Mouth Breathing, Occlusion, and Modernization in a North Indian Population

An Epidemiologic Study

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Village-dwelling Punjabi youths show significantly better dental occlusion and less chronic respiratory allergy than their city-dwelling counterparts. Field diagnosis finds posterior crossbite the only occlusal condition correlated with mouth breathing in the samples studied.

KEY WORDS: • MALOCCLUSION • MOUTH BREATHING • URBANIZATION •

Habitual oral breathing and its relation to dentoskeletal occlusion has spawned a large and varied literature which is covered in recent reviews (VIG ET AL. 1981, O'RYAN ET AL. 1982, BRESOLIN ET AL. 1983, SMITH 1982, VIG 1979, SAIN 1982, AND LINDER-ARONSON 1979). A general inconclusiveness or at least lack of consistency characterizes this literature. There is variable mention of specific occlusal features resulting from oral breathing (e.g., anterior openbite and posterior crossbite are mentioned as resultant conditions in some but not all studies).

Mouthbreathing is a thorny term, still undergoing refinement. Ambiguities such as mutually noninclusive morphological concepts of nasal obstruction, oral respiration, adenoid facies, long-face syndrome, etc. compound the problem. VIG (1981)

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attempted objective determination of respiratory mode with an apparatus for measuring nasal airflow, and concluded that the issue is more complicated than generally thought.

A new perspective is cast on the mouthbreathing—malocclusion connection by considering changing epidemiologic conditions surrounding these diseases during cultural evolution. Human societies undergoing rapid modernization and acculturation show increases in both allergy/asthma (CORRUCCINI AND KAUL 1984, MARKS 1965) and in malocclusion (CORRUCCINI AND KAUL 1984, CORRUCCINI AND WHITLEY 1981), over previously very low or nonexistent levels characterizing hunter-gatherer and prehistoric groups.

It must therefore be asked whether increased urban tendencies toward oral breathing directly underlie some of the well-documented epidemiologic transition from predominantly good preindustrial to frequently imperfect modern dental occlusion (CORRUCCINI AND KAUL 1984, OMRAN 1971).

— Materials and Methods —

We had originally targeted the Punjabi population around and in Chandigarh, India as ideal for study of the epidemiologic transition in dental occlusion (CORRUCCINI ET AL. 1983, KAUL AND CORRUCCINI 1984). Over a short geographic distance and within a short period of time, this population covers the entire spectrum from traditional agricultural/rural to quite modern industrial/urban lifehabits. The difference in activity, environment and diet are far-reaching, yet there is thorough documentation of genetic homogeneity among the population components (CORRUCCINI AND KAUL 1984, KAUL AND CORRUCCINI 1984).

We previously found very significantly higher levels of various measures of occlusal variation in a sample of urban Punjabi youths, compared with a rural sample (Corruccini et al. 1983, Kaul and Corruccini 1984). The search for etiological correlates of this difference focussed on diet, premature deciduous tooth loss, and on unexplored differences in allergy/asthma. We found that we could reject differential caries rates, genetic frequencies, age variation, inbreeding and gene mixing, periodontal disease, and interproximal attrition as explanations.

Accordingly, in the second year of the study we returned to urban and rural schools, systematically cross-sectionally sampling youths in the same 12-16 year age range. The design was to identify subjects definable as chronic oral breathers, assess and quantify their key occlusal variables using the earlier criteria, and compare them statistically with the general population. We acknowledge limitations imposed by the fact that oral breathing is but one small part of the respiratory allergy spectrum, and that field examination primarily reflects dental occlusion even though there may also be skeletal components of traits such as incisor overjet.

Field diagnosis of respiratory allergy indicative of chronic oral breathing was based on positive complaint or history of breathing difficulty through the nose (at night, in certain seasons) from interviews, and on examination for clinical signs based primarily on Marks' criteria (MARKS 1965, 1973, 1977). These were boggy turbinates, nasal crease, wheeze, gaping habitus/lip incompetence, torus palatinus, deviated nasal septum, buccal ridge, allergic pseudopannus, and nasal obstruction. These traits occur in statistically significant frequency in children undergoing desensitization treatment for asthma and hay fever (FLANDER 1982).

