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What's new for the clinician?
- Excerpts from and summaries of recently published papers

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Compiled and edited by V Yengopal

1. Evaluation of postoperative sensitivity in restorations with self-adhesive resin - a randomized split-mouth design controlled study

NG de Oliveira, ASLC Lima, MT da Silveira, et al. Evaluation of postoperative sensitivity in restorations with self-adhesive resin: a randomized split-mouth design controlled study. Clin Oral Invest. 2020; 24: 1829-35.

ABSTRACT

Self-adhesive restorative materials have been developed to simplify the restorative procedure by reducing the number of operative procedures and thus decreasing the number of possible errors from multiple steps such as inadequate acid etching in dentin, moisture contamination, etc.

The type of adhesive system used in the bonding of restorative material can contribute to marginal microleakage and sensitivity. To obtain adequate bonding, the smear layer, which is formed during cavity preparation, must be treated or removed by adhesives.[1] However, the effects of different adhesive systems vary widely both on the smear layer and in bonding quality. Biologically and technically, bonding mechanisms are different in etch-and-rinse and self-etch systems.[1]

In etch-and-rinse systems, the bonding mechanism is micromechanical and is based on the formation of a hybrid layer. In addition to micromechanical adhesion, diffusion and infiltration of resin within etched collagen fibrils are also effective in bonding to dentin.[1] In self-etch systems that are easy to use, the bonding mechanism occurs by dissolving the smear layer and through penetration of acidic monomers into dentin to create a hybrid layer.[1]

The self-adhesive resin composite (SAC) acts simultaneously as a self-etching adhesive and a flowable resin, thus eliminating the acid etching step and separate application of a bonding agent. de Oliveira and colleagues (2020)[1] reported on a split mouth trial that sought to evaluate the post-operative sensitivity of restorations with self-adhesive resin composite (Vertise Flow) compared with conventional resin composite with self-etching adhesive (Filtek Z250 and Clearfil SE Bond).

The null hypothesis tested was that no difference would be found regarding the postoperative sensitivity between restorative techniques.

MATERIALS AND METHODS

This study was a randomized, controlled, double-blind, split-mouth, two-arm clinical trial conducted in Brazil. Twenty-seven volunteers, aged between 18 and 40 years (mean 25.92 years) and of both sexes were recruited into this trial. A total of fifty-four third molars with an indication of extraction were included.

The study inclusion criteria were (1) two third molars indicated for extraction for orthodontic reasons; (2) healthy teeth without caries, score "0" according to the International Caries and Assessment System (ICDAS); (3) complete root development; and (4) fully erupted teeth.

Teeth without pulpal vitality or with altered pulpal vitality demonstrated using cold sensitivity tests, percussion, or palpation; the presence of pulpal calcification; and the impossibility of isolation with rubber dam were excluded.

A total of 54 restorations in 27 volunteers were performed by the same operator. Each participant received two restorations according – one was the test/experimental material and the other the control. The treatment allocation was done by the toss of a coin – "tails" meant that the tooth received a SAC whilst "heads" meant that the tooth restored using the conventional tech-

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nique with prior bonding procedure. Patients and evaluators were not aware of the type of material used for each tooth.

One previously calibrated operator performed all restorations. The cavity preparation was standardized. The restorative materials were applied according to the manufacturers' instructions. All photoactivation procedures were performed with halogen light (Ultralux) at a power density of 800 mW/cm2, previously measured with a radiometer.

After restoration placement, the occlusal contacts were evaluated with marking paper. The finishing and polishing were performed in the same session. Both restorations were done during the same clinical appointment.

Postoperative sensitivity was evaluated at 24 h and 15 and 30 days after the restorative procedure. Information on the presence of pain was collected (present or absent). If present, the characteristics of the pain were recorded: the localization of pain (localized or diffuse), the type of stimulus (triggered or spontaneous), the duration of pain (short or prolonged), its frequency (intermittent or continuous), and intensity of pain (mild, moderate or severe). Thermal stimulation (refrigerant spray Endo-Ice) was used to evaluate the type of stimulus. The pain intensity was recorded with the visual analog scale (VAS). The VAS consists of a 100 mm line divided into equal intervals of 10 mm, where 0 represents "absence of pain" and 100 "severe pain." The results of VAS were classified as mild (0-30 mm), moderate (40-70 mm), or severe pain (>70 mm).

After each evaluation period, the patients had the tooth extracted as previously recommended.

