Decodify® System: Cephalometrics as a risk manager applicative and administrative tool for the orthodontic clinic

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Abstract

Introduction: Cephalometrics may have limited use in orthodontics because of its subjective interpretation. An Artificial Intelligence (AI) system, the Decodify® System, was developed to allow the customized quantitative assessment of contextualized cephalometric data. In this article, the system is tested as an administrative tool in orthodontic offices. **Methods:** The development of algorithms includes the norms and standard deviations modeling of Brazilians' cephalometric data, measured in lateral radiographs. In order to test the system, initial cephalograms of 60 orthodontic patients of two different orthodontic offices (30 cases each) were processed and re-processed by three different technicians. The intra-observer and inter-observer reproducibility and reliability indices were checked by paired comparisons. The risk in each orthodontic case, assessed by the electronic analysis, was compared by covariance matrices and agreement coefficients. **Results:** Levels of paired agreement inter-observers (versus golden-pattern) for 23 pairs of variables ranged from 0.68 (S-Go distance) to 0.98 (Na-Me distance) in an orthodontic clinic (JU) and from 0.66 (L1.APg angle) to 0.98 (S-Go distance) in the other (SP). All the correlations were significant at the $p<0.001$ level. The average of the agreement coefficients was 0.78 for one clinic (JU) and 0.75 for the other (SP). The agreement coefficients were significant at the $p<0.001$ level. **Conclusions:** The results of such research support that the analyses provided by the Decodify® System are reproducible and reliable. Therefore, the system can be applied in order to contextualize conventional cephalometric measurements and to generate individualized risk indices. The system may be used by orthodontists as an administrative tool in the daily professional evaluations.

Keywords: Orthodontics. Diagnosis. Artificial Intelligence.

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» The authors declare to be developers of Decodify® System.

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Editor's abstract

Even with its limitations, cephalometrics represents an important tool for the orthodontic/orthopedic diagnosis. Essentially, cephalometrics allows the orthodontist to evaluate the existence of skeletal and/or dental components involved in the malocclusion of the patient and what is its severity. However, experienced orthodontists are aware of the variability to be considered throughout the cephalometric assessment of the patient, as imprecision in the location of the cephalometric landmarks, growth phase and craniofacial development of the patient, or moreover, biases associated to intrinsic methodological or geometrical problems associated to the cephalometric analyses. Facing that, the Decodify® System was proposed, a software of artificial intelligence algorithms, which provides decisions for the orthodontic cephalometric diagnosis, imitating the human being thinking. For that, the system associated the uncertainty and the inconsistency of each cephalometric number, increasing or decreasing its contribution for the final decision of the skeletal and/or dental commitment in each malocclusion. The objective of the present research was to evaluate the reproducibility and reliability in the assessment using the Decodify® System. For this purpose, 60 initial lateral cephalometric radiographs were traced and retraced by three trained technicians, being one of them considered the golden standard. Eighteen cephalometric landmarks were identified and, after digitalization, generated 23 cephalometric variables. The normal values were obtained from the Craniofacial Growth Atlas,[1] collected in Bauru-SP. The intra- and inter-examiner reproducibility were tested (in comparison to the golden standard), by correlation tests ($p<0.001$). The risks involved in each orthodontic treatment, generated by the Decodify® System, were analyzed by covariance matrices and agreement indices. The indices of inter-examiner correlation varied from 0.68 to 0.98 for one examiner and from 0.66 to 0.98 for the other, in comparison to the golden standard. The agreement indices for the Decodify® System were 0.78 for one examiner and 0.75 for the other, in comparison to the golden standard. From the results, the authors concluded that the risk calculated by the Decodify® System was reproducible and reliable. Therefore, the Decodify® System represents an important cephalometric tool for the assessment of the malocclusion and can estimate with greater reliability the degree of severity and the treatment time expected for each individual treatment.

Questions to the authors

1) Which are the main advantages of the Decodify® System for the clinical orthodontic practice?

The best contribution of the Decodify® System for the orthodontic clinic is the identification of the severe cases and, consequently, the operational demand to achieve a good result in such cases (knowledge and experience of the orthodontist, necessary orthodontic supplies and time extension of the treatment to which the patient will be submitted).

2) Could the Decodify® System be associated with analyses from cone beam tomography assessments?

Not yet. Such algorithms rely on homogenous norms, with minor variance. For tomographies or other exams of such nature we still do not have such norms. The drawback for such deficiency of data is economical and operational.

When an atlas with populational norms based upon such type of exam is published by the academy, the mathematical modeling will be possible, as we have modeled the conventional cephalometric norms.

3) With these "intelligent software", how do the authors see the orthodontic diagnosis in the future?

The contribution of the electronic diagnosis will come in the administrative scope. For instance, dental insurance plans already use such technology to quantify the risk involved in each case. Risk for an insurance company means control of the degree of utilization and amount paid out in claims. And increase in the amount paid out in claims implies in increase in the nominal cost for coverage.

That is the reason why dental insurance companies are interested in the quantitative control that the Decodify® System provides and already use it. For orthodontists, it is an important IT tool, which differentiates and add value to their clinic. Many colleagues from all over Brazil have contacted me interested in using this technology in their orthodontic clinics.

REFERENCES

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