

## Commentary

### Facial growth during adolescence in early, average and late maturers

*The following commentary was intended for publication along with the original article in the Fall edition of The Angle Orthodontist. (Silveira AM, Fishman LS, Subtelny JD, Kassebaum DK. Facial growth during adolescence in early, average and late maturers. Angle Orthod. 1992;62:185-190).*

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Due to the complex nature of craniofacial growth, predicting the outcome of treatment results in a growing patient is often more difficult than in a non-growing patient. In this context, prior knowledge of the amount, rate, timing and direction of mandibulofacial growth in any given patient would be extremely useful for forecasting treatment outcomes, taking advantage of growth where necessary and trying to minimize growth where undesirable. However, as is true with most complex biological systems, the predictability of expected facial growth may remain a relatively unachievable goal. Nevertheless, any information which makes the evaluation of a growing patient a little more accurate can be useful. An understanding of the potential relationships between maturational indicators and expected growth increments would, therefore, be beneficial. Towards this end, studies have been undertaken to establish whether changes in facial dimensions relate to maturity indicators such as chronological age, stature and skeletal age (Johnston et al.,<sup>1</sup> Hunter,<sup>2</sup> Tofani,<sup>3</sup> Fishman,<sup>4,5</sup> Houston,<sup>6</sup> Moore et al.,<sup>7</sup>) By far, the closest relationship exists between growth increments in facial dimensions and skeletal age, a finding which is further substantiated in the present study.

In this study the investigators wanted to determine the relationships between increments in six facial dimensions and maturation status in 70 adolescents. To accomplish this, orthodontic patients with hand-wrist radiographs were divided into late, average or early maturers by comparing

their chronological and skeletal ages. Changes in six craniofacial dimensions were established and compared among the three groups. The findings suggest that late maturers tend to have greater increments in most of the measured facial dimensions than either average or early maturers. Furthermore, the mandible grew significantly more than the maxilla during the later stages of puberty. This study adds to our existing knowledge of differences in facial growth in differently maturing individuals, confirms previous observations that the mandible grows more than the maxilla during late adolescence, and further emphasizes the importance of hand-wrist radiographic evaluation in those patients in whom growth will substantially impact the treatment plan, mechanics and outcome.

In assessing the relatively few limitations of this study, the use of orthodontically treated cases to address the objective is of some concern. Although cases subjected to orthopedic manipulation of the maxilla or mandible were not included in the sample, in its strictest sense the study actually evaluates changes in facial dimensions in adolescents undergoing orthodontic treatment. It is conceivable that use of a sample which had not had any orthodontic treatment would have yielded the same answers, but this cannot be conclusively stated without further studies. This point is emphasized when considering measurements using A point. Since A point remodels to a substantial extent during orthodontic treatment even in non-extraction cases (Hershey,<sup>8</sup> Battagel,<sup>9</sup> Goldin,<sup>10</sup>)

measurements made using this point may be affected not only by growth but also by treatment. The evaluation of longitudinal records of untreated individuals would be useful.

It is also difficult to discern from the description of the statistical analysis in the materials and methods section whether the tests actually assessed intergroup differences between late, average and early maturers. Since the differences between these groups are presented in the results

and discussion, one may assume this was done.

The findings of the present study taken together with others referred to in this commentary suggest the usefulness of the hand-wrist radiograph as a diagnostic aid in cases where the expected facial growth will significantly impact treatment. These studies also emphasize the limitations in our ability to accurately predict craniofacial growth and indicate a rich area for continued research.

#### References

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### Author's response

Dr. Kapila's comments are well taken and appreciated. The primary conclusion of this paper is that individuals who are delayed maturationally express more late facial growth than average and accelerated maturers, particularly in the mandible. Accelerated maturers express the least amount of growth during this period.

This fact has a great deal of clinical significance, as it allows us to individualize treatment options. Many delayed maturers should continue with growth related therapy such as headgear or face-mask treatment well into the retention phase of orthodontic care, even during the later phases of development. Conversely, many surgical cases can be initiated before the termination of adolescent growth if the individual is an accelerated maturer, since an insignificant amount of skeletal growth can be expected during late adolescence.

The System of Maturation Assessment (SMA) approaches the evaluation of biologic age incorporating two factors. The skeletal maturity indicators (SMIs) provide an objective means of establishing a stage of maturation that relates to a relative point in time during adolescent development. The second factor is maturational level (accelerated vs. average vs. delayed). This study emphasized the importance of including the second factor of maturational level into the biologic

age equation. Between all stages of maturation differences between accelerated and delayed maturers directly relate to differences in the amounts of time, amounts of incremental skeletal and soft-tissue growth, and with growth velocity patterns. Using chronological age as our only yardstick for the timing of orthodontic treatment significantly increases the variability of error.

Dr. Kapila mentioned that it would have been more advantageous to have used orthodontically untreated individuals for this study. In this regard, he particularly emphasized the increased probability of error with maxillary measurements. This unquestionably is true although the investigation purposely did not include patients who had undergone any orthopedic force mechanics, including maxillary headgear. Dr. Kapila also inquired about the statistical evaluation of the data relative to the intergroup differences between the three levels of maturation. The investigation basically used mean and standard deviation values for comparison because they clearly depicted the differences between the subgroups.

In addition to research interests, hand-wrist radiographs should be routinely utilized clinically as a very useful adjunct to diagnosis and treatment planning.

—Anibal M. Silveira

—Leonard S. Fishman