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Dental Bio-Metrics Information used for Binary Image Processing, Segmentation and Matching

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Research Article

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ABSTRACT

Objective: The purpose of the study was to investigate if the binary technique can be applied to field of dental implants. We came up with new dental implants whose tooth roots with a Crescent Groove. From these two aspects, we hope to improve the technology of dental implants.

Study design: We took dental implant surgery photos of a 28 year old female patient by analyze for the application of binarization technique. The uniqueness feature for insertion of the titanium dental implant contains several teeth in different portions. After the process of the binary image technique, the colourful images become gray ones, and the teeth and mucosa have unique feature information in different gray scales. Binary values are from 0 to 255, 256 digits. The threshold value range is [0, 255]. We just take the interval of 100-190 scale. Then, we divided them into the different ranges of these values. After that, to compare different stages of operation surgery in different scales, we observed the clarity of teeth and mucosa the datum was used in statistical analysis. In addition, we present a special structure of the root implant dentistry: Crescent Groove, proposed a new type of dental implant structure model which provides a theoretical basis for future clinical treatment.

Results: We found that range from 1-255, in the 140-160 range, tooth shape is the clearest and background noises are almost completely hidden. When over 160, however, tooth shape also started to be hidden when this value is set at 190 and shape of the teeth are almost completely hidden. The clear interval taken 44.4%, accounting for 15.6% of the total range. From mechanical and biological point of view, crescent groove structure can better buffer pressure, to form good synostosis with the alveolar bone.

Conclusion: Range from 120-160, the teeth are clear and background color is almost hidden, which provides for image processing with some reference values. What's more, for the appearance structure, this paper proposes a utility model structure of dental implants.

INTRODUCTION

There are many technologies serviced for stomatology that included X-ray [1,2] and Panoramic Radiography [3] CAD/CAM planting Guide technology [4], Cone Beam Computed Tomography (CBCT) [5,6] and 3DPrinting, etc. [7]. Meanwhile, the binary image technique is also an effective method for picture processing, which has been widely utilized in every field with its special superiorities in recent years. But as yet, no oral clinical applications of the binary image technique have been reported. We took dental implant surgery photos of a 28 year old female patient for case. In this literature, we analyze the case for the photos **(Figures 1a-1d)** by binarization technique. In this paper, the color photos are transformed into other gray scale value in the process. After that, to compare different stages of operation surgery in different scales. We observed the clarity of teeth and mucosa by the datum was used in statistical analysis for the effective threshold value range.

Because the binary images are closely related to optical character recognition (ORC) technology with huge economic benefits,

which has been a hot research focus [8-11]. Apart from the OCR, image binarization technique is also used for document processing to increase the clarity, readability and publication for saving storage space, be easy to transport and rescuing cultural relics. Now, it is being used in medical diagnosis and treatment. Realization of image binarization technique needs software and appropriate hardware to support [12-14].

Binarization of the images is actually a picture of all the pixels of the image without a pattern classification, known as segmentation in image processing. The critical question is to find a threshold value. The problem referred to in image processing the threshold values.

In addition to the image processing technology, many aspects of biocompatibility profiles established for dental implants have been shown in depend on interrelated biomaterials, tissue, and host factors, being associated with either surface and bulk properties. Several important requirements for successful dental implant systems have be reported, and followed by variety of surface modifications and technology to accommodate the biological interaction at the interface between placed implant and receiving vital tissue. Within an increased predictability of dental implants, the same treatment modalities have come under consideration for growing patients [15]. However, there are special issues taken into account, due to the shape of the dental implant. Although extensive reviews on implants have been previously published [16,17] no integrated concerns can be found on dental implantology in growing patients. Accordingly, we added a utility model structure of the dental implant in this research with implant practices in growing patients.

