What's new for the clinician?

Summaries of and excerpts from recently published papers

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Compiled and edited by V Yengopal

1. Template-guided vs. non-guided drilling in site preparation of dental implants

Scherer U, Stoetzer M, Ruecker M, Gellrich NC, von See C. Clinical Oral Investigations, 2015: 19: 1339-46.

Sufficient primary stability of the implant is a prerequisite for successful clinical success in osseointegration. A micro-movement of no more than between 50 and 150µm is acceptable.[1] Osseointegrative processes are dependent on the width of the necrotic zone which needs to be kept to a minimum in site preparation. Critical mechanical aspects during site preparation are the geometry of drills, which directly affects the magnitude of drill temperature reached, the pressure applied to the bone and the speed and torque used.[1] It is known that the bone is very susceptible to thermal injury and factors such as drill bit geometry, feed rate, shape of the drill flute, sharpness of cutting edges, the value of the point angle, and drill wear influence the amount of frictional heat production which can cause thermal injury to bone.[1]

Bone is a very challenging material to drill, due to its unique properties. Drill bits need to fulfil special requirements such as the ability to evacuate chips and debris from the drill flute, as the bone tends to clog.[1] Clogging leads to significant increases in force and torque. Unguided free-handed manual handling drilling actions are influenced by individual strength, hand movement and technical skills. These characteristics may be able to balance or compensate for the problems of dull cutting tools and frictional heat and and thus influence the result of drilling action on the bone but this may vary depending on the type of instruments used, the experience of the clinician and the quality of the bone.[1] Thus, it is clear that the drilling of bone is a dynamic process, and is influenced by several factors.

Procedures involving the drilling of the bone are highly challenging due to vibration, inaccessibility of the surgical area and potential failure by inaccurate motion control or even drill bit breakage. In oral surgery and in dental implantation, guide templates are extensively used for the gradual expanding drilling sequences in the human jawbone.[1]

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Scherer and colleagues (2015)[1] reported on a study that sought to investigate the potential ability of template-guided drilling to aid in compensating for the inevitable irregularities of manual working procedures on the part of the handler. The researchers described drilling tests carried out using guidance templates as well as free-hand drilling procedures and compared the results of experienced against inexperienced handlers.

MATERIALS AND METHODS

The drilling experiments were carried out in a total of 24 fresh cadaveric porcine mandibles taken from three-year-old animals, which were divided into four groups. Mandibles in group 1 (n=6) underwent the free-handed drilling actions of persons without surgical knowledge and poor operating experience in mechanical drilling. Group 2 (n=6) consisted of the same operators, but this time performing drilling actions with the help of template guidance. Group 3 (n=6) saw free-handed drilling actions performed by highly experienced oral and maxillofacial surgeons. In group 4 (n=6), these professionals were performing drilling actions with support of template guidance. Each of these four experimental groups comprised three operators. Every jawbone underwent a total of five drilling actions of a single operator. Results were thus obtained for 15 drilling actions per operator, and a total of 180 drilling actions could be analysed.

Prior to each experiment, porcine mandibles were cleaned of adherent soft tissue. Specimens were separated in half by sawing, one section was placed on a drilling platform and the assembly securely clamped in a phantom head. An electric drilling instrument with continuous saline cooling was used.

Drilling actions for preparation of monocortical implant anchorage were carried out according to the surgical protocol suggested by the drill manufacturer (Bego, Bremen, Germany). Template-guided drilling was provided using Plexiglas gauges with embedded guiding sleeves. Into these guiding sleeves, spoons with a precise drilling channel could be clamped with a twisting motion, ensuring a stable positioning. The load-bearing structure of the Plexiglas gauge itself was anchored with screws to the jawbone for maximum resistance of distortion. Drills were changed after every three holes to avoid the possibility of inaccurate diameter due to drill wear.

Jawbones were analysed in conebeam computer tomography (CBCT) and the bone quality of the specimen was classified as type D2.

The diameter of each drill hole was recorded with a precision measuring instrument at drillholes depth of 2, 4 and 6mm. Each measurement was taken twice in different orientations. The values of the two corresponding measurements were then averaged.

RESULTS

The drilling performances of inexperienced versus experienced operators in free-handed or template-guided drilling procedures were evaluated by diameter analysis with respect to three different levels of depth measurement.

