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Diagnosis of Small Tumors of the Jaw and Mouth by X-Ray Contrast with Zinc Oxide-Polyethylene Glycol Nanoparticle-Doped Iodine

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Abstract

X-ray imaging is one of the most widely used medical imaging methods and has provided the possibility of diagnosing cancerous tissues by producing high-contrast images. The use of contrast agents is one of the conventional methods for improving the separation power of medical images. In this article, the effectiveness of zinc oxide nanoparticles (polyethylene glycol doped with iodine) as a contrast material for X-ray diffraction was investigated. zinc oxide nanoparticles (NPs)-polyethylene glycol doped with iodine were synthesized. The crystallization quality of the sample was investigated by X-ray diffraction. The suspensions obtained from the synthesis of zinc oxide nanoparticles—polyethylene glycol doped with iodine—in the artificial jaw and the bone were investigated and compared in terms of differences in the contrast of the images before and after the use of the substance in question. The results show an increase in the contrast of the images after using the contrast material.

Keywords: X-Ray, Suspension, Tumor, Zinc Oxide, Polyethylene Glycol and Image Contrast.

1. Introduction

Tumors develop in the jaw. Malignant tumors are called odontogenic tumors. Oral and jaw odontogenic factors can include smoking, poor nutritional status, alcohol consumption and genetics. Oral and jaw odontogenic diagnosis is performed by biopsy (sampling) or CT scan. The odontogenic symptoms of the jaw and mouth are swelling, jaw pain and loose teeth. Radiotherapy (laser), chemotherapy and surgery can be used for odontogenic treatment [1, 2].

It is possible to diagnose jaw tumors through imaging methods, including the use of opg. This graph takes a panoramic X-ray image of the maxillary and mandibular teeth and shows a flat two-dimensional view of a semicircle from ear to ear [3]. Dental X-ray technology is moving away from traditional technology to digital X-ray technology, using electronic sensors and computers to create high-quality images. In other words, this type of imaging involves a two-dimensional dental X-ray examination that records the shape of the mouth in a single image that includes teeth, upper and lower jaws, surrounding structures and tissues [4]. With this diagnostic method, dentists can detect many other disorders that cannot be detected with a normal photo during dental surgeries.

In jaw tumors, the interval between symptom and tumor diagnosis was 3 months. Additionally, benign and malignant odontogenic diagnoses differ in terms of shape, size, anatomy, etc [5]. Good odontogens are oval and do not have streaks. Malignant odontogenic cells are round and streaked [6, 7]. Surrounding the tumor is sour (that is, acidic and hydrogen peroxide H2O2). When a good cyst is present, the size is clear (it usually does not exceed 2 cm after a few months) [8]. However, in a malignant cyst, the boundaries are not clear, and the size of the cyst is large. First, many tumors of the jaw and mouth do not bother the person's mouth. When the tumor size increases, people may not be bothered, and the tumor may not be treated or cause death. Jaw tumors are more common in the lower jaw [8].

Sometimes drugs are used in medical images for contrast; it is a substance that people consume orally or other substances...to have better imaging [9]. There are contrast agents in markets for all body parts except the jaw. From 2000-2023, barium sulfate (white colour BaSo4), gold, silver, iron, iron oxide and cobalt oxide were used in the area to aid in better diagnosis of the neck and lower parts of the person [9]. In 1986, iodine was used as a contrast agent. Iodine is more compatible with the neck and is a contrast agent for the neck [10-18]. Adjacent tissues inside the body, such as bone, soft tissue, and air cavities, were observed and distinguished [19-21]. The difference in the amount of radiation absorption depends on the nature of the absorbing tissues and the thickness of the target tissues. For the contrast material, if the atomic number of the material is high, the contrast is cloudy; if the atomic number of the material is low, the contrast is transparent [22]. In soft tissues (heart and lungs), there are carbon, oxygen and hydrogen, whose atomic numbers are 6, 8, and 10, respectively. Therefore, their atomic number is low. There is calcium and phosphorus in bone, whose atomic numbers are 20 and 15; therefore, their atomic number is high [23]. X-rays are more likely to detect an element with a higher atomic number. Ninety percent of the contrast material is iodine, which is relatively toxic. Its atomic number is 53. (it has a high atomic number), which is why it is used in radiographs [24]. To prevent it from being toxic, a drug carrier or coating is placed around it to reduce its toxicity. Most drugs use benzoic acid derivatives as carriers, the former of which is a hexagon.

2. Method

For drug synthesis, iodine, nanozinc oxide and PEG are needed. The drug is synthesized in two steps:

We combined 1 g of PEG with 20 ml of water and 0.5 g of zinc oxide nanoparticles with 100 ml of distilled water. The mixture was placed on a mixer at room temperature for 12 hours. Then, the samples were washed and dried. The first stage ends. In the second step, we prepared a 0.01 M iodine solution, which was mixed with 25 ml of iodine in the solution we prepared in the first step; 12 hours later, the final product was ready. We filtered half of the material, dried it, and then turned it into powder. We used the other half of the material for the final test (contrast formation).

3. Results

3.1. FTIR

FTIR spectroscopy is a method for determining the structure of molecules. By using this method, it is possible to determine the presence or change of chemical in a substance. With this method, it is possible to understand the structure of the molecules, functional groups and bonds in the sample. In the FTIR spectroscopy method, an infrared (IR) beam passes through the sample. Part of it is absorbed by the sample, and the other part passes through the sample. The molecular structure of these materials is also unique. The horizontal graph in the FTIR analysis corresponds to the wavelength of the functional group, and the vertical graph corresponds to the absorption intensity of the functional groups. The synthesized zinc oxide-polyethylene glycol sample doped with iodine was subjected to FTIR analysis, and the results are shown in Figure 1.