MATERIALS AND METHODS

Techniques used to Plan Implants

Techniques used to plan implants should be carefully thought over. Planning for dental implants focuses on the general health condition of the patient, the local health condition of the mucous membranes and the jaws and the shape, size and position of the bones of the jaws, adjacent and opposing teeth **(Figure 1a).** Sometimes the final position and restoration of the teeth will be simulated **(Figure 1b)**. The implant fixture is first placed, so that it is likely to osseointegrate **(Figure 1c)**, then a dental prosthetic is added **(Figure 1d).** This paper quotes surgical operation by material and case pictures from Puai Yihong Dental Clinic **(Figures 1a-1d).**

In this literature, we analyze this case of Dental Bio-metrics information used for binary image processing, segmentation and matching. Also, it provided with uniqueness. This paper describes a dental surgery within the root canal. This work shows as the uniqueness feature for insertion of the titanium dental implant was present **(Figures 1a-1d)**. More than 95% of these insertion teeth will never cause problem into normal position in the mouth [18].

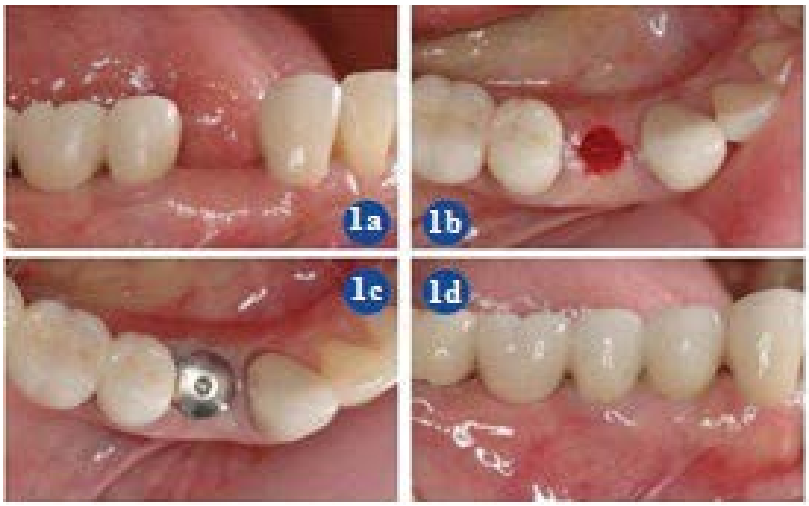

Figure 1. The titanium dental implant **(1a)** Front view of teeth. **(1b)** Top view and drilling hole for insertion of the titanium implant. **(1c)** After insertion of the titanium implant. **(1d)** After implant by similarly nature teeth.

DENTAL IMPLANT TECHNOLOGY

The titanium crescent-shaped groove dental implants include: the titanium dental implant matrix, fixing screw, transformation matrix, matrix groove, cutting edge, micro-pyramid, the crescent-shaped alveolar, combat vibration pin, morse micro-taper **(Figure 2)**.

Through the crescent groove in process for dental implants surrounding bone tissue, it can be used the blood and crescent groove teeth together. Due to insert of the titanium dental implant effective prevent dental implants loose and fall off achieve the goal of reasonable operation. Surgery operation is simple and effective is great. This shaped could replace by secondary dental implants. Also, it increases the surface area of the implant and the alveolar bone.

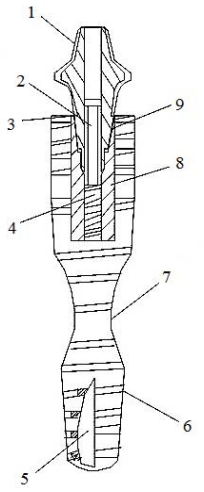

Figure 2. Titanium crescent-shaped groove.

1: The titanium dental implant matrix; 2: Fixing screw; 3: Transformation matrix; 4: Matrix groove; 5: Cutting edge; 6: Micro-pyramid; 7: The crescent-shaped alveolar; 8: Combat vibration pin; 9: Morse micro-taper

The specimen with 2D perspective view is shown in **Figure 2**; where the utility design of the titanium dental implant could effective avoid dental implants prone to pull too tightly and dislocation operation. Also, it could remission the mucous membrane surrounding tissues increased facial muscle tension and additional pain for the patient.

LITERATURE SURVEY AND DISCUSSION

The uniqueness feature for insertion of the titanium dental implant contains several teeth in different portion. After binary image and gray image, the teeth in each portion have diverse gray scale. This different portion and size information could determine each tooth have unique feature information. Later on, we could refer to apply algorithm and database of this uniqueness feature achieve retrieval purposes.

From this literature study, it has been discovered that the insertion of the titanium dental implant and nature teeth have different shows by binary image and gray image.