Intra-individual differences in the diameters of the holes prepared by free-hand drilling by inexperienced persons (group 1) were obvious due to the high variances and standard deviations. Group 1 showed the highest levels of alterations of diameter with a maximum of 2.72mm in a drillhole, measured at depth of 6mm. In contrast, in the group of highly skilled individuals (group 2) representing professional oral surgeons, the variability of the particular free-hand drillholes remains relatively small. Statistical analysis of the average drillhole diameters prepared by these two groups gives very significant differences ($p \leq 0.001$), seen at 4mm and 6mm depth of measurement. The degree of deviation is more pronounced than at the depth of 2mm.

In general, the accuracy of drillhole diameter and the deviations from the ideal radius decreased with the depth of measurement. Diameter measurement showed this effect across all experimental groups in this relationship.

Differences between values obtained from experienced operators exercising free-hand drilling (group 2) versus template-guided action of experienced operators (group 4) showed statistical relevance at measuring depths of 2 and 4mm ($p \leq 0.001$). At the depth of 6mm, no significant differences were observed. Inexperienced handlers using template guidance were represented in group 3. They showed almost comparable and no significantly different results in accuracy as did the group of experienced operators (group 4). High intra-individual differences such as were found in group 1 (without template guidance) were not observed in group 3 (with template guidance) due to lower failure bars. Variability of measured diameters and calculated standard deviation in groups 3 and 4 showed very low values due to a higher level of precision in using template guidance drilling. Highly skilled operators performing free-handed drilling actions, represented in group 2, show the ability to produce drillholes with a comparable level of accuracy as if assisted by template guidance.

In general, very high significances ($p \leq 0.001$) were observed between inexperienced free-handed drilling actions (group 1) and the performance of template-guided drilling (group 3 and 4).

CONCLUSIONS

The researchers concluded that template-guided drilling procedures lead to significantly enhanced accuracy compared to free-handed drilling actions were achieved, irrespective of the clinical experience level of the operator.

CLINICAL IMPLICATIONS FOR PRACTICE

These results provide evidence that Template-guided drilling procedures lead to a more predictable clinical diameter. These results need to be confirmed in clinical studies.

Reference

1. Scherer U, Stoetzer M, Ruecker M, Gellrich NC, von See C. Template-guided vs. non-guided drilling in site preparation of dental implants. Clinical Oral Investigations, 2015: 19: 1339-1346.

2. The relationship between resting arterial blood pressure and oral postsurgical pain

Deschaumes, CDevoize L, Sudrat Y, Baudet-Pommel M, Dualé C, Dallel R. Clinical Oral Investigations 2015; 19:1299-1305

Postoperative pain is a common feature of most surgical procedures performed in the oral cavity, such as endodontic treatment, tooth extractions, or periodontal surgery. In order to identify individuals with a high risk of developing severe postoperative pain, preoperative screening methods have been investigated.[1] These studies have assessed the association between perceived intensity of postoperative pain and patient features, tooth characteristics, and surgery variables but only a few studies have examined the relationship between the cardiovascular system and pain perception in human experimental pain models as well as in acute and chronic clinical pain conditions in the orofacial region.

Early experimental data demonstrated an inverse association between blood pressure (BP) levels, electrical dental pain thresholds and pain tolerance levels.[1] More recently, the same significant inverse association between resting BP and acute postoperative pain was observed in patients undergoing nonsurgical root canal therapy.[1] Interestingly, in patients with chronic orofacial pain, elevated resting BP levels were found to be associated, not with decreased sensitivity to acute pain as in healthy individuals but rather with increased sensitivity.[1] Deshaumes and colleagues (2015)[1] from France reported on a study that sought to examine the relationship between resting BP (primary outcome), demographic features of patients, anatomical characteristics of the extracted teeth, surgery variables (secondary outcomes), and acute postsurgical pain in patients undergoing tooth extraction.

MATERIALS AND METHODS

In this prospective observational study, consenting adult patients undergoing ambulatory tooth extraction for pericoronitis, caries, periapical lesions, or orthodontic purposes were enrolled in this study

All extractions were performed under local anaesthesia using a standardised technique. For impacted or submucosal teeth, the procedure included gingival incision, mucoperiostal flap elevation, and osteotomy of the contiguous bone with a bur under irrigation, when necessary. About half of the extracted teeth were third molars. All patients received mouth rinses with an antiseptic (chlorhexidine 0.12 %) three times a day for 7 days after the surgery. All patients were prescribed postoperative analgesics (NSAIDS, tramadol or paracetamol, alone or in combination with opioids), but they were instructed to take the drugs only if required. An oral antibiotic was prescribed in case of infected teeth or after a large osteotomy.

