JOURNAL OF APPLIED ORAL SCIENCE
ISSN 1678-7757

GUEST EDITORIAL

Self-referral: an ethical concern with respect to multidimensional imaging in dentistry?

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Cone Beam Computerized Tomography (CBCT) is an application that has taken dentistry by storm. With CBCT, imaging is accomplished by using a rotating gantry to which an x-ray source and detector are fixed. A divergent pyramidal- or cone-shaped source of x- radiation is directed through the area of interest onto an area x-ray detector. The x-ray source and detector rotate around a fixed fulcrum within the region of interest (ROI). During the exposure sequence hundreds of sequential planar projection images are acquired of the field of view (FOV) in an arc of at least 180 degrees. In this single rotation, CBCT provides precise, essentially immediate and accurate three-dimensional (3D) radiographic images. As CBCT exposure incorporates the entire FOV, only one rotational sequence of the gantry is necessary to acquire enough data for image reconstruction.

Three dimensional imaging certainly has advantages in such clinical situations as the planning of dental implant placement where important structures such as the mandibular canal need to be avoided to prevent reduced quality of life due to injury. Perhaps it is also of value in planning the extraction of impacted mandibular third molars to again help avoid damaging the contents of the mandibular canal. Providing sufficient spatial resolution is possible for a given CBCT unit, it has also proven useful in determining the causes of failed endodontic treatment. Situations where medical multislice CT is used for planning orthognathic and other surgery procedures can benefit from the reduced radiation exposure usually the case for CBCT. Like all imaging procedures involving ionizing radiation, there should prescription based upon diagnostic or image-guidance necessity. The jury is still out on the use of CBCT for planning and tracking regular orthodontic procedures. Beam hardening artifact makes the use of CBCT unsuited to use for detection of dental caries in most instances.

At last count approximately 3,000 CBCT units had been purchased in the USA, and 800 units in Germany among other countries. These systems currently vary in price from approximately US $90,000 to more than US $300,000. Depending on the number and price charged for each CBCT imaging procedures performed, a rush to achieve return on investment could well lead to unethical over-prescription of procedures. Such over prescription could have impacts both on healthcare costs and also on the radiation exposure load to the patient. As the tissues included in the imaged volume need to be read to maximize the diagnostic yield potential relative to the exposure given, it can be questioned whether all individuals who presently own CBCT systems are trained to a level of competency to evaluate the images that they produce. Referral of these images for reading by specialists in oral and maxillofacial radiology might be necessary, but this in itself can also add to the cost of healthcare

Hillman, et al.[1] (1992) in studying physicians' utilization and charges for outpatient diagnostic imaging found that self-referral resulted, depending on physician specialty, in 1.7 to 7.7 times more frequent performance of imaging examinations than radiologist-referral. This difference was statistically significant ($p < 0.01$) across all presentations. Within all physician specialties, self-referral uniformly led to greater utilization of diagnostic imaging than radiologist-referral, with mean imaging charges per episode of medical care 1.6 to 6.2 times greater when self-referral applied.

While self-referral can have economic implications, as mentioned above there is another side to this matter, namely, the question of training and experience to accurately interpret the diagnostic images that are made. Alfaro, et al.[2] (1995) looked into the issue of accuracy of interpretation of cranial computed tomography scans in an emergency medicine residency program. Non-concordance between radiologists and emergency physicians was found in 38.7 % of cases, with potentially significant misinterpretations in 24.1 % of cases. There were multiple misinterpretations of new infarcts, mass lesions, cerebral edema, parenchymal hemorrhage, contusions, and subarachnoid hemorrhage. It was concluded that more CT training was needed for emergency room physicians. These findings of a decade ago are perhaps now worth thinking about with respect to CBCT use in dentistry. Dentists have commonly self-referred radiographic procedures, and many dental procedures require immediate radiography be available. However, these procedures have traditionally been simple transmission approaches such as periapical, bitewing, panoramic and cephalometric radiography. Now, more advanced techniques such as CBCT that involves 3D reconstruction of multiple basis images requires far more complex diagnostic thinking for adequate interpretation. Further, such radiographic procedures are more expensive than the more traditional methods used in dentistry that dentists were trained to conduct while in dental school. Perhaps there should be an evaluation of whether CBCT should be permitted for self-referral or whether it is better restricted to specialist imaging centers where patients are referred only by outside practitioners based upon diagnosis or treatment needs rather than a quick return on investment for a relatively expensive piece of equipment. Let the debate begin…

1- Hillman BJ. Self-referral for diagnostic imaging. Radiology. 1992;185:633-4.

2- Alfaro D, Levitt MA, English DK, Williams V, Eisenberg R. Accuracy of interpretation of cranial computed tomography scans in an emergency medicine residency program. Ann Emerg Med. 1995;25:169-74.