In this literature, the titanium dental implant has advantages and positive effects: (1) Through the Crescent-shaped Groove in the first phase of implant dentistry implant during the peri-implant bone tissue, blood and Crescent-grooved teeth together. (2) Through prevention of the Crescent-shaped slot to prevent the growing teeth loosen and fall off, meet reasonable operational purposes. (3) The titanium dental implant could be replaced secondary dental implants and disassemble through fixing screw, transformation matrix, matrix groove, combat vibration pin, Morse micro-taper. (4) By Crescent dental molars in the principle of, able to adapt to the implant and surrounding tissue, blood and bone together, better protection of the surrounding tissue, avoid the traditional technical operations or long-term chewing and hold up a face as a result of secondary injury and complications, so as to meet the purpose of the dental implant surgery better go on smoothly. (5) The Groove structure increases the surface area of implants and bone, making teeth more optimum stress distribution.

Compare before and after surgery, there are a few main features: powerful: to restore tooth function very well, chewing function significantly better than other traditional dentures. Not molar: relying on its own artificial teeth repaired without healthy teeth next to the mill, to teeth without any damage. Retention: the clasp do not use traditional dentures or braces, artificial tooth root combination of alveolar bone, rooted like real teeth in the mouth, strong retention and stability. Appearance: according to the patient face, other shapes and colors making the Crown of the tooth, and achieve the best overall harmonious and beautiful.

Image Matching Algorithms

Gradually flattening gray scale/color spectrum theory and technique were used to determine the scope of the value parameter, using the theory of gradually flattening to determine scope of what we have to deal with the pixels of the image, to further process them by binarization method.

If binary picture compared to mining, the image of the theory of gradually flattening gray scale/color spectrum is similar to mineral exploration. When mining, we must firstly carry out prospecting; parameters of binary image information must take precedence over the binary image.

Sood et al. found that different size in each portion information regarding missing each tooth in any portion [19]. From the literature study, we through a computer method by gray image **(Figures 3a-3d)**.

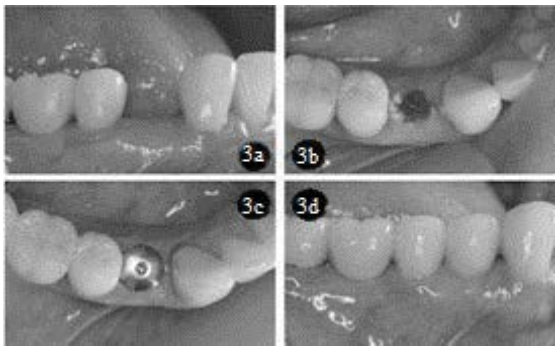

Figure 3: The titanium implant by gray image.

Figure 3 shows the titanium dental implant views as: (1) Front view of teeth. (2)Top view and drilling hole for insertion of the titanium implant. (3) After insertion of the titanium implant. (4) After implant by similarly nature teeth. Further, we through a computer method by binary image processing, segmentation and matching **(Figures 4-13)**. The dental implant photograph is almost not possible to tamper [20].

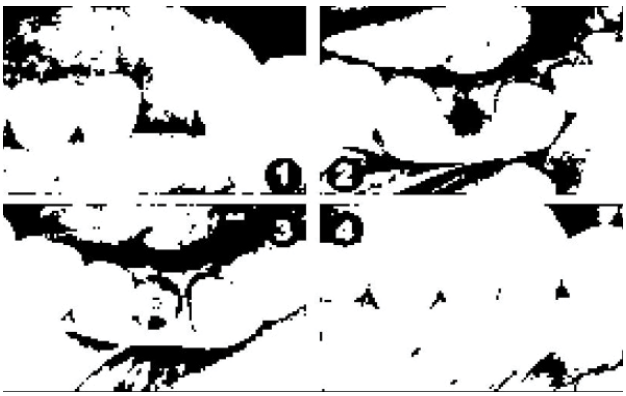

Figure 4. The titanium implant by binary image of the gray scale is 100.

