SMART DENTAL UPDATES

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Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you **"SMART DENTAL UPDATES"** which contain latest and interesting news in the field of Dentistry.

This issue contains:

- **A study on current issues with 3D printing complete dentures**
- **A Study to Differentiate Between Odontogenic Keratocysts and Ameloblastomas using a Novel Three-Dimensional and Non-Invasive Diagnostic Approach**
- **A study on the clinical effectiveness of short (6mm) and longer implants placed side by side in a posterior partially edentulous area.**
- **A case report of a rare odontogenic cyst: Gingival cyst of the Adult.**

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A study on current issues with 3D printing complete dentures

INTRODUCTION

3D Printed Dentures

Dentures are often made by applying pressure and heating acrylic resins to cure them while they are under pressure and enclosed in a plaster mould. When resin is cured, contraction results in deformation. The correctness of a denture's fit is crucial for enhancing comfort, stability, and chewing effectiveness [(1)]. The creation of partial and complete dentures has advanced significantly as a result of the introduction of digital technologies. In the near future, the speed and ease of dental procedures will change due to digital manufacturing. These cutting-edge technologies include additive manufacturing (three-dimensional (3D) printing) and computer-aided design/manufacturing (CAD/CAM) [(2)]. However, the absence of a standardised clinical process and the scarcity of considerable data from randomised clinical trials (RCTs) persist. The purpose of this study was to create the best clinical and laboratory procedures for making 3D printed dentures.

3D-printed dentures using regular clinical techniques was possible but not better than traditional dentures. 3D printing worked well for creating baseplates, and hybrid scanning improved coverage.

METHODS

The prospective cohort study was conducted on 16 patients of which 2 patients were withdrawn from the study. The inclusion criteria included being edentulous, available for follow-up, clinically needing new dentures, willing to give informed consent, and over 60 years old. Each patient got traditional and 3D-printed dentures, using the same processes. The study explored various ways to get data for printed dentures fitting surface. Options included direct scans impressions, casts or hybrid scans. Clinicians chose between traditional and 3D-printed jaw registration rims. After successful trials, virtual dentures were created and printed with customized sockets. An occlusal splint was involved for proper alignment. Both traditional and 3D-printed dentures were produced. Although the study's primary goal was to determine whether a manufacturing approach was feasible, the secondary outcomes were also evaluated: the 'occlusion registration' phase of denture manufacture uses a 3D-printed baseplate, the quality of completed dentures, the patient's choice between the traditional denture and the 3D-printed denture.

TABLE 1 - PATIENT PREFERENCES

Patient ID	Patient preference
1	Conventional
2	Conventional
3	Conventional
4	Conventional
5	Both satisfactory
6	Conventional
7	Conventional
8	Conventional
9	Both satisfactory
10	Conventional
11	Printed
12	Both satisfactory
13	Both satisfactory
14	Printed

RESULTS

Out of 16 cases, clinicians favoured the 3D printed jaw registration rim in 13 instances. There were 5 cases where conventional was more retentive and one case where the digital denture had better retention. In 6 cases, the 3D printed denture was equally retentive as the conventional. The conventional denture was considered more stable in 5 cases, with one instance of the printed denture being more stable. In 8 cases, both types of dentures were equally stable. Notably, conventional dentures were all rated as 'comfortable' or 'very comfortable', while 3 digital dentures were 'uncomfortable' and 2 were 'neutral'. Among 14 cases, 8 patients preferred conventional dentures, 2 preferred 3D- printed dentures and 4 found both dentures satisfactory (TABLE 1).

DISCUSSION

The current study showed that, among 14 cases, 8 patients preferred conventional dentures, 2 preferred 3D- printed dentures and 4 found both dentures satisfactory [(1)]. The study by Ohara K et.al., showed despite the fact that patients were less satisfied with digital dentures (DDs) compared to conventional dentures (CDs), 20% of them chose and utilized DDs (12 patients favoured CDs while 3 patients selected DDs). Therefore, DDs created through 3D printing might exhibit similar practicality and effectiveness as CDs [(3)].

CONCLUSION

Baseplates for jaw registration blocks and wax trial insertions may be created via 3D printing. The use of standard clinical methods for imprints, jaw registration, and wax trial implantation may be used to create 3D-printed dentures. The process for making 3D-printed dentures in this study is not more effective than making traditional dentures. The task requires more effort.