To each surgical procedure, there corresponded one observation. Demographic features were weight, height, body mass index, age, and gender. Existence of chronic diseases, including arterial hypertension, and previous surgeries were noted. If patients reported any event of postsurgical or oral pain, they were asked to quote the maximal pain they remembered on a numerical verbal scale (out of 100); this value was set to 0 in case of no history. They were also asked to fill in a questionnaire of hospital anxiety and depression scale. The blood pressure (BP) and heart rate were measured at rest once after the patient was sitting for at least 5min before entering the operating room.

Surgical features were operator's qualification, type of operating room, number of extracted teeth and their condition, avulsion of a third molar, concerned jaw, position of teeth on the dental arch, need for osteotomy, suture, root separation, mucoperiosteal flap elevation, and number of cartridges of local anaesthetic used. After surgery, the following were noted: duration of surgery, surgical complications, postoperative nausea or vomiting, spontaneous pain reported on a visual analog scale (VAS) out of 100, recorded every 10min during the first six hours after the end of surgery in the hospital, the type and dose of every administered analgesic drug, as well as the delay of the first food intake after the end of surgery. An index was created to represent the deepness of implantation (on arch/submucosal/impacted) and the integrity of the extracted tooth/teeth (residual root/intact). Five classes were identified: intact impacted tooth, intact submucosal tooth, intact on arch tooth, impacted root, and submucosal root.

As the prescription of analgesics was freely decided by practitioners, a composite numerical index (referred to as "postoperative pain/analgesia score" or PPAS) was built out of pain values and analgesic drug intake, integrating two intermediate composite numerical indexes of (i) the degree of spontaneous pain reported by the patient (postoperative pain score or PPS) during the first six hours and (ii) the amount of analgesic drug intake (postoperative analgesia score or PAS) during the first three days. For each observation, the mean and maximal pain scores over the 360-min observation time were extracted.

RESULTS

A total of 293 patients (135 women and 158 men) with complete data sets were included in the analysis. Out of the independent outcomes for which significance was reached, only the following were kept for the multivariate analysis: age, anatomy of the extracted teeth, involved jaw, avulsion of a third molar, and mean resting BP. Gender was intentionally kept in the model for adjustment. Other independent outcomes—for which the univariate analysis reached significance—were intentionally not kept to avoid the effect of multicollinearity. Then, history of previous surgery, history of hypertension, duration of surgery, and number of intact teeth extracted were withdrawn.

Univariate analysis reveals that the intensity of postoperative pain is related to age, history of hypertension and previous oral surgery, number of extracted teeth, duration of surgery, and extraction of the third molar. On the other hand, there is no relationship with gender, anxiety, and operation duration. Multivariate analysis reveals that the intensity of acute postoperative pain is only associated with the location (upper/lower jaw, $P=0.004$) and deepness of implantation of the extracted tooth ($P<0.0001$), and mean resting BP ($P=0.031$).

CONCLUSIONS

The authors concluded that patients with high resting BP had lower oral postsurgical pain than those with low resting BP. This suggests that high resting BP is a protective factor against oral postsurgical pain.

IMPLICATIONS FOR PRACTICE

These study findings suggest that the measurement of resting BP before surgery may be used in clinical practice to identify patients at risk of developing severe postoperative pain.

Reference

1. Deschaumes, CDevoize L, Sudrat Y, Baudet-Pommel M, Dualé C, Dallel R. The relationship between resting arterial blood pressure and oral postsurgical pain. Clinical Oral Investigations 2015; 19:1299-1305

3. Cognitive status of edentate elders wearing complete denture: Does the quality of the denture matter?

Cerutti-Kopplin D, Emami E, Hilgert JB, Hugo FN, Padilha DM. Journal of Dentistry.2015; 43:1071-5.