One positive complaint plus at least one positive clinical sign in combination were required for diagnosis as a chronic oral breather.

Oral examination in comparison to a wax-bite impression taken in centric occlusion allowed scoring of the following occlusal variables:

Horizontal incisor overjet, arbitrarily assessed as "normal" within limits of 1Mm to 4Mm of anterior positioning of the upper central incisor's incisal edge relative to the lower central incisor's labial surface.

Vertical incisor overbite, scored as "normal" when the maxillary central incisor overlaps the mandibular antagonist but by no more than 2/3 of the cervical height of the latter.

Posterior crossbite, scored as "normal" if the mesiolingual cusp of the maxillary first molar does not deviate from proper occlusion with the lower molar's central occlusal fossa to a cusp-to-cusp or worse extent.

Sagittal buccal segment relation of the first molars, scored as "normal" if Class II or Class III discrepancy is lacking or does not exceed a cusp-to-cusp or worse displacement from ideal occlusion.

Tooth displacement score, the sum of teeth notably displaced or rotated from ideal arch alignment. Teeth displaced more than 2Mm or rotated more than 45° are counted twice.

The occurrence, type and extent of deviations from the "normal" limits of all five traits are used to compute a malocclusion index (TPI) (Kelley and Harvey 1977). We employ this summary measure of difference from arbitrary norms only as an epidemiologic variable, not as an indicator of orthodontic treatment need.

Statistical analysis of the frequency of nonnormal occlusions according to sex, age, provenience and oral breathing status, is based on the standard error of the frequency $[\sqrt{(p-p^2)/N}$, where p denotes the frequency and N the sample size], and on the chi-square test of difference in proportions.

Discrepancies in either anatomical direction from the norm are combined without sign in the nonnormal category (i.e., excessive positive with negative overjet; openbite with deep incisor bite). The tooth displacement and TPI scores are treated as ratio-interval variables using the t test of sample mean differences.

All statistical tests of difference between oral breathers and controls are one-tailed, testing only the proposition that cases are less well occluded than controls.

— Results —

There was no significant association of age with either oral breathing or any occlusal variables. The possibility of systematic measurement error between the first and second years of data collection was not confirmed. Among rural controls, which were the only component sampled in both years, the average sex-specific difference in the summary TPI score and tooth displacement score supports the null hypothesis.

A total of 315 youths were examined for chronic oral breathing in the most recent year's study. Some 18 out of 188 rural youths were diagnosed as mouth breathers, a frequency of 9.6%, compared to 27 of 127 urban youths (21.3%). The difference is significant at $p < .002$. This confirms the rural/urban difference in this aspect of allergy/asthma in the Punjabi population, as in others (Corruccini and Kaul 1984).

However, there was a marginally significant difference between the sexes, males (27.1% of urban and 13.8% of rural), being more at risk than females (14.0% of urban and 5.9% of rural,

$p < 0.08$). Sex-specific risk ratios are significant between urban and rural samples at $p < 0.02$ for males and $p < 0.05$ for females.

Occlusal differences between urban and rural youths were equally notable. Crossbite and buccal segment anomalies were more frequent in urban subjects at $p < 0.01$ and $p < 0.001$ respectively. There were no sex differences in occlusal variables.

Tooth displacement was nearly twice as great in urban youths (averaging 3.87 versus 2.26, $p < 0.0001$). The TPI averaged 4.72 for urban and 2.87 for rural subjects ($p < .0001$). More details are available for these results elsewhere (CORRUCCINI AND KAUL 1984, CORRUCCINI ET AL. 1983, KAUL AND CORRUCCINI 1984).

Some grasp of the meaning of these findings is indicated by the fact that 23% of urban but only 5% of rural subjects exceeded a TPI of 7.0, which KELLEY AND HARVEY (1977) arbitrarily define as the threshold for "severe malocclusion."