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A Study to Differentiate Between Odontogenic Keratocysts and Ameloblastomas using a Novel Three-Dimensional and Non-Invasive Diagnostic Approach

INTRODUCTION

To distinguish between Ameloblastomas and odontogenic keratocysts, House field unit(HU) and gray scale values (GSV) spectra derived from CT and CBCT scans can be employed.

Ameloblastomas (AMs) and odontogenic keratocysts (OKCs) are the two most common odontogenic neoplastic tumours benign lesions. AMs, OKCs primarily present as well-defined radiolucent lesions [(1)], which are more prevalent in the back of the mandible and can develop at any age [(2)]. Clinically, the treatment of maxillary AMs should be more aggressive, with a longer follow-up period. But curettage and enucleation are frequently used to treat OKCs. Planning the course of treatment requires a convincing preoperative diagnosis. Nowadays, spiral CT or cone beam CT (CBCT) play a significant role in the detection and delineation of maxillary lesions and their influence on neighbouring tissues [(1)]. Efforts have been made to distinguish these lesions using their appearance in images. Certain Housefield unit(HU) ranges can express tissue characteristics in CT scans. This study explores if these values can differentiate between OKCs and AMs in both CT and CBCT scans, presenting a new diagnostic approach. The hypothesis is that such differentiation might not be achievable [(2)]. The purpose of this study was to illustrate the diagnostic capability of distinguishing odontogenic keratocysts from Ameloblastomas using CT and CBCT scans.

METHODS

The study was conducted on a group of participants who underwent surgical treatment for maxillary and mandibular cysts (OKCs or AM). The initial group included 124 participants, and their clinical information like age, gender, lesion location, histology and imaging methods were analysed. Over 16 years, 51 participants met the inclusion criteria. 39.22% were females, 60.78% were males. The main requirement was having a high-resolution CT or CBCT scan prior to surgery. CT scans were done with specific settings on a SOMATOM Definition flash machine, while CBCT scans were conducted using an orangedental master 3DS machine. These criteria narrowed down the group to 51 participants for further analysis. Lesion quantification was done using Mimics software by processing baseline CT scan data. Lesions were differentiated from normal tissue using Hounsfield Unit(HU) thresholds, and virtual dissection corrected any errors (FIGURE 1 A-C). HU spectrum was then calculated for each case. Similar procedures were applied to CBCT scans

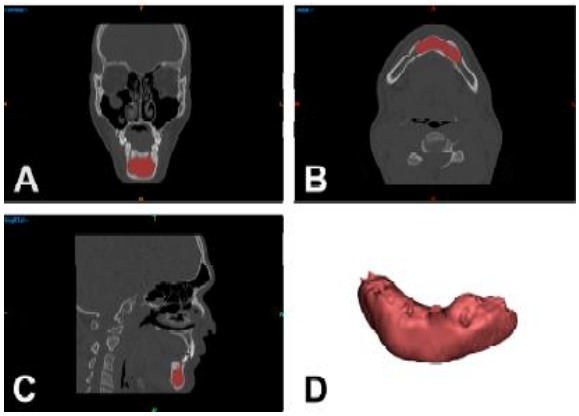

Figure 1 Hounsfield unit thresholding and virtual bone dissection in the coronal(A), axial(B), and sagittal reformations(C) were used to separate the cystic structures (red area), quantify the included Hounsfield unit spectrum, and create a 3D model that showed the size of the odontogenic keratocyst (D).

to calculate the GSV spectrum. Two independent investigators performed these steps, and comparisons were made within the same imaging modality (CT or CBCT). A statistical analysis of the data was performed.

RESULTS

42.50% of females had OKC, along with 57.50% of males. 18.18% of females had AM, along with 81.82% of males. Average age was 42.06 years, OKC participants averaged 38.74 years, AM participants averaged 55years. Of 40 OKCs, 47.50% had CT scans, 52.50% had CBCT scans. For 11 AMs, 63.64% had CT, 36.36% had CBCT. Lesions were in various jaw areas, with mandibular angle most common. Average lesion volume was 7179 mm^3, pixel count averaged 160,832 pixels. The measurements of HU and GSV spectra were reliable between investigators. For CT scans, OKCs had an average HU of 19.79, while AMs had 43.52(FIG 2A). In CBCT scans, OKCs had a mean GSV of -564.76 and AMs had -413.76(FIG 2B). both HU and GSV were significantly higher in AMs than OKCs, aiding their differentiation. The factors influencing discrimination between OKCs and AMs were examined based on HU and GSV. Gender, age and lesion location didn't impact HU and GSV differences. Lesion size and configuration, caused HU and GSV differences between OKCs and AMs.