RESULTS

Two patients with 4 third molars were excluded after enrolment because of lost to follow-up. The remaining 50 third molars of 25 patients (56% male vs. 44% female) were included. Regardless of the time intervals, postoperative sensitivity was observed in 52% and 48% of the conventional and self-adhesive resin composite (SAC) groups, respectively. No differences were observed between the postoperative sensitivity of the studied groups ($p = 1.000$) regardless of the time intervals.

None of the characteristics related to pain sensitivity, localization, type of stimulus, duration, frequency, and intensity demonstrated statistical differences between groups. Regarding the type of stimulus, triggered pain corresponded to 92.3% of the conventional group and 91.7% of the self-adhesive resin composite (SAC) group.

As for pain intensity, most was considered mild for both self-adhesive resin composite (SAC) group (75%) and conventional treatment group (76.9%). Moderate pain was observed in the conventional treatment group (23.1%), and severe pain (8.3%) was only observed in self-adhesive resin composite (SAC) group. No statistical differences were observed between groups.

All patients who had postoperative sensitivity reported that the pain was localized and of short duration with both materials.

When the evaluation period was considered for both groups, the 15-day time point presented the highest pain occurrence (87.5%) of mild intensity.

CONCLUSION

The authors found that Self-adhesive resin composite and conventional resin composite with a self-etching bonding agent showed similar responses regarding postoperative sensitivity in deep class I cavities. When postoperative sensitivity was present, mild pain was observed in about half the participants; this decreased over time.

Implications for practice

This study provides evidence that the self-adhesive resin composite performed similarly to the conventional resin composite with a self-etching bonding agent for the main outcome of postoperative sensitivity.

Reference

1. de Oliveira NG, Lima ASLC, da Silveira MT, et al. Evaluation of postoperative sensitivity in restorations with self-adhesive resin: a randomized split-mouth design controlled study. Clin Oral Invest. 2020; 24: 1829-35

2. Photo-activated implants: a triple-blinded, split-mouth, randomized controlled clinical trial on the resistance to removal torque at various healing intervals

A Puisys, M Schlee, T Linkevicius, P Petrakakis, A Tjaden. Photo-activated implants: a triple-blinded, split-mouth, randomized controlled clinical trial on the resistance to removal torque at various healing intervals. Clinical oral investigations. 2019 Sep; 11: 1-11.

ABSTRACT

The success rates for implant therapy has been reported to be well above 95% after a 10 year observation period in a number of published studies.[1] The term "osseointegration" was coined to describe the osseous bonding of the bone to implant and more recently this process has been referred to as "encapsulation" resulting from a foreign body reaction". The quality and stability of the osseointegration (OI) or osseoencapsulation (OE) enables the implant to bear chewing forces.[1]

Implant stability is achieved at two levels—primary and secondary stability. Primary stability is mechanically obtained immediately after implant insertion as a result of friction between implant and bone, whereas secondary stability is achieved by deposition of mineral on the implant surface, beginning 2 weeks after surgery.[1]

Factors affecting primary stability are numerous and include bone quality and quantity, different drilling protocols depending on bone density, surgical technique and surgeon's skills, and implant and surface characteristics.[1] The quality and timeline of secondary implant stability are influenced by surgical technique; surface characteristics of the implant such as roughness, hydrophilicity, and chemical modifications; and general health of the patient.[1] Surfaces that attract water are termed hydrophilic, whereas surfaces that repel water are termed **hydrophobic**. The degree to which a surface either attracts or repels water can be termed, respectively, the **hydrophilicity** or the **hydrophobicity** of that surface.

In vitro studies have demonstrated that cell differentiation and growth factor expression increase on hydrophilic implant surfaces. Moreover, animal studies indicated improved early soft and hard tissue integration of hydrophilic titanium implants. Some authors have demonstrated that titanium surfaces will be contaminated within 4 weeks and lose initial hydrophilicity.[1]

This effect is associated with the progressive deposition of hydrocarbons and a change of electrostatic charge from positive to negative. These effects have a negative impact on protein absorption capacity, osteoblast migration, attachment, spread, and proliferation. Mineralization also decreases on 4-week-old titanium surfaces.

Application of ultraviolet (UV) light can regain hydrophilicity of titanium dioxide.[1] *In vitro* and animal models investigated the effect of photo-activation (PA) on fresh, aged, and photo-activation treated implant surfaces. PA was found to increase hydrophilicity, turns the electrostatic charge to positive, and removed hydrocarbons from the surface.[1]

PA was also reported to have positive effects on alkaline phosphatase activity, calcium deposition spreading of human stem cells, protein absorption capacity, osteoblast migration, attachment, spread, and proliferation.