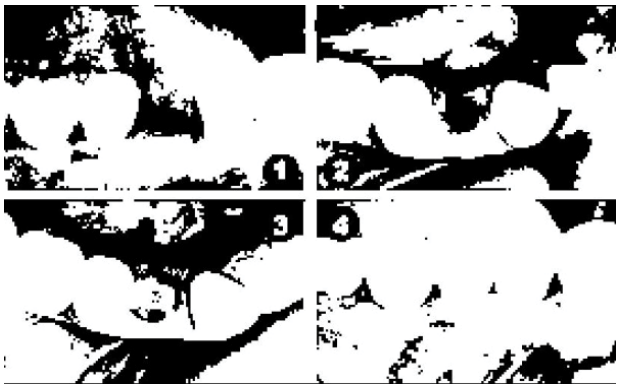

Figure 5. The titanium implant by binary image of the gray scale is 110.

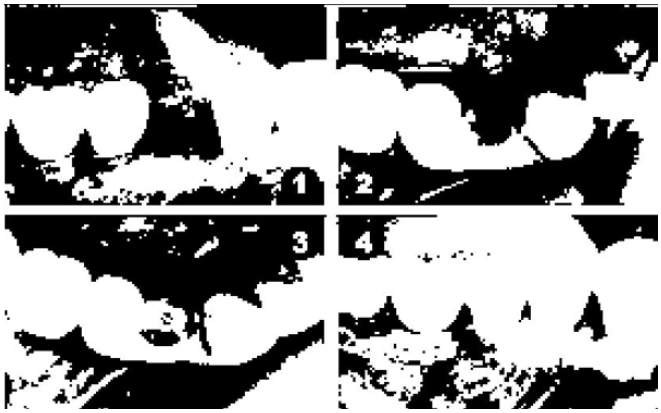

Figure 6. The titanium implant by binary image of the gray scale is 120.

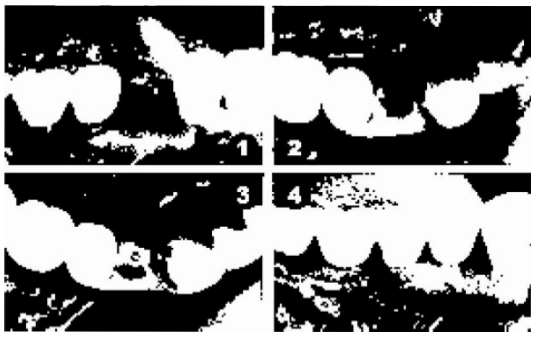

Figure 7. The titanium implant by binary image of the gray scale is 130.

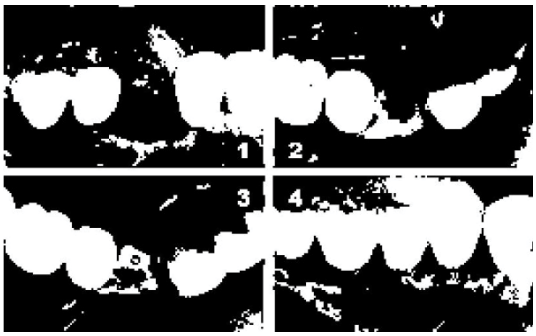

Figure 8. The titanium implant by binary image of the gray scale is 140.

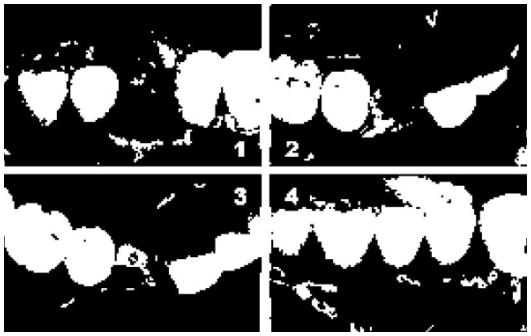

Figure 9. The titanium implant by binary image of the gray scale is 150.

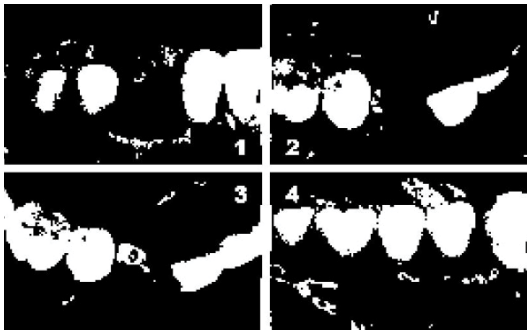

Figure 10. The titanium implant by binary image of the gray scale is 160.