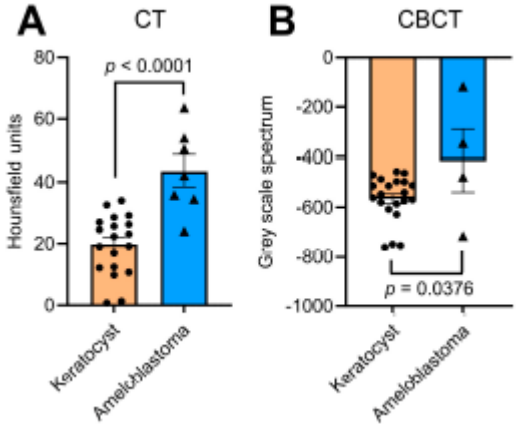

Figure 3 Hounsfield unit and grey scale spectra were quantified to distinguish between odontogenic keratocysts and ameloblastomas in CT (A) and CBCT (B) imaging.

DISCUSSION

This study showed, Lesions were more commonly present in mandible and are more common in males compared to females. The HU and GSV spectra for OKCs and AMs in CT and CBCT images, respectively, were identified. This study was able to distinguish both entities in the scans based on density values with a statistically significant difference in both CT and CBCT. Nath P.et.al., study showed Except for three in maxilla, all of the OKCs were discovered in the mandible. Incidence was much greater in males between the ages of 21 and 30[(3)]. Chai ZK.et.al., study showed CBCT had good accuracy in diagnosing ameloblastoma (AME) and odontogenic keratocysts (OKC) [(4)].

CONCLUSION

The results showed that distinguishing between OKCs and AMs using CT is possible as a non-invasive diagnostic choice. Similarly, CBCT scans offer another practical, non-invasive and low-radiation option for diagnosing both conditions.

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A study on the clinical effectiveness of short (6mm) and longer implants placed side by side in a posterior partially edentulous area.

INTRODUCTION

Compared to conventional implants, 6mm short implants in a posterior edentulous location produced outstanding results.

Dental implant therapy has emerged as a reliable option for patients with partial or complete tooth loss. Over the years, numerous clinical studies have demonstrated remarkable outcomes in terms of appearance, speech and mastication [(1)]. Due to insufficient vertical bone volume, poor bone quality, restricted vision, decreased interarch space, and sinus pneumatization, dental implantation in the posterior maxilla is typically difficult. The sinus floor can be elevated to create enough vertical bone volume in the posterior maxilla. However, surgery to raise the sinus floor is typically more expensive with more complications including infection, perforation of the sinus membrane, and graft failure. As an alternative to sinus floor elevation surgery, short implants with enhanced implant design and surface qualities have been used successfully and have had positive outcomes in the posterior maxilla. According to reports, the survival rates of implants less than 10 mm, 8 mm, 7 mm, and 6-8 mm22 are equivalent to those of long implants [(2)]. This study evaluated the clinical results of 6mm short implants in comparison to conventional implants when both are inserted in equivalent bone quality settings and exposed to similar occlusal forces.

METHODS

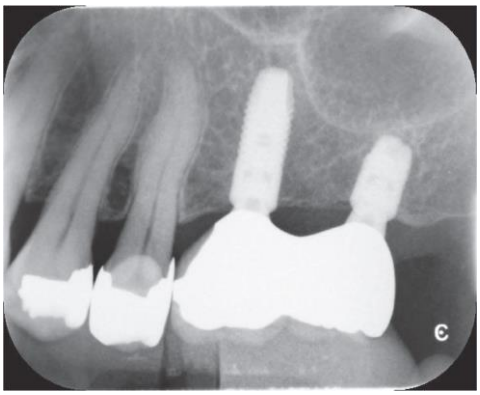

Figure 4 : Radiography taken inside the mouth three years after loading. One standard-length implant and one short implant were positioned adjacent to one another.

