

Radiological displays: a necessity or luxury?

Monitores radiológicos: necessidade ou luxo?

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In a series of previous editorials⁽¹⁻³⁾ we have discussed some relevant topics related to teleradiology. With the ever increasing digitization of Radiology services in our country, a new theme brings us again to the pages of this journal: which would the minimum required specifications be for the utilization of electronic displays in imaging diagnosis? Are there regulations or laws on this subject in Brazil?

Technically, there is a set of solid reasons pointing toward the utilization of high quality displays, moreover when one considers those imaging methods which provide finer details and variations gray scale such as the case of mammography. But would that display quality be necessary for computed tomography reporting, for example?

It is necessary to know something about the nature of contrasts perception by the human eye, before going further into the discussion. A series of studies have demonstrated that our perception of the gray scale is both relative and adaptive, and depends upon the context of lighting in the environment we are in. In our contrast perception, the subjective differences of intensity among different luminosity levels or gray scale shades mainly depend upon the luminosity extremes in the environment we are in, and very little upon the luminosity ratio between the points of such scale. That happens because our eyes have evolved to be able to see both under the desert sunlight and at the twilight and in a moonlit night. Under each one of these contexts, the eyesight will unconsciously adapt in order to define

a “white” and a “black”. This means that as we look at a radiological image on an ultimate LCD display with a contrast ratio of 10,000:1, what we see as white is 10,000 times brighter than what we perceive as black. On the other hand, as we look at the same image on a conventional CRT display, it is very likely that what we see as being white is only 50 times brighter than what is perceived as being black. And, if we look at the screen of this old display for several days, we will become deeply convinced that its “black” and its “white” are in fact black and white. On the other hand, if we place such old display side by side with the ultimate LCD display, we may find that the black was only a darker gray on the higher resolution display, and that the white was only a light gray. It is such adaptability of the human eyesight which makes us perceive colors based on their context, and not on their absolute brightness values. And that can lead to misinterpretation of subtle or imaging findings at a chest radiograph or at mammograms, for example.

As subtle variations in radiological density are poorly represented on bad-quality displays, the current specifications for displays utilized in Radiology are based on absolute luminosity tables of radiological density, the lookup tables (LUT's). As the luminosity perception decreases with distance, such specifications are always defined for an observer at a given distance from the display, usually two meters. However, this is not enough: a light gray tone may look “white” in the dark, or even a “median gray” if we light the display with a surgical light. That is why the radiological display specifications always comprise a detailed specification of the ambient lighting where the display will be utilized, also defined in absolute terms of luminosity per area. That means that in order to properly utilize such displays, it is also necessary to control the ambient lighting in the workstation room.

Does that mean that we should necessarily utilize displays which are classified as “radiological” in our pro-

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fessional activity, or would it be enough to utilize “good” displays? Because of the cost of radiological displays, which can reach 100 times (!) the cost of a standard display of comparable size, the subject has been widely discussed, particularly about what would be “enough” to provide reliable reports, and on how that can be different for each imaging diagnosis modality. In the literature, there is a multitude of studies in different areas of the specialty trying to determine whether this necessity exists or not. The majority of such studies approach either very specific areas or are based on a limited evidence, and so, as far as we could investigate, the conclusions of such studies cannot be generalized. That means that the subject demands further and deeper investigation to define standards and parameters in order to know when high-definition radiological displays should be utilized, and on how to establish minimum parameters for the visualization of medical images. Some countries have already defined standards on the subject, such as the AAPM TG-18 (USA) and DIN V 6868-57 (Germany), establishing minimum parameters for the display and imaging modality. In Brazil, the regulatory status is not yet clearly defined, but in the context of Anvisa’s Image Working Group a committee is currently discussing this matter. At a sole attachment to the CFM resolution nbr. 1890/2009 which defines and standardizes teleradiology, only level 4 imaging modality (digital mammography) requires the utilization of specific displays, and even so without specifying technical details.

It is important to remember that the matter is particularly relevant in the teleradiology practice which advocates the promptness to provide “reports from any place and at any time” with the radiologist, in emergency situations, having to be able to access medical images on his tablet or smartphone, as necessary. Even at international level there is no consensus on the subject. Standards such as AAPM TG-18 and DIN V 6868-57 establish that the compliance with the quality of displays for interpretation of different imaging modalities is many times met by radiological displays. On the other hand, the American College of Radiology is more pragmatic, and defines different situations on its Standard for Teleradiology, discerning between official reporting and clinical follow-up/emergency reporting.

Another increasingly relevant subject refers not only to the minimum display resolution, but also to the necessity of quality control programs to ensure the preservation of their luminance levels as the displays age. This subject has been approached by an excellent article recently published in this journal⁽⁴⁾.

Thus, we believe that we should more actively participate in the discussions that take place in the sphere of Anvisa, and prepare ourselves with studies based on clinical experience for the moment where the resolutions are opened for public consultation, as it recently happened with the regulations regarding the regimen for health surveillance of used, refurbished, rented or ceded equipment in the area of imaging diagnosis (Public Consultation nbr. 34 for the Anvisa RDC review nbr.25).

We would like to suggest that CBR internally organizes such discussion, utilizing the experience from the specialty committees’ members in order to define what they would consider the minimum display specifications for diagnosis in each area of practice. Provided it is performed by professional with recognized competence and clinical experience, the comparative assessment of different imaging modalities (radiography, mammography, computed tomography, and magnetic resonance imaging) on radiological displays *versus* conventional high-resolution displays, considering the classical patterns of anatomy and disease, can generate an important document proposing technically reliable solutions, however with common sense.

A network infrastructure for such investigations is already in place: the Special Interest Group of RUTE – Rede Universitária de Telemedicina (University Telemedicine Network) of the Brazilian Science and Technology Ministry was created exactly for discussing this kind of subject. It is up to us to start this process.

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