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*Abstract* - **Children with prelingual profound hearing impairment have great difficulty in acquiring speech. Speech-training systems providing visual feedback of vocal-tract shape are found to be useful for improving vowel articulation. Vocal-tract shape estimation, based on LPC and other analysis techniques, generally fails during stop closures, and this restricts its effectiveness in speech training for production of consonants not having visible articulatory efforts. A technique based on two-dimensional surface modeling of the area values, estimated by LPC analysis, during the vowel-consonant and consonant-vowel transitions preceding and following the stop closure, has been investigated for interpolating the area values during the stop closures. Surface modeling was based on least-squares bivariate polynomials and Delaunay triangulation methods. Syllables of the type /aCa/, /aCi/, /iCa/, /iCi/, and /uCu/ with stop consonants /p/, /b/, /t/, /d/, /k/, and /g/ were analyzed for the estimation of place of stop closure. For bilabial, alveolar, and velar stops, the place could be estimated consistently with conic polynomial surface interpolation. Estimation of place, based on Delaunay surfaces, was consistent for bilabial and velar stops. However, cubic polynomial surface interpolation results were less consistent in estimating the place of constriction.**