The open labelled observational study was conducted on 9 patients (2 males, 7 females), aged between 53 and 72 years. The study included participants who were missing 2 successive teeth in the posterior maxilla or mandible and had a single tooth gap, necessitating the use of a short implant. Initial screening involved a clinical assessment and radiographic evaluation of the volume of bone in the jaw using computed tomography(CT). All patients were given a short implant (4.0mm wide x 6mm length) and a standard-length implant (4.0mm width x 8mm length or longer) placed side by side (FIGURE 1). Following the surgery, patients were given antibiotics, pain relievers and mouthwash. They were advised to

avoid brushing the surgical area. Sutures were removed after 7-10 days and patients were reminded of proper oral hygiene practice. The implants remained covered for 3-6 months to heal before receiving prosthetic restorations. X-ray was taken regularly to monitor changes in bone level around the implants. Patients were examined every 6 months for implant success, gum health, complications and prosthetic issues. This follow-up period lasted for 3 years. The collected data was analysed using IBM SPSS version 23 software.

RESULTS

The study included 9 patients, with 6 receiving implants in mandible and 3 in maxilla. A total of 20 implants were inserted in the molar/premolar region, 10 of which were shorter(6mm) and 10 were standard length (8mm, 9mm or 11 mm). All implants integrated successfully with no mobility or suppuration during the 3-year follow-up (100% survival rates). Some minor bleeding occurred around a new implant, which was resolved through oral hygiene guidance. Over the observation period, a few short and standard-length implants experienced bone loss, and one standard-length implant had more significant bone loss during functional use. No other issues were observed (TABLE 1), resulting in 70% and 60% success rates for short and standard-length implants respectively. The marginal bone level(MBL) changes around both type of implants indicated slight bone gain. Cortical bone thickness and trabecular bone CT value showed no notable differences between implant groups. Additionally, there was no significant correlation between these bone characteristics and bone loss after 3 years of use.

TABLE 1: Data on implant success, biological, and prosthetic complications.

		SHORT IMPLANT		CONVENTIONAL IMPLANT	
		Maxilla	**Mandible**	**Maxilla**	**Mandible**
Annual bone loss ≥0.2mm	**Mesial**	0	3	0	3
	Distal	0	2	1	1
Total bone loss≥0.6mm	**Mesial**	0	0	0	1
	Distal	0	0	0	0
Sulcus bleeding index ≥1		0	2	0	1
Suppuration		0	0	0	0
Prosthetic complications		0	0	0	0

DISCUSSION

The current study showed a few short and standard-length implants experienced bone loss, and one standard-length implant had more significant bone loss during functional use resulting in 70% and 60% success rates for short and standard-length implants respectively. Papaspyridakos P et.al., study showed that after period of 1–5 years in function, shorter implants (6 mm) were shown to have more variability and less predictability in survival rates compared to longer implants (>6 mm) [(3)].

CONCLUSION

The clinical results of 6mm short implants and conventional implants put under equivalent settings of bone quality and occlusal stress were examined for MBL modifications, survival rates, and extra biological or prosthetic issues. Given the limitations of this study, it may be concluded that short implants functioned better than standard implants in a posterior edentulous site.

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A case report of a rare odontogenic cyst: Gingival cyst of the Adult.

INTRODUCTION

Gingival cyst of the adult (GCA) are rare in older individuals and they should be considered in the differential diagnosis of gingival swelling.

Gingival cyst of the adult (GCA) is a very rare odontogenic disease that develops where the dental lamina rests. It is more common in the mandible and often appears in the vestibular gingiva of canine and premolars [(1)]. GCAs appear as tiny, single nodules or vesicles that are often no larger than 6 mm in size [(2)]. Typically, it affects individuals in their 50s and 60s [(1)]. This cyst's histopathological characteristics include a thin nonkeratinized epithelial lining with or without isolated regions of acanthosis that contains transparent cells with glycogen-rich cytoplasm [(3)]. This report described a rare case of a single GCA in an 82 years old patient who had a distinct nodule between the first premolar and the right canine of the mandible.

