SHORT COMMUNICATION

Dental cone beam CT image quality possibly reduced by patient movement

K Donaldson*, S O'Connor and N Heath

Glasgow Dental Hospital and School, Glasgow, UK

Patient artefacts in dental cone beam CT scans can happen for various reasons. These range from artefacts from metal restorations to movement. An audit was carried out in the Glasgow Dental Hospital analysing how many scans showed signs of “motion artefact”, and then to assess if there was any correlation between patient age and movement artefacts. Specific age demographics were then analysed to see if these cohorts were at a higher risk of “movement artefacts”.

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Patient artefacts in dental cone beam CT (CBCT) scans can happen for various reasons. These range from artefacts from metal restorations to movement.^{1–3}

An audit was carried out in the Glasgow Dental Hospital analysing how many scans showed signs of “motion artefact” and then to assess if there was any correlation between patient age and movement artefacts.

The gold standard for radiology image audits would be 100% success with no need for retake imaging. This is difficult to achieve, however. The Health Protection Agency guidelines for dental CBCT scans recommend a minimum of 95% of scans to be diagnostically acceptable without the need for retakes.²

Methods

Our aims were to assess the number of patients who showed signs of movement artefact during CBCT acquisition and how many of these required retakes for diagnostic reasons. We also wanted to assess if the scans which exhibited movement artefacts were in specific patient age cohorts. Our hypothesis was that patients at the extremes of age were more likely to move during scan acquisition.

This was a retrospective audit looking at 200 randomly selected dental CBCT scans. The scans were looked at in alphabetical order using Xoran i-CAT Classic software (Xoran Technologies, Ann Arbor, MI) for dental CBCT. All scans were analysed by two Dental Foundation trainees after tuition from a National Health Service consultant in dental and maxillofacial radiology. The images were assessed in cross-sections, looking at the coronal, sagittal and axial views.

The initial 200 scans were all undertaken between 2008 and 2010 in Glasgow Dental Hospital and School and were taken by radiographers under supervision from consultant dental and maxillofacial radiologists.

The ages ranged from 8 years to 89 years. The scans had fields of view between 4 cm and 22 cm and all had the voxel size of 0.4 mm.³ All scans had the same time for acquisition (20 s) except for the 22 cm scans, which required two revolutions (therefore double the acquisition time) at differing heights.

Movement artefact was defined as “unsharpness or double contours of bony margins”. An example of this is seen in [Figure 1](#). Regions of the scans in which there were signs of “star artefacts” from metallic restorations were not assessed.

To attempt to reduce retakes, all patients were immobilized using a head strap, and if they were unable to place their feet flat on the floor a footstool was used to provide a flat surface to rest their feet on. Prior to acquisition, the patients were asked to close their eyes, to carry out a slow breathing technique and to swallow before the scan started.

*Correspondence to: Miss Kirstyn Donaldson, Department of Oral Radiology, Glasgow Dental Hospital and School, 378 Sauchiehall Street, Glasgow G2 3JZ, UK. E-mail: kirstyn.donaldson@nhs.net

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Figure 1 Double bony contours seen in the mandible

Results

9 scans from the 200 patients analysed showed signs of movement artefact during scan acquisition. However, only 0.5% of the scans analysed required a retake for diagnostic reasons. These patients were found to be mostly in two specific patient demographics: under 16 years old and over 65 years old. For this reason, a new sample of scans was looked at for these age groups.

65 scans for those under 16 years old were analysed. Seven patients showed “double bony contours” during analysis of the scans (10.7%). 86% of patients whose scans showed movement artefacts were male.

37 scans for the over-65-years-old demographic were analysed. Patients in this demographic ranged in age from 65 years to 87 years. Of the 37 scans analysed, 8 (21.6%) patients moved. 62.5% of the patients who

moved were female. Two patients in this cohort required retake scans, both of whom were 80-year-old females.

The patients’ medical history forms were assessed retrospectively following analysis of the scans. The patients whose scans showed movement artefacts complained of dysphagia, spinal pain, Parkinson’s disease and dyskinesia.

Conclusion

In conclusion, 95.5% of the initial scans analysed showed no signs of movement artefacts and 99.5% were diagnostically acceptable without the need for retakes. Both these values were consistent with Health Protection Agency guidelines.

We also found that the patients under 16 years old and those over 65 years old showed an increase in movement artefacts during the scans. A use of a “removable chin rest” has since been implemented, following manufacturer’s guidance.

Prior to requesting a dental CBCT scan, we ask the referring clinician to make the oral radiology department aware of any medical conditions that may affect movement artefacts and to assess previous panoramic radiographs for any sign of movement. A shorter acquisition time would be possible to attempt to reduce the movement artefacts. However, this increases signal-to-noise ratio in the image.

We are aware that some movement may not affect image quality, but this will affect the spatial resolution.

“Movement unsharpness” is only one of the parameters involved in image degradation. It is, however, one that can be minimized with attention to detail and good radiographic technique.

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