— Malocclusion and Respiration —

Both dental malocclusion and respiratory allergy thus show sharp and rapid rises in the urban environment. To what extent are the two phenomena interrelated?

The question is approached by comparing frequency and amount of occlusal discrepancy within environment-specific samples of normals and mouth breathers. Fig. 1 graphs the proportion "malocculded" and the 68% confidence limits of the proportion (± 1.0 standard error) for qualitative occlusal traits.

Overjet shows the strong rural-urban difference previously mentioned, while diagnosed mouthbreathers do not differ from normals in either environment; nor is there a consistent pattern in how normals and mouth breathers differ.

Overbite shows less variation overall, and less difference between rural and urban samples. The mouthbreathing factor again is not significant.

Buccal segment relation anomaly, likewise, shows large divergence of urban from rural prevalence in the normal breathers, while the smaller mouthbreather samples do not differ significantly from normals.

Crossbite discrepancy also shows marked rural-urban differences. In this variable there is also a consistent increase in variation in mouthbreathers (all observed discrepancies were with the maxillary teeth displaced lingually). This was statistically significant at $p < 0.01$ in the rural sample, but nonsignificant ($x^2 = 0.87$; $p < 0.15$) in urban youths.

Fig. 2 shows results in continuously-scored occlusal variables, which are treated as ratio-interval variables. The tooth displacement score is quite significantly less in rural subjects than normals. The TPI, compounding all five of the prior occlusal variables, followed a similar pattern.

— Discussion —

We have attempted to treat mouth breathing as it is classically conceptualized in the orthodontic literature, although we acknowledge the many recently discussed ambiguities surrounding diagnosis and significance of nasal obstruction and oral respiration (VIG ET AL. 1981, O'RYAN ET AL. 1982, BRESOLIN ET AL 1983, SMITH 1982, VIG 1979, SAIN 1982, LINDER-ARONSON 1979).

Traditional rural and recently urbanized Punjabi populations differ sharply in prevalence and severity of occlusal variations, and they also differ to a roughly comparable extent in prevalence of respiratory allergy and asthma indicative of probable mouth breathing. Nevertheless, within the rural and urban

