

AVALON BIOMED JOURNAL ABSTRACTS



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Biocompatibility / Cytotoxicity

QIN SUN, MENG MENG, JEFFREY N. STEED, STEPHANIE J. SIDOW, BRIAN E. BERGERON, LI-NA NIU, JING-ZHI MA, FRANKLIN R. TAY, MANOEUVRABILITY AND BIOCOMPATIBILITY OF ENDODONTIC TRICALCIUM SILICATE-BASED PUTTIES, JOURNAL OF DENTISTRY, VOLUME 104, 2021, 103530, ISSN 0300-5712

MANOEUVRABILITY AND BIOCOMPATIBILITY OF ENDODONTIC TRICALCIUM SILICATE-BASED PUTTIES

PURPOSE

The present study evaluated the indentation depth, storage modulus and biocompatibility of an experimental endodontic putty designed for endodontic perforation repair and direct pulp-capping (NeoPutty). The results were compared with the properties associated with the commercially available EndoSequence BC RRM Putty (ES Putty).

METHODS

Indentation depth was measured by a profilometer following indentation with the 1/4 lb Gilmore needle. Elastic modulus was evaluated using a strain-controlled rheometer. The effects of eluents derived from these two putties were examined on the viability and proliferation of human dental pulp stem cells (hDPSCs) and human periodontal ligament fibroblasts (hPDLFs), before (1st testing cycle) and after complete setting (2nd testing cycle).

RESULTS

The ES Putty became more difficult to indent and acquired a larger storage modulus after exposure to atmospheric moisture. Biocompatibility results indicated that both putties were relatively more cytotoxic than the bioinert Teflon negative control, but much less cytotoxic than the zinc oxide–eugenol cement negative control. NeoPutty was less cytotoxic than ES putty in the 1st testing cycle, particularly with hDPSCs. Both putties exhibited more favourable cytotoxicity profiles after complete setting.

CONCLUSION

NeoPutty has a better window of maneuverability after exposure to atmospheric moisture. From an in vitro cytotoxicity perspective, the NeoPutty may be considered more biocompatible than ES putty.



INEM BIRANT, MUAZZEZ GOKALP, YAZGUL DURAN, MINE KORUYUCU, TUNC AKKOC, FIGEN SEYMEN, CYTOTOXICITY OF NEOMTA PLUS, PROROOT MTA AND BIODENTINE ON HUMAN DENTAL PULP STEM CELLS, JOURNAL OF DENTAL SCIENCES, 2020, ISSN 1991-7902

CYTOTOXICITY OF NEOMTA PLUS, PROROOT MTA AND BIODENTINE ON HUMAN DENTAL PULP STEM CELLS

PURPOSE

Dental pulp stem cells (DPSCs) play a crucial role in the tissue healing process through odontoblast like cell differentiation. The aim of this study was to evaluate the biocompatibility and compare the potential invitro cytotoxic effects of NeoMTA Plus, ProRootMTA and Biodentine on human dental pulp stem cells (hDPSCs).

METHODS

To assess the effects of NeoMTA Plus, ProRoot MTA and Biodentine extracts at 1st, 3rd and 7th d on hDPCs, cell populations was determined by flow cytometry using an Annexin V detection kit. The data were analyzed statistically using the Kruskal–Wallis test. A $p < 0.05$ was considered as statistically significant.

RESULTS

All groups showed cell viability similar to that of the control group on 1st, 3rd and 7th d. Although Biodentine exhibited higher cell viability rates than the other material groups, no statistically significant differences were noted between the sampled days ($p > 0.05$).

CONCLUSION

All materials extracts are not cytotoxic and do not induce apoptosis in the hDPSCs. These results suggest that all the tested materials can lead to positive outcomes when used as reparative biomaterials.



PINHEIRO LS, IGLESIAS JE, BOIJINK D, ET AL. CELL VIABILITY AND TISSUE REACTION OF NEOMTA PLUS: AN IN VITRO AND IN VIVO STUDY. J ENDOD. 2018;44(7):1140-1145. DOI:10.1016/J.JOEN.2018.03.007

Cell Viability and Tissue Reaction of NeoMTA Plus: An In Vitro and In Vivo Study

PURPOSE

The aim of this study was to evaluate the cell viability and tissue reaction of NeoMTA Plus (NMP; Avalon Biomed Inc, Houston, TX) compared with mineral trioxide aggregate (MTA; Angelus, Londrina, PR, Brazil) and Biodentine (BD; Septodont, Saint-Maur-de-Fossés, France).

METHODS

Fibroblasts (3T3) were plated and exposed to 1% extract from the test material before and after setting. Cytotoxicity assessment was performed using the 3-(4,5-dimethyl-thiazoyl)-2,5-diphenyl-tetrazolium bromide and sulforhodamine B assays. In vivo evaluation consisted of polyethylene tube implantation of the materials in rat subcutaneous tissue. Histologic analysis occurred at 7, 30, and 90 days, scoring inflammatory events and collagen fiber formation. Analysis of variance and the Turkey and t tests were used for cytocompatibility assays, and the Kruskal-Wallis test followed by the Dunn test were used for biocompatibility assays ($P \leq .05$).

RESULTS

The materials in the cytotoxicity assays presented greater viability after setting ($P \leq .05$). NMP and MTA presented higher viability than the control (Dulbecco modified Eagle medium) on the 3-(4,5-dimethyl-thiazoyl)-2,5-diphenyl-tetrazolium bromide assay before and after setting ($P \leq .05$). The sulforhodamine B assay showed that MTA and BD presented less viability than NMP and the control, and NMP was similar to the control before setting. After setting, MTA and BD presented higher viability when compared with the control group ($P \leq .05$) and NMP was similar to control. Inflammatory infiltrate reduction occurred throughout the test periods for all materials. At 7 days, neutrophils were present in BD ($P \leq .05$), and granuloma and giant cells were