Kumar and colleagues (2020)[1] reported on a randomized controlled clinical trial that sought to investigate the influence of photo-activation (PA) on implant stability using Removal torque (RT) at different time points as a surrogate outcome. RT is defined as the force which is necessary to detach an implant from the bone, thus indirectly providing information on the degree of bone-implant contact (BIC).

The null hypothesis stated that surface-treated implants (test group) will show the same deliberation force at specific time points as implants without surface treatment (control group).

MATERIALS AND METHODS

In this single-center study, 180 partially edentulous patients requiring two implants were selected and the position of test and control implant was randomly assigned. Both implant locations had to be in the same jaw. Furthermore, the patients were randomly allocated to six groups. Randomization was performed using computer-generated random numbers, sealed in sequentially numbered opaque envelopes.

One hundred eighty test implants and 180 control implants (N = 360) with a tapered design, a micro-textured surface morphology in the neck area, and an internal connection (BioHorizons® Tapered Plus) were inserted epicrestally in single-stage surgery. Each patient received one test and one control implant of the same diameter and length. The implants used had a diameter of 3.8, 4.6, or 5.8 mm and a length of 9.0, 10.5, 12.0, or 15.0 mm, respectively.

Patients, surgeon, and outcome assessors were blinded to the type of implant (test or control). Patients in good systemic health requiring (at least) two dental implants were included in the study.

Exclusion criteria were:

- Patients unable to commit to the follow-up period.
- Patients needing bone augmentation at implant placement.
- Post-extractive sites (implants were intended to be inserted after a healing period of at least 3 months).
- Patients with an acute infection or suppuration at the site intended for implant placement.

- Patients with acute or untreated periodontal disease (BOP >15%); General contraindications to implant surgery.
- Immune-suppressed/immune-compromised patients.
- Patients irradiated in the head and/or neck area.
- Patients with poorly controlled diabetes, pregnancy, poor oral hygiene and motivation, addicted to alcohol or drugs or those with psychiatric problems and/or unrealistic expectations were excluded.

Surfaces of the test implants were treated by UV irradiation (180-300 nm) with a processing time of 12 min, using the TheraBeam® SuperOsseo Device immediately prior to implant placement. Implant stability quotient was measured by the Osstell ISQ Device using resonance frequency analysis (RFA). A Smart Peg® (Osstell) was attached to the implant in order to be used in combination with the abovementioned meter. Resonance frequency was calculated as an ISQ value, on a scale from 0 to 100.

Cone beam computed tomography (CBCT) scans were used to evaluate available bone volumes and to determine a patient's eligibility for study participation. Patients who met the inclusion/exclusion criteria and signed the informed consent form took 2.0-g Augmentin (in case of allergy, 600 mg clindamycin) 1 h before surgery for antibiotic prophylaxis.

Prior to the surgical intervention, patients rinsed with 0.2% chlorhexidine for 1 min to reduce microbial count. Local anesthesia was applied at the discretion of the dental surgeon. All implants were inserted by a single surgeon using exactly the same surgical procedure. Drilling protocols and surgery followed manufacturer's recommendations and were the same for each implant, irrespective of the particular bone quality or location (800 rpm, no taping). No augmentation procedures were performed.

After a crestal incision, a mucoperiosteal flap was elevated. Implants were inserted with a calibrated drilling device combined with a calibrated contra-angle handpiece with an automatic torque control and integrated RFA module. To avoid any calibration problem, the same handpiece was used for all patients. The same staff member recycled and sterilized the handpiece using the identical process. Implants were placed epicrestally with the appropriate insertion tool.

The same tool was used with the Implantmed contra-angle handpiece for Removal Torque (RT) assessment. The RT was limited to a maximum torque of 80 Ncm to avoid mechanical alteration of the implants. Immediately after implant placement at time point one (T1), ISQ and peak RT were gauged.

Test and control implants were of identical diameter and length in each patient and were placed in the same jaw to minimize the risk of bias due to different bone density in maxilla and mandible. After RT testing, the implant was returned to its former position and a healing abutment was placed. Finally, healing abutments were inserted and the mucoperiosteal flap was repositioned and sutured.