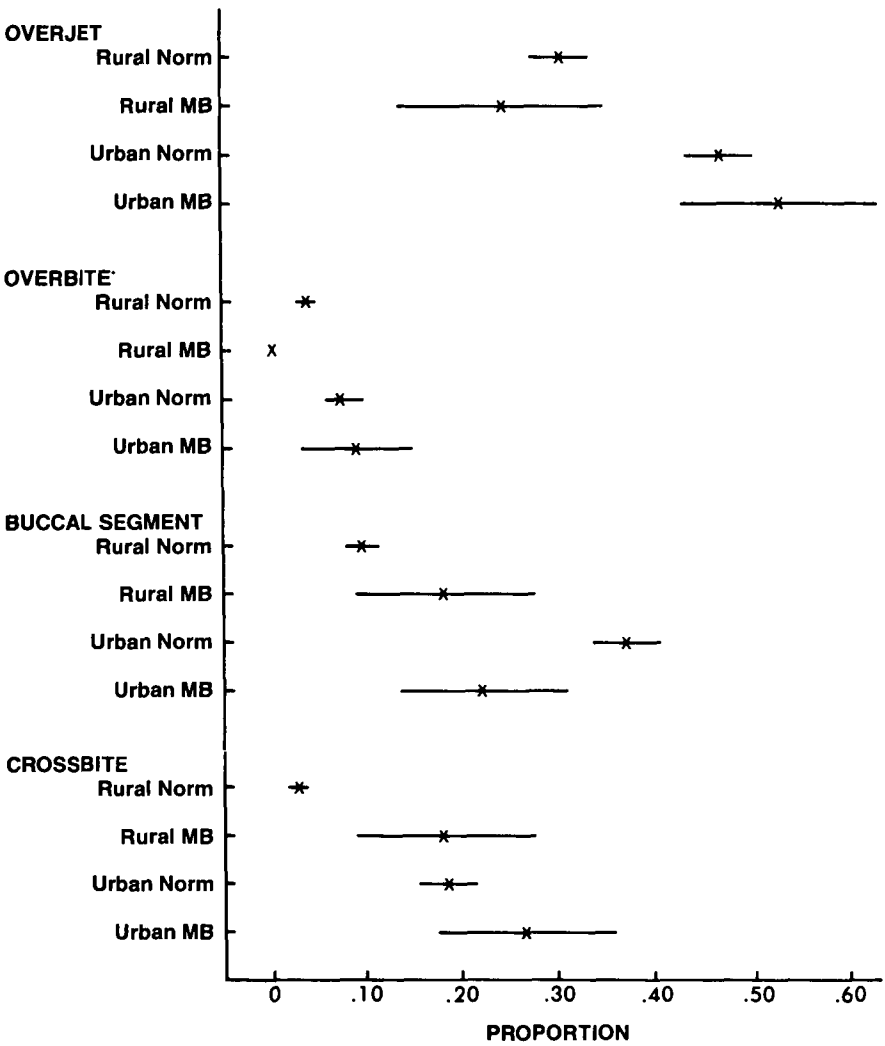

Fig. 1 Incidence of occlusal discrepancy for four qualitative traits in four components of the Punjabi sample. X signifies the recorded frequency of the anomaly, the horizontal line shows one standard error in each direction. MB = Mouthbreathers

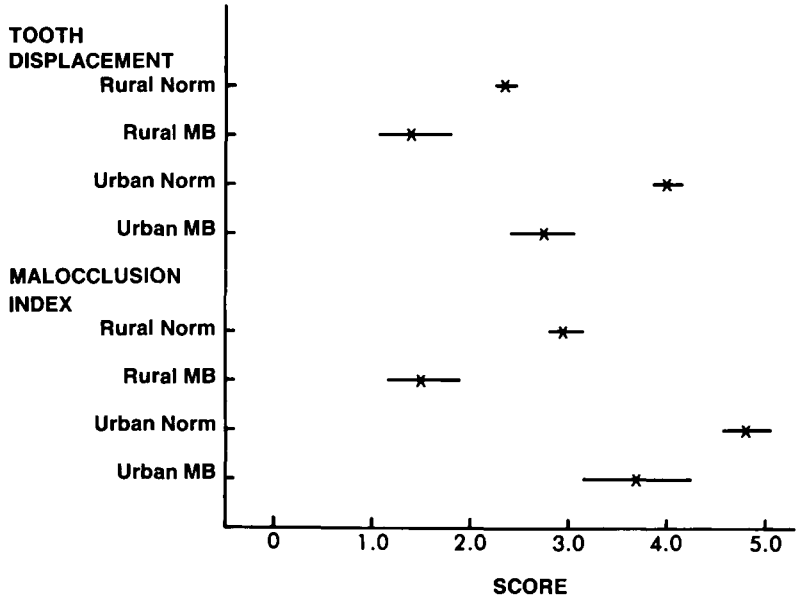

Fig. 2 Mean scores (X) and 95% confidence intervals (horizontal lines) for quantitative occlusal variables

samples there is little tendency for chronic oral breathers to show more frequent or greater discrepancies from occlusal norms.

Crossbite alone indicates a possible relation, as also found by BRESOLIN ET AL. (1983). Even this conclusion should be treated with some caution, as the difference was statistically significant only in the rural sample where mouth breathing was infrequent (the combined sample of 462 subjects showed $p < .01$ for the higher posterior crossbite prevalence in mouthbreathers).

This finding may be specific to this population, but should be considered together with results from western and other nonwestern populations in seeking causes for the rapid rise in malocclusion in urbanizing and industrializing peoples (CORRUCCINI AND KAUL 1984).

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