CASE PRESENTATION

FIGURE 1- Visual observation during the initial examination

An 82-year-old women visited the dentist for routine check-up. The patient had a painless swelling on her lower right gingiva, that had been growing slowly for a few months. The patient had some dental issues, like tooth wear, missing teeth, and had a history of colorectal adenocarcinoma resection 5 years ago. The patient had a past medical history of type II diabetes, high cholesterol and hypertension which were not been treated. During the clinical examination, a small, solitary, translucent, yellow nodule measuring 3 × 3mm was discovered. This nodule was located on the attached gingiva below the interdental papilla, positioned between the lower right mandibular canine (tooth #43) and the first premolar (tooth #44). It felt firm and had a sessile base (FIGURE 1). Pulp testing showed normal pulp vitality for the adjacent teeth. X-ray didn't show any bone involvement. Based on these findings, a tentative diagnosis of a cystic gingival lesion was made. Other possible diagnoses like fibroma, retained

FIGURE 2- Visual observation at 2.5-year follow-up examination.

foreign body, lipoma and rare conditions like peripheral odontogenic keratocyst were considered. A surgical biopsy was done while the patient was under local anesthesia. Injections were administered above 3mm away from the lesions to prevent any harm to the tissue and to enable thorough microscopic analysis. A spindle-shaped incision was made, removing the surface mucosa and underlying connective tissue. Interestingly, a translucent, yellowish liquid was discharged during the procedure. The tissue that was removed underwent histopathological examination. Upon examination the removed tissue, a soft, grayish nodular piece measuring around 4 × 3× 2mm was observed. Microscopic examination of gingival tissue sections showed a cystic cavity lined with 2-3 layers of cuboidal cells forming non-ketatinized stratified squamous epithelium (FIGURE 3A AND 3B). Additionally, certain areas contained clear cells within the epithelium (FIGURE 3C). The fibrous wall didn't show signs of inflammation. The histopathological analysis identified it as a Gingival cyst of adults(GCA). The sutures were removed after 2 weeks without any issues. During follow-ups for over 2.5 years, there was no signs of recurrence (FIGURE 2).

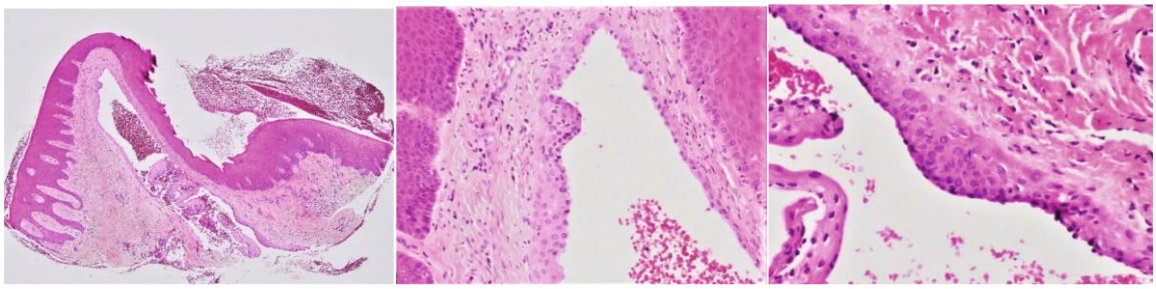

FIGURE 3- A) A fragment of mucosa covered by layered squamous epithelium supported by fibrous connective tissue containing a cystic space. B) The cystic space is covered by a lining of squamous and cuboidal cells typically 2-5 cell thick. C) High-power view displaying an epithelial plaque.

DISCUSSION

This report described a rare case of a single GCA in an 82 years old patient who had a distinct nodule between the first premolar and the right canine of the mandible. Microscopic examination of gingival tissue sections showed a cystic cavity lined with 2-3 layers of cuboidal cells forming non-ketatinized stratified squamous epithelium. Surgical biopsy was done and the histopathological analysis identified it as a Gingival cyst of adults(GCA) [(2)]. The study by Viveiros SK et.al., showed GCA commonly occurs in the mandible, affecting individuals in their 50s and 60s [(1)]. Studies showed a nonkeratinized squamous cystic epithelium lining a fibromyxoid connective tissue cyst on microscopic examination and excision biopsy was the most effective treatment for GCA, and the likelihood of recurrence is rare [(4)].

CONCLUSION

GCAs are infrequent, benign, odontogenic cysts that grow slowly and are usually found in the mandibular attached gingiva around the canine-premolar region. While these cysts are rare in older individuals, they should be considered in the differential diagnosis of gingival swelling.

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