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IMPLANT PLANNING THERAPY BASED ON CBCT IMAGES OF THE RADIOSENSITIVE TEETH

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Abstract: The loss of one, several or all teeth reduces the quality of life. Modern dentistry offers many options for the rehabilitation of such patients. The planning and preimplantation diagnostics and preparation take an important place in oral implantology. In the process of planning and preparation for implantation, radiography occupies a central place. This paper presents the case of 60 year old patient, edentulous, who came to the Dentistry Clinic of Vojvodina in order to get fixed dental restorations carried by dental implants. Both upper and lower acrylic complete dentures were made, using radiosensitive teeth and a CBCT scan was made with the dentures in the mouth of the patient. Analyzing scans obtained in this manner, the final treatment plan was made.

Key words: Implantology, CBCT, radiosensitive teeth


Ključne reči: Implantologija, CBCT, radiozensitivni zubi

1. INTRODUCTION

The teeth and oral cavity, as the initial part of the digestive system, have an important physiological role in the organism, as well as their role in the function of speech, they have an impact on the appearance of a person, so they have a large affect the psychology of a person and its identity. The loss of one, several or all teeth has multiple consequences, reducing the quality of human life [1].

Modern dentistry offers many options for the rehabilitation of such patients. In last two decades especially dental implantology has developed, enabling us to make fixed and removable dental restorations carried by dental implants.

In everyday clinical practice, we meet with a relatively large number of patients who require implant treatment, and where the loss of one, several or all teeth led to a significant bone loss of the alveolar ridge [2].

Alveolar ridge of the jaw carries the teeth in the dental alveoli and the formation of this ridge begins simultaneously with the eruption of teeth, and its atrophy and reduction is caused by their loss. This means that the alveolar bone has the function to receive and distribute the forces of chewing on the bones of the skull [3].

In these situations it is necessary to compensate the lost bone in order to ensure optimal conditions for placement of dental implants and prosthodontics [2].

Loss of alveolar bone may occur prior to tooth extraction because of periodontal disease, periapical pathology or trauma to teeth and bone [4]. The tooth extraction can also result in a significant bone loss.

All of the above, can cause the appearance of unevenly resorbed ridges of different shape, height and width, which creates serious problems if we want to obtain the quality prosthetic rehabilitation of these patients [3].

The problem of rehabilitating partially or totally edentulous patients is not only related to underdeveloped countries. More than 60% of the population in the highly industrialized countries requires treatment with dental implants, which is the reason for the annual growth of implants market of about 15% [5]. It is estimated that in the US alone, according to current data, there are about 36 million edentulous people [3].

The planning and preimplantation diagnostics and preparation take special important place in oral implantology. Planning is mostly teamwork involving professionals of different specialties. In the process of planning and preparation of implant therapy radiological diagnostics occupies a central place [3].
2. APPLICATION OF CBCT WITH RADIOSENSITIVE TEETH

CT and CBCT (Cone beam computerized tomography) technology provides clinicians with new methods to view patient anatomy exceeding conventional two-dimensional radiology. Interactive software applications allow for improved interpretation of the CT scan data. The enhanced capability of innovative software applications that allow clinicians to interpret and maneuver through various three-dimensional images has far-reaching implications when interactive treatment planning software is combined with computer-aided design and manufacturing [6]. Cone beam CT (CBCT) permits finely detailed visualization of the osseous architecture with high contrast and without burn out. By offering tomographic slices download to 0.08 mm, a true volumetric presentation of the arch is obtained [7]. Information obtained from cone beam computed tomographic scans permits the measurement of the density, height, and buccolingual with of the alveolar bone at any jaw location, as well as visualization of the pathology, inclination of the bone, and anatomic vital structures [8].

In everyday clinical practice use of CBCT is a standard today, and it is crucial in planning of the implant position. If a patient lost only one or a small number of teeth, only CBCT scan is sufficient, but with totally edentulous patients it does not provide us with enough data so that we can accurately determine the exact position of the implants. CBCT scan with a model of a tooth restoration using radiosensitive markers in the mouth is one way to overcome this problem, because it gives us information about the teeth position in the final prosthesis. As markers, unlike in conventional radiographic methods, in making CBCT images metal can’t be used, but takes into account the use of gutta-percha points or radiosensitive acrylate [3].

Making the temporary prosthesis with radiosensitive acrylic teeth is just a method that enables us to overcome the above problems and limitations of CBCT in the planning of implant treatment in edentulous patients. Software analysis of the recorded images thus gain us insight into the dental-alveolar relations, and we can accurately determine the position and inclination of the implant and to plan augmentation procedures on residual alveolar ridge if there is a need.(Figure 1.)

CT and computerized systems have brought revolutionary changes in implantology and in the future will certainly have a key importance in the development of this discipline [3].

3. IMPLANT PLANNING THERAPY - CASE REPORT

This paper presents the case of a 60 year old patient, totally edentulous, responding to the Dentistry Clinic of Vojvodina in order to get fixed dental restorations carried by dental implants. His medical history data were obtained and showed that the patient is in a good general state of health, does not take any treatment and is not allergic to food, medicines nor dental materials. Teeth have been extracted successively for several years, and he had never had dentures. It also states that in the upper jaw he had surgery twice on the roots of the front teeth.

Clinical intraoral examination shows significant degree of bone resorption in the residual alveolar ridges, which is especially pronounced in the upper jaw (Figures 2. And 3.)

By making an analysis and X-ray OPT footage a considerable loss of bone in both jaws was noticed, as well as enhanced pneumatisation of both maxillary sinuses.

It was decided that prior to definitive treatment plan, the patient should be provided with a temporary upper and lower total acrylic prosthesis, but conventional acrylic teeth should be replaced with radiosensitive teeth (Figure 4).
Next step would be making of a CBCT scan with these dentures and placing them in the patients mouth. (Figure 5)

After the analysis of the obtained images, it was possible to make a definitive treatment plan (Figures 6., 7. and 8.). Number, positions and dimensions of the dental implants that will carry dental restorations was established, as well as the amount of bone tissue that must be compensated prior to the implant placement. In the upper jaw, since the atrophy of the ridge was far more progressive, a two-phase intervention was planned, whereby in the first act alveolar ridge augmentation should be carried out, and in the second insertion of the implants. In the lower jaw it was possible to implement therapy in one act, i.e. implants will be placed with simultaneous compensation of smaller amount of bone loss. After such a developed treatment plan, we started its implementation.
4. CONCLUSION

Tooth loss and its consequences in modern society represent a serious medical, social and economic problem and, therefore, it is not surprising that a large number of scientists of medical and technical sciences are dealing with it. The development of science and technology in the last 20 years puts dental implantology in the front row, as a branch of dentistry that largely solves this problem. Particular progress has been made in terms of preimplantation diagnostics and planning of implant therapy.

Today, dental implantology is not possible without the use of CBCT devices and a software support for these machines, in the form of a number of programs aimed at analyzing, planning, virtual implant placement into the desired position, and all other processes that allow us to implement optimal therapy in each case. The introduction of radiosensitive teeth in treatment planning of edentulous patients greatly improves the accuracy and reliability, and reduces the possibility of error when making teeth restorations. The very simplicity of the procedure to make dentures with the teeth is giving it an advantage over some other procedures that have been used in practice.

Although this procedure extends a treatment and makes it more expensive, benefits which it brings exceed its disadvantages, and the authors of this paper suggest that the this protocol should be included in the regular protocols in implant treatment of edentulous patients.

5. REFERENCES


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