675>
- **Patterned orocutaneous therapy improves sucking and oral feeding in preterm infants.** Poore, M. A., Zimmerman, E., Barlow, S. M., Wang, J., & Gu, F. (2008). Acta Paediatrica, 97(7), 920–927. <https://doi.org/10.1111/j.1651-2227.2008.00825.x>
- **Synthetic orocutaneous stimulation entrains suck in preterm infants with feeding difficulties to suck.** Barlow SM, Finan DS, Lee J, & Chu S. (2008). J Perinatol;28(8):541-8. DOI: [10.1038/jp.2008.57](https://doi.org/10.1038/jp.2008.57)
- **Non-Nutritive sucking in the preterm infant.** Pineda, R., Dewey, K., Jacobsen, A., & Smith, J. (2019). American Journal of Perinatology, 36(3), 268–276. <https://www.thieme-connect.com/products/ejournals/abstract/10.1055/s-0038-1667289>
- **Amplitude-integrated EEG and range-EEG modulation associated with pneumatic orocutaneous stimulation in preterm infants.** Barlow, S., Jegatheesan, P., Weiss, S. et al. (2014). J Perinatol 34, 213–219. <https://doi.org/10.1038/jp.2013.150>
- **Modulation of EEG spectral edge frequency during patterned pneumatic oral stimulation in preterm infants.** Song D, Jegatheesan P, Weiss S, et al. (2014). Pediatr Res. 75:85-92. <https://doi.org/10.1038/pr.2013.179>
- **Preterm Neurodevelopmental Outcomes Following Orosensory Entrainment Intervention.** Loeb, D., Imgrund, C., Barlow, S., (2018) J Neonatal Nurs. Aug; 24(4): 203–207. [10.1016/j.jnn.2017.11.001](https://doi.org/10.1016/j.jnn.2017.11.001)
- **Implementation of the NTrainer System into clinical practice targeting neurodevelopment of pre-oral skills and parental involvement.** Soos, A, & Hammer, A (2015). Newborn and Infant Nursing Reviews, 15, 2, 46-48. <https://doi.org/10.1053/j.nainr.2015.04.012>

CLINICAL RESEARCH USING THE NTRAINER IN SPECIFIC POPULATIONS:

- **Frequency-modulated orocutaneous stimulation promotes non-nutritive suck development in preterm infants with respiratory distress syndrome or chronic lung disease.** Barlow, S. M., Lee, J., Wang, J., Oder, A., Hall, S., Knox, K., Weatherstone, K., & Thompson, D. (2013). Journal of Perinatology, 34(2), 136–142. <https://doi.org/10.1038/jp.2013.149>
- **Effects of Oral Stimulus Frequency Spectra on the Development of Non-nutritive Suck in Preterm Infants with Respiratory Distress Syndrome or Chronic Lung Disease, and Preterm Infants of Diabetic Mothers.** Barlow, S. M., Lee, J., Wang, J., Oder, A., Oh, H., Hall, S., Knox, K., Weatherstone, K., Thompson, D. (2014). Journal of Neonatal Nursing, 20(4), 178–188. <https://doi.org/10.1038/jp.2013.149>
- **Respiratory Distress Syndrome Degrades the Fine Structure of the Non-Nutritive Suck In Preterm Infants.** Stumm, S; Barlow, S M.; Estep, M; Lee, J; Cannon, S; Carlson, J; and Finan, D, (2008). *Special Education and Communication Disorders Faculty Publications. 138.* <https://digitalcommons.unl.edu/speccedfacpub/138>
- **Respiratory Distress Syndrome history predicts suck spatiotemporal index in preterm infants.** Poore M, Barlow SM, Wang J, Estep M, Lee J. (2008b). J Neonatal Nursing, 14, 185-192. PMID:19956344. DOI: [10.1016/j.jnn.2008.07.006](https://doi.org/10.1016/j.jnn.2008.07.006)
- **Frequency modulation (FM) and spatiotemporal stability of the sCPG in preterm infants with RDS.** Barlow SM, Urish M, Venkatesan L, Harold M, & Zimmerman E. (2012). Int J Pediatrics, vol. 2012, Article ID 581538, 9 pages, PMID: 22888359. <https://doi.org/10.1155/2012/581538>

FOUNDATIONAL RESEARCH TO DEVELOP THE NTRAINER:

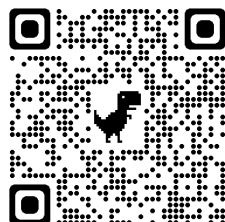
- **Synthetic orocutaneous stimulation entrains suck in preterm infants with feeding difficulties to suck.** Barlow SM, Finan DS, Lee J, & Chu S. (2008). J Perinatol;28(8):541-8. DOI: [10.1038/jp.2008.57](https://doi.org/10.1038/jp.2008.57)
- **Short-term effects of pacifier texture on NNS in neurotypical infants.** Oder A, Stalling D, Barlow SM. (2013). Int J Pediatrics, 2013:168459. doi: 10.1155/2013/168459. PMID: 23737804. <https://doi.org/10.1155/2013/168459>
- **Pacifier stiffness alters the dynamics of the suck central pattern generator.** Zimmerman E, Barlow S, Seibel L, Poore M, Stumm S, Estep M, et al. (2008). Journal of Neonatal Nursing, 14;3. 79-86. <https://doi.org/10.1016/j.jnn.2007.12.013>