Patients were instructed about postsurgical care (1.0 g of amoxicillin or 300 mg clindamycin respectively as antibiotics of second choice twice a day for 1 week, a soft diet was recommended for 1 week, rinsing twice a day with chlorhexidine for a period of 14 days, ibuprofen 400 mg twice a day in case of pain). To ensure healing without any functional load, occlusion was checked.

After a certain healing time (time point T2), the healing abutments were removed; ISQ and RT values of test and control implants were recorded at 1 week (group 1), 2 weeks (group 2), 3 weeks (group 3), 4 weeks (group 4), 6 weeks (group 5), and 8 weeks (group 6). The force to retrieve the implants was limited to 80 Ncm as described above. After RT assessment, the implants were returned to their original position and left for open healing.

RESULTS

Postoperative healing was uneventful in all patients; all implants finally osseointegrated and no implant was lost. No mechanical damage to implant components was observed.

Twenty patients had to be excluded from the analysis due to protocol deviations (test and control implants placed in different jaws). The mean age of the whole patient sample was 50.65 years. One hundred eleven patients were female and 69 patients were male.

There was no significant difference between the six groups with regard to age and gender. The majority of the patients were non-smokers ($n = 128$, 71.1%); 50 (27.8%) patients declared consumption of ≤ 10 cigarettes per day, whereas only two patients (1.1%) consumed more than ten cigarettes per day.

There was no statistically significant difference concerning the smoking habits between all groups (chi-square test, $p = 0.894$). Forty-eight participants from the female group (43.2%) had premenopausal status, whereas 63 female patients (56.8%) were in a postmenopausal state. No statistically significant difference was recorded between all the groups (chi-square test, $p = 0.786$).

The total number of fixtures was 360, out of which 142 implants (71 test and 71 control implants) were inserted in the maxilla (39.4%) and 218 (109 test and control) were placed in the mandible (60.6%). In both the test and control group, the majority of the implants were inserted in the posterior part of the dental arch. The machine used in this clinical study was set at 80 Ncm reverse torque as a maximum to prevent mechanical damage to the implants (RTmax).

The frequency of occurrence of reaching RTmax was calculated for each group and point in time. At time point T1, there were no significant differences between the test and control implant for all groups (McNemar test, $p \geq 0.05$). At T2, however, a significant difference was seen in group 3 (McNemar test, $p = 0.008$). The limit of 80 Ncm was reached, a total of 63 times in the test group and 43 in the control group.

Comparing the amount of measurements above 80 Ncm between T1 and T2 for the test implant, there was a significant change for the test implant in groups 1, 2, and 4 ($p < 0.05$). In groups 3, 5, and 6, however, there was no significant change ($p \geq 0.05$).

Comparing the amount of RTmax values for the control implants T1 versus T2, the statistical test was not applicable in groups 1, 2, and 5 as the tables were non-symmetrical. For groups 3 and 4, no significant changes were revealed. However, the amount of measurements above 80 Ncm was significant for group 6 ($p < 0.001$).

The statistical analysis showed that there is a strong correlation between the insertion torque and the removal torque at time point T1 for all groups and equally for test and control implants At the later time point (T2), there was only a small correlation between the original insertion torque (at T1) and the removal torque applied at T2 ($R = 0.2$, $p < 0.05$).

CONCLUSION

The authors concluded that Photo-activating (PA) the surface of titanium implants leads to higher resistance to RT forces compared with that of non-treated implants, showing higher implant stability especially in the early healing phase. Additionally, they found that Photo-activation results in an increased speed of osseointegration.

Implications for practice

This trial has provided evidence that the use of PA leads to greater implant stability. The RT test seems to be a suitable method for the measurement of implant stability during the healing phase in humans.

Reference

1. Puisys A, Schlee M, Linkevicius T, Petrakakis P, Tjaden A. Photo-activated implants: a triple-blinded, split-mouth, randomized controlled clinical trial on the resistance to removal torque at various healing intervals. Clinical oral investigations. 2019; Sep 11: 1-11.

Do the CPD questionnaire on page 339

The Continuous Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education. The importance of continuing professional development should not be underestimated, it is a career-long obligation for practicing professionals.

Online CPD in 6 Easy Steps

1 Go to the SADA website www.sada.co.za.
2 Log into the 'member only' section with your unique SADA username and password.
3 Select the CPD navigation tab.
4 Select the questionnaire that you wish to complete.
5 Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.
6 View and print your CPD certificate.