RESULTS

In this paper, we analyze the gradually flattening gray-scale/color spectrum with a binary transformation technology for image grayscale/color information that provided to determine parameters. We started the gray value of 100, and then, increased by 10 units every time, setting a range from 100 to 110 for a range of different range of gray values, in order to confirm the clarity of the teeth and mucosa picture. From **Figures 4-13**, they show the grayscale information, when photos were taken during operation, we adjust the camera to the same parameters. This can also be seen, using this method can change the color of the background and objectives, thus it is suitable for a variety of occasions concluded that a suitable range of values, providing a reference about range of datum for later use.

In this literature, we describe threshold value range information by **Tables 1-3** and **Figures 14 and 15**, summarized as follows:

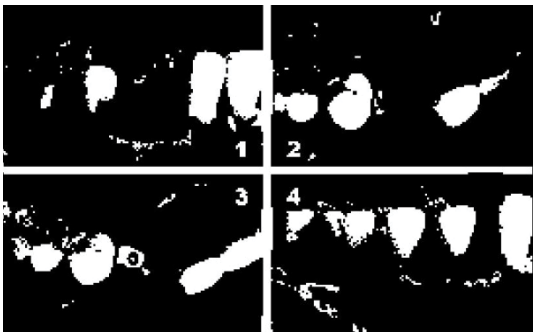

Figure 11. The titanium implant by binary image of the gray scale is 170.

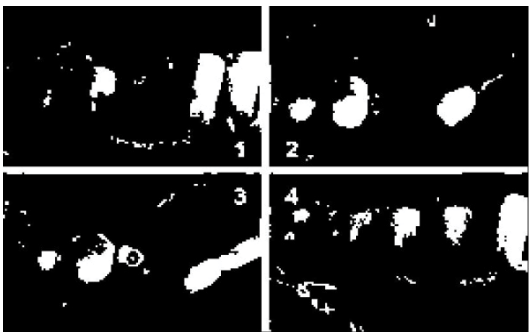

Figure 12. The titanium implant by binary image of the gray scale is 180.

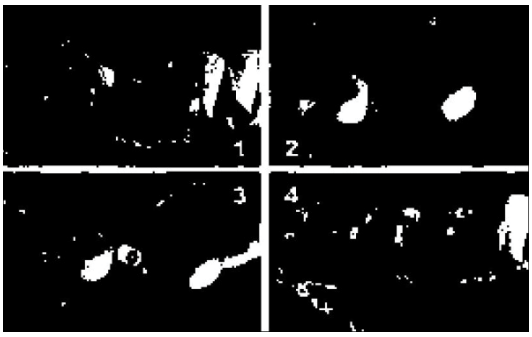

Figure 13. The titanium implant by binary image of the gray scale is 190.

Table 1. The clarity of teeth by different gray values.

Clarity: Threshold Value	Oral mucosa	Teeth
100-120	The background color is hard	The profile of the teeth is not clear
120-140	The background color is increasing hidden	The profile of the teeth is well clear
140-160	The background color is appropriately hidden	The profile of the teeth is clear
160-190	The background color is all hidden	The teeth color is increasing hidden

From the **Table 1**, we can see that: (1) In the 100-120 range, the background color is very heavy, and the noise is particularly high. (2) Over 120 this value, it began to hide the background color, background noise of the oral mucosa and tongue gradually fade. (3) The contours of the teeth gradually cleared up. In the 140-160 range, tooth shape is the clearest; background noises are almost completely hidden. (4) Over 160, however, tooth shape also started to be hidden when this value is set at 190, and shape of the teeth are almost completely hidden.

Table 2. The percentage of effective interval of the entire one.

Threshold Value	Percentage (%)
0-100	39.45
101-120	7.81
121-160	15.62
161-190	11.72
191-255	25.39

From **Table 2** and **Figure 14**, we can see that: (1) actually selected interval, only accounted for the entire section range of 35.15% (11.72%+15.62%+7.81%). (2) Effective threshold value range of 15.62% in the range 101-190 value. (3) Useless intervals respectively are 0-100 and 191-255.

