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**DEVELOPMENT OF A PROGRAM OF RADIOPAQUE LESIONS IMAGING VIA
RADIOGRAPHIC CASES FOR ACTIVE LEARNING IN ORAL MEDICINE**

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1. Objectives proposed in the project presentation

The objectives we set in the presentation of our innovation and improvement of teaching quality project were as follows:

1. Prepare a file of radiopaque radiographic images of jawbone pathologies, and ordered by location.
2. Establish explanatory bases of each pathological process in relation to other pathologies in the same location.
3. Point out a diagnostic guide for each image to properly establish a correct differential diagnoses.
4. Improve the acquisition of practical skills by using selected clinical images, versus the conventional system of clinical practice.
5. Facilitate learning through personal research (from the student side) of links using keywords.

2. Reached objectives

We will comment on each of the objectives achieved on each of the sections:

Prepare a file of radiopaque radiographic images of jawbone pathologies, and ordered by location.

We have prepared a file with 59 radiopaque radiographic images. Such lesions are included in the following sections to facilitate learning:

- *“Anatomic radiopacities”*: we have included 6 radiopaque images of the most common anatomical lesions to facilitate the differential diagnosis of what is normal and pathological.
- *“Periapical radiopacities”*: we have included 20 radiopaque images located in the tooth apex area.
- *“Solitary radiopacities not necessarily contacting teeth”*: we have included 22 single, radiopaque images of well-defined jawbone and maxilla lesions that may or may not be in contact with the tooth.
- *“Multiple separate radiopacities”*: we have included 7 well-defined, multiple, radiopaque images.
- *“Generalized radiopacities”*: we have included 4 images of radiopaque lesions of the jaws due to systemic disease that causes lesions radiopacities all bones.

1. . *To establish the major explanatory bases of each pathological process in relation to other pathologies of the same location.*

We have made 4 flowcharts or outlines corresponding to each of the pathology groups classified by their location (as discussed above) in which we synthesized the most significant characteristics of each. We have focused primarily in those clinical and radiographic features that can help us differentiate a pathology from another.

2. *Highlight the diagnostic process in each image, to properly establish the differential diagnosis.*

In each of the flowcharts, we followed a guide to aid in the diagnostic process. In each of the 4 diagrams, we used a different process because in some cases it was impossible to group the lesions and make different sections as they were very different from each other. In some, we have begun by the most common pathologies and their clinical and radiographic features, and in others by the vitality of related teeth (vital or non-vital); then we have highlighted the most common age of onset, symptomatology, appearance of the lesion (cloud-like, cotton-wool, ...). The aim of this process has been to rule out pathologies from the same initial group, to be able to stay with the diagnostic pathology or a small group of pathologies.

3. *Improve the acquisition of skills by using selected clinical radiographic images, versus conventional clinical practice.*

This objective has not been fully achieved because we will test it next academic year in the subject of Oral Pathology for third year dental students.

Yes, we tested the effectiveness of our project with a small group of students belonging to the Oral Medicine specialist degree. In this postgraduate degree, we have 10 students, and each of them received lessons regarding the usual kinds of pathologies of the jawbone of which 25% belonged to radiopaque lesions of the jaws. Also, 5 students randomly selected also received this form of learning (flowcharts, cases, images and clinical diagnosis). Of the 20 questions in the final exam pertaining to radiopaque lesions, the 5 students who received the material, answered correctly 93-98% of the questions, but the other group only answered 50-55% of them correct.

Anyway we believe that this study guide should be implemented in the next academic year, as we specified above, for its effectiveness among third year dental students.

4. *To facilitate student learning through personal search using keywords*

We believe that by giving the student a knowledge base through flowcharts, and provide clinical cases, the student will develop the curiosity needed to seek new cases on the Internet or try to watch for images that we have not been able to locate due to low frequency. Anyway, this section also has to be checked after implementing it among third year dental students next academic year. In addition, as the work has been done in English, we will initiate our students with literature searches, as most medical and dental literature is in English; thus helping them with the necessary material necessary to make appropriate searches in English.

3. Methodology used in this project

First, we selected the most representative clinical images, each of us providing images. 80% of the images were provided by Dr. Ortega Piga, eminence in oral and maxillofacial radiology in our country.

Later we discuss what images would be included in the project. Out of 78 images, we ruled out 19. These images were discarded by low quality (3 images), tests too complex for the student (12 images), great diagnostic difficulty (value of 9 and 10 on a scale of 1-10) (4 images).

The images that were not in digital format, were scanned and improved with Photoshop. After having all the images in digital format, we were able to place notes and highlight in yellow to aid students in locating lesions on the radiographs.

Later we made flowcharts or outlines to help diagnose injuries by group of lesions such as with the Power Point program. "anatomic radiopacities", "periapical radiopacities", "solitary radiopacities not necessarily contacting teeth", "multiple separate radiopacientes" and "generalized radiopacities" Microsoft Power Point.

We collected medical records for each of the radiographic cases, we summarized the most significant data, and also classified them by the different sections named above, except in the case of "anatomic radiopacities". These medical records were numbered to match the number with the radiographic clinical case. This was done with Microsoft Word.

We collected radiographic cases with bookmarks and annotations, and put them in the corresponding section. The number in the Power Point document corresponded to the number of medical history of the previous document.

We also made a document with the diagnosis of the lesions, so that the student after thinking hard and trying to diagnose each case, could check if he/she had been successful or if the correct result was within the possible final diagnoses

All documents were made as PDF files. This pack, flowchart or outlines, medical records, and diagnostic radiographic cases, were available to all members of the group in order to correct possible errors. Subsequently it has been placed in the hands of the 5 students from the Oral Medicine specialist degree to estimate its utility as a preliminary step.

4. Human resources

The professors that have worked on this innovation and improvement of teaching quality project are:

- Gonzalo Hernández Vallejo, profesor and Head of the Department of Stomatology III at Complutense University of Madrid.
- Rosa M^a López-Pintor Muñoz, associate profesor from the Department of Stomatology III at Complutense University of Madrid.
- Ricardo Ortega Aranegui, associate profesor from the Department of Stomatology III at Complutense University of Madrid.
- Víctor Manuel Paredes Rodríguez, honorary collaborating profesor from the Department of Stomatology III at Complutense University of Madrid.
- Elisabeth Casañas Gil, external collaborator in clinical practice from the Department of Stomatology III at Complutense University of Madrid.
- Lorenzo de Arriba de la Fuente, associate profesor from the Department of Stomatology III at Complutense University of Madrid

5. Activity development

Since they communicated the acceptance of this project until the beginning of December 2015, we made a selection of images. It was difficult to get images of all the pathologies, especially those less frequent. This phase, therefore, has taken us the longest. As discussed above 80% of the images were provided by Dr. Ortega Piga, the remaining 20% were contributed by Dr. Hernández, Dr. Paredes, and Dr. López-Pintor.

In the months of december, january and february, Dr. López-Pintor developed diagrams in English, that she then classified according to the relationship of the lesion to the tooth. She made 5 groups of radiopaque lesions of the jaws such as "anatomic radiopacities", "periapical radiopacities", "solitary radiopacities not necessarily contacting teeth", "multiple separate radiopacities" and "generalized radiopacities".

We only made diagrams for 4 groups of pathological radiopaque images. In each of these four diagrams, we included the anatomical radiopacities to be ruled in each of the sections, to facilitate the diagnostic process. Such diagrams were done using Microsoft Power Point, which sometimes included drawings to aid diagnosis, especially at the starting point.

During the months of January, February and March, Dr. Víctor Paredes, Dr. Lorenzo de Arriba and Dr. Gonzalo Hernández scanned (as some images were very old), edited (as the images were not well calibrated according to brightness and contrast) and improved images with Photoshop.

Also, they created a Power-Point presentation, by groups (see the above 5 groups), and made notes and highlighted in yellow to help students locate lesions on radiographs. Nonetheless, it is difficult for them locate lesions or there may be several of them, and we just want the students to center their attention in diagnosing one of them. Also they numbered each of the cases within their subgroup

During the months of February and March, Drs. Paredes, López-Pintor, and de Arriba, located the medical records of each of the cases, the most significant data were summarized and also classified by the different sections named above.

There were medical records (12 cases) that could not be located because they were very old or were cases referred for radiological diagnosis to Dr. Ortega Piga. In such cases, we made a medical history based on the diagnosis of the lesion, according to the general characteristics of the pathology.

These medical histories were numbered to match the corresponding radiographic clinical case. This was done with Microsoft Word.

In March, Dr. Hernandez made the diagnostic documents for each of the images, so that the student after thinking thru and try to diagnose each case could check if the result had been the right one or if the correct answer was within the possible final diagnoses. This works as a final evaluation test to assess the effectiveness of this learning strategy.

During late March and early April, Ms. Elisabeth Casañas Gil, a bilingual (english-spanish) dentist, corrected the English of all documents. Later, Dr. López-Pintor transformed all documents to PDF files, 4 flowcharts, 5 Power Point documents that included radiographic cases placed in groups according to their location, 4 documents of medical records classified according to their location, and 4 documents with the diagnosis of each of the lesions.

During the second half of April, this pack, made of diagrams or charts, medical records, and diagnostic radiographic cases, was available to all members of the group in order to correct possible errors.

Later, a few weeks ago, Dr. Hernandez Vallejo provided this folder to 5 students from the Oral Medicine Specialist degree, to assess its effectiveness in learning. The results are promising, as discussed above.