Cognitive impairment is when a person has trouble remembering, learning new things, concentrating, or making decisions that affect their everyday life. Cognitive impairment ranges from mild to severe. With mild impairment, people may begin to notice changes in cognitive functions, but still be able to do their everyday activities. Severe levels of impairment can lead to losing the ability to understand the meaning or importance of something and the ability to talk or write, resulting in the inability to live independently. Cognitive impairment is among the major public health concerns as a result of global increased life expectancy, and population aging.[1] The risk factors for cognitive impairment can be divided into two major categories: non-modifiable (e.g., age, sex, genetic factors, etc.) and modifiable (e.g., hypertension, diabetes, dietary habits, physical activity, cognitive activity.[1]

Poor oral health and non-optimal mastication have been introduced as potential modifiable risk factors for cognitive impairment.[1] Longitudinal cohort studies have linked poor oral health and cognitive impairment such as dementia and Alzheimer's disease.[1] An association between the number of teeth in the mouth and cognitive status has been reported in published studies.[1] However, little or no data exists on the role of functional quality of dentures in the cognitive status of edentate elders. Cerutti-Kopplin and colleagues (2015)[1] reported on a study that sought to test the hypothesis that quality of denture, via the mastication pathway, will influence the cognitive status in edentate elders.

MATERIALS AND METHODS

This was a cross-sectional study of Brazilian persons aged 60 years or over. Potential candidates were invited to participate in the cohort study by phone call or personal contact. Data was analyzed from edentate participants wearing maxillary and mandibular complete dentures, who had undergone both functional assessment of dentures (FAD) and mini-mental state examination (MMSE) (n = 117). Assessment of cognitive status, quality of denture, and masticatory ability was assessed with the Brazilian version of the mini-mental state examination (MMSE), with higher scores indicating better cognitive status. A trained and calibrated dentist assessed the functional quality of denture as well the history of complete tooth loss for completely edentate elders. The quality of dentures was clinically examined by use of the FAD (functional assessment of dentures) validated instrument. The FAD measure has nine items, which allow the evaluation of the freeway space, occlusion, retention, and stability of dentures. The total range of the scale is 0–9 points, with higher scores indicating better functional quality. Furthermore, masticatory ability was self-assessed by the use of a composite measure (changes in dietary intake, avoiding hard-to-chew foods, and chewing only soft foods because of difficult chewing.

Information on socio-demographic characteristics (age, sex, years of education, income), lifestyle factors (physical and mental activity, alcohol use, and smoking status), and medical history (diabetes, hypertension, heart disease) was obtained using self-administered questionnaires. The geriatric depression scale (GDS) and the short-form mini nutritional assessment (MNA) was used for screening depressive symptoms and nutritional status, respectively.

RESULTS

The sample was comprised of 92 (78.6%) women and 25 (21.4%) men. The mean age of the sample population was 73.7 (SD 5.6) years, with a median of 73 years. Among the individuals, 77.8% reported elementary school as the highest level of education, 60.7% lived in an urban area, most of them were married (70.1%), and 60.7% had a monthly income of less than two times the Brazilian minimum wage (540 USD). The total FAD (functional assessment of dentures) mean score was 5.7 ±2.1, and according to this clinical measure the majority of elders (80%) had adequate maxillary denture, however 67.5% of participants had non-retentive and non-stable mandibular dentures. Unsatisfactory masticatory ability was more frequent in completely edentate individuals with lower FAD total score ($p < 0.001$) and led to a lower mini-mental state examination (MMSE) total score.

The mean of MMSE score in the total sample was 23.1 (SD=4.4) and was associated with age ($p = 0.001$), education ($p < 0.0001$), and depressive symptoms ($p = 0.003$), as well as perceived masticatory disability ($p = 0.001$) and functional quality of dentures ($p < 0.0001$). Perceived masticatory disability was associated with cognitive status ($p = 0.002$) after adjusting for significant risk factors including age, years of education, and depression. The final model predicted about 25% of the variation of the MMSE score (R2 = 0.246). Masticatory disability contributed to about six percent changes in MMSE score (DR2 = 0.063, $p = 0.002$).

CONCLUSIONS

These results suggest that cognitive status may be influenced by functional denture quality via the mastication pathway. There is a need for large-scale cohort studies with comprehensive assessments of oral health status, masticatory function, and cognitive activity with both objective and subjective measurement tools.

IMPLICATIONS FOR PRACTICE

The importance of an active masticatory function and its link to cognitive status is highlighted in this paper.

Reference

1. Cerutti-Kopplin D, Emami E, Hilgert JB, Hugo FN, Padilha DM. Cognitive status of edentate elders wearing complete denture: Does quality of denture matter? Journal of Dentistry.2015; 43:1071-5.