Table 3. The percentage of effective interval of the entire one.

Threshold Value	Percentage (%)
101-120	22.22
121-160	44.44
161-190	33.33

From **Table 3** and **Figure 15,** we can see that in our actual choices range, effective interval is about 44.44%, and the rest is controlled comparison of fuzzy interval.

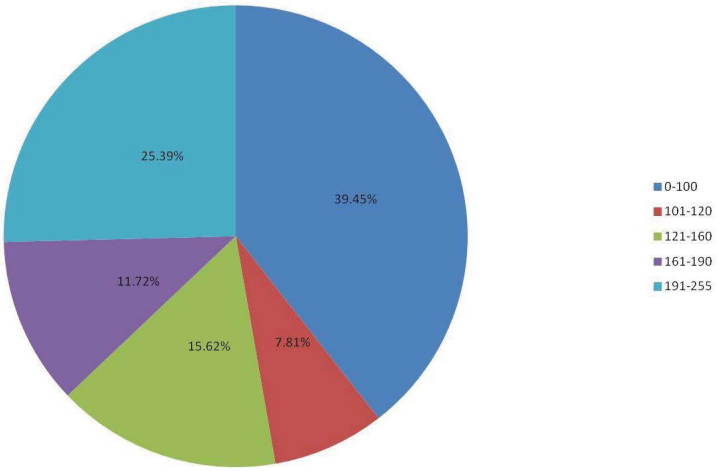

Figure 14. The percentage of effective interval of the entire one.

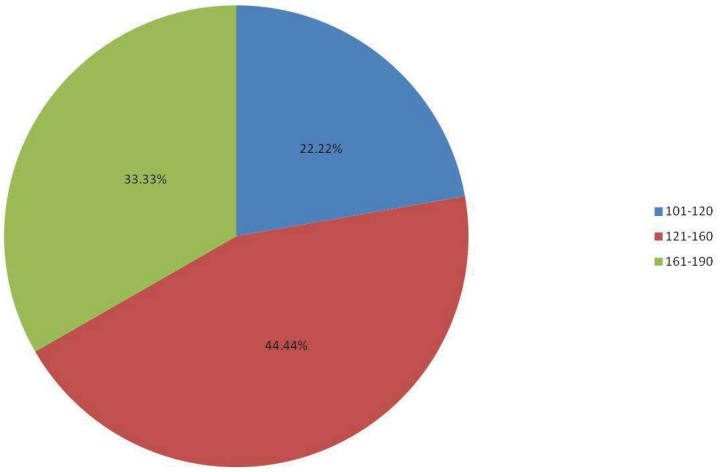

Figure 15. The percentage of effective interval of the entire one.

CONCLUSION

The research adds new supplication to image binarization technique. The binary image theory and technique has flexible and universal features. Image theory of gradually flattening gray/color spectrum and technology for image threshold parameters determined and proved to be a powerful tool, it can dig up human vision that can't tell but practical gray, providing gray scale/color information to support for the image binarization technique.

In addition, the templates are derived from the input data, and the template size is automatically adjusted to the image resolution, so that the method is scale invariant. As a result of the self-adapting properties, the method is robust with respect to imperfections in the confocal image stacks due to varying intensity levels, poor signal-to noise ratio or strong anisotropic blurring. Finally, we have confirmed the accuracy, robustness and scale invariance of the algorithm.

This study proves that picture binarization processing can be applied in the diagnosis of oral mucosal disease. There have also been reports about applications in other fields of medicine. We can go on further research for providing better clinical services [21-23].

On the basis of this dental implant, the following can be concluded.

(1) The groove type structure could prevent dental implants loose and fall off.

(2) The groove type structure could increase the surface area of the implant and the alveolar bone (As shown in **Figures 2-7**).

(3) The titanium dental implant could be replaced secondary dental implants and disassemble (As shown in **Figures 6-9)**.

(4) The titanium dental implants prone to avoid pull too tightly and dislocation operation in surgery.

All in all Crescent Groove structure provides us with the theoretical basis of a dental implant shape structure through subsequent clinical validation, which is better service to patients.

This research took dental implant surgery photos of a 28 year old female patient by analyze for the application of binarization technique, it is necessary, in the next step, we should do it for 45 years old for more information.

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