- **Neurophysiological monitoring of the orofacial system in premature and term infants.** Barlow SM, Dusick A, Finan DS, Biswas A, Coltart S & Flaherty KJ. (2000). J Med Speech-Language Path, 8(4), 221-238. <https://doi.org/10.1203/00006450-199904020-02018>
- **Somatosensory gating is dependent on the rate of force recruitment in the human perioral system.** Andreatta RD, Barlow SM. (2009). J Speech-Language-Hearing Research, 52(6), 1-13. PMID: 19717653. [https://doi.org/10.1044/1092-4388\(2009/08-0116\)](https://doi.org/10.1044/1092-4388(2009/08-0116))
- **Cutaneous stimulation of the digits and lips evokes responses with different adaptation patterns in primary somatosensory cortex.** Popescu M, Barlow SM, Estep M, Popescu E-A, Venkatesan L, Auer ET, Brooks WM. (2010). NeuroImage, 52: 1477–1486. <https://doi.org/10.1016/j.neuroimage.2010.05.062>
- **Non-nutritive sucking recorded in utero via fetal magnetography.** Popescu EA, Popescu M, Wang J, Barlow SM, Gustafson KM. (2008). Physiological Measurement, 29, 127-139. PMID: 18175864. <https://doi.org/10.1088/0967-3334/29/1/009>
- **Hemodynamic changes in cortical sensorimotor systems following hand and orofacial motor tasks and pulsed pneumotactile stimulation.** Rosner A, Barlow SM. (2016). Somatosensory & Motor Research, 1-11, PMID: 27550186. <https://doi.org/10.1080/08990220.2016.1219711>
- **TAC-Cell inputs to human hand and lip induces short-term adaptation of the primary somatosensory cortex.** Venkatesan L, Barlow SM, Popescu M, Popescu A, Auer E. (2010). Brain Research, 1348, 63-70. PMID: 20550944. <https://doi.org/10.1016/j.brainres.2010.06.015>
- **Integrated approach for studying adaptation mechanisms in the human somatosensory cortical network.** Venkatesan L, Barlow SM, Popescu M, Popescu A. (2014). Exp Brain Research, 232, 3545-3554. PMID: 25059913. DOI: [10.1007/s00221-014-4043-5](https://doi.org/10.1007/s00221-014-4043-5)
- **Intrinsic dynamics and mechanosensory modulation of non-nutritive sucking in human infants.** Finan DS, Barlow SM. (1998). Early Hum Dev. 52:2, 181-97. [https://doi.org/10.1016/S0378-3782\(98\)00029-2](https://doi.org/10.1016/S0378-3782(98)00029-2)
- **Automatic non-nutritive suck waveform discrimination and feature extraction in preterm infants.** Liao, C., Rosner, A.O., Maron, J.L., Song, D., & Barlow, S.M. (2019). Computational and Mathematical Methods In Medicine. <https://doi.org/10.1155/2019/7496591>
- **Spectral Dynamics of NonNutritive Suck in Preterm Infants.** Seibel L, Barlow SM, Vantipalli R, Finan D, Urish M, Cannon S, Carlson J. (2005). Society Pediatric Research, 2139. http://www2.ku.edu/~cnl/presentations/Seibel_Poster.pdf

PUBLISHED REVIEWS ABOUT THE SCIENCE AND PURPOSE BEHIND THE NTRAINER

- **Oral and respiratory control for preterm feeding.** Barlow SM. (2009a). Curr Opinion in Otolaryngology: Head & Neck Surgery, 17: 179-186. PMID: 19369871 87. doi: [10.1097/MOO.0b013e32832b36fe](https://doi.org/10.1097/MOO.0b013e32832b36fe)
- **Central pattern generation involved in oral and respiratory control for feeding in the term infant.** Barlow SM. (2009b). Curr Opinion in Otolaryngology: Head & Neck Surgery, 17: 187-193. PMID: 19417662. doi: [10.1097/MOO.0b013e32832b312a](https://doi.org/10.1097/MOO.0b013e32832b312a)
- **Mechanically evoked perioral reflexes in premature and term human infants.** Barlow, S.M., Dusick, A., Finan, D.S., Coltart, S., Biswas, A. (2001). Brain Research, 899, 251-254. PMID: 11311887. [https://doi.org/10.1016/S0006-8993\(01\)02239-9](https://doi.org/10.1016/S0006-8993(01)02239-9)
- **Central Pattern Generation and the Motor Infrastructure for Suck, Respiration, and Speech.** Barlow SM, Estep M. (2006). J Communication Disorders, 39, 366-380. PMID: 16876186. <https://doi.org/10.1016/j.jcomdis.2006.06.011>
- **Feeding skills in the preterm infant.** Barlow, S. M., Poore, M. A., Zimmerman, E. A., & Finan, D. S. (2010). ASHA Leader, 15(7). <https://doi.org/10.1044/leader.FTR3.15072010.22>
- **The connectivity of orofacial systems.** Estep M, Barlow SM. (2009). Perspectives in Speech Science and Orofacial Disorders - SID 5. 19(1), 28-36. <https://doi.org/10.1044/ssod19.1.28>
- **Suck predicts neuromotor integrity and developmental outcomes.** Poore MA, Barlow SM. (2009). Perspectives in Speech Science and Orofacial Disorders - SID 5. 19(1), 44-51. <https://doi.org/10.1044/ssod19.1.44>

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