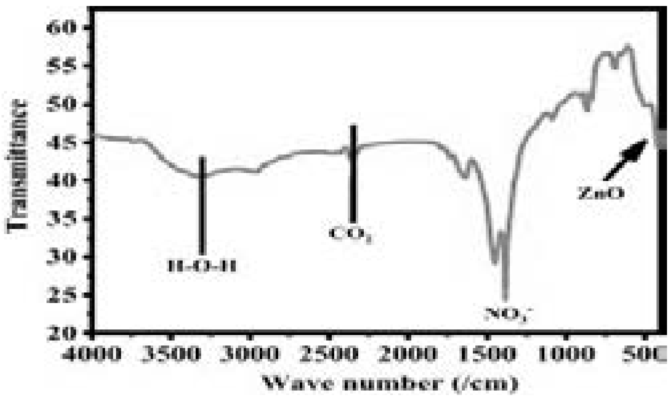


Figure 1: FTIR Image of the Synthesized Sample of Zinc Oxide-Polyethylene Glycol Nanoparticle-Doped Iodine.

As shown in Figure 1, the zinc oxide peak can be observed at 450 nm. As is clear from the chart, point 3443 is the playing point of the combination. Expansion in this part shows the nature of the game. Peak 1638 corresponds to the C-O bond.

3.2. XRD

The synthesized samples were subjected to X-ray diffraction to measure the degree of crystallization of the material. X-ray diffraction was performed with a copper lamp at a wavelength of 1.5406 angstroms. Figure 2 shows the XRD pattern of zinc oxide-polyethylene glycol nanoparticle-doped iodine. All the diffraction peaks appear in this pattern, and these peaks are long and narrow, which indicates a high degree of crystallization of the material. However, there are several peaks at values of 32, 35, 37, and 48.

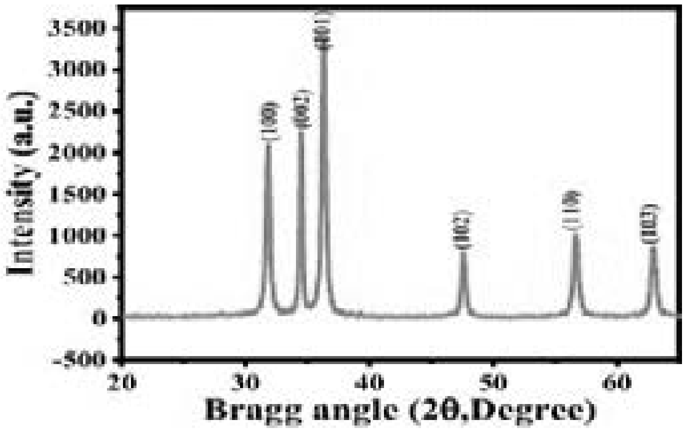


Figure 2: XRD Pattern of the Synthesized Zinc Oxide-Polyethylene Glycol Sample Doped with Iodine.

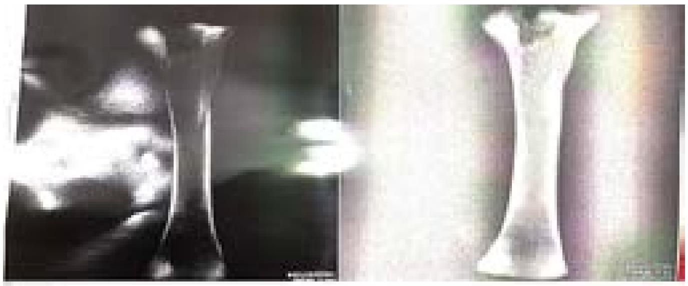
3.3. X-Ray Radiation and Imaging

For the imaging test, we performed CR imaging with an EMERALD X-ray tube and Calestream software. Our initial phantom was an artificial jaw. Two images were taken, one before being coated with polyethylene glycol zinc oxide and the second after being coated with this substance (Figure 3).

(a) (b)

Figure 3: a: Before Contrast Material b: After Contrast Materialsince the Target of the Phantom is the Jaw, the Patient Should Use the Position of Reeling or Rotating in the Mouth Before Imaging.

Chicken femurs were subjected to the second extraction test. The phantom type of the software was set on the finger, and the voltage and current of the tube were set to 48 kV and 125 mA, respectively (Figure 4). A comparison of the right and left images revealed an increase in contrast in the right image.



(a) (b)

Additionally, for retesting, we exposed the synthesized solution to X-rays, and we observed the contrast agent (Figure 5).

Figure 5: Zinc Oxide-Polyethylene Glycol Nanoparticle-Doped Iodine Solution in the Vicinity of the X-Ray.

4. Conclusion

In this article, the efficiency of zinc oxide-polyethylene glycol doped with iodine in X-ray imaging was investigated. Zinc oxide-polyethylene glycol doped with iodine was synthesized. The accuracy of the molecular bonding of the cobalt oxide nanoparticles was investigated and confirmed by FTIR analysis. The quality of crystallization of the samples was determined by X-ray diffraction. The desired contrast agent was rubbed on the target, and a graphic image was taken. The resulting images showed that zinc oxide-polyethylene glycol doped with iodine can be used in photography. X should be used as a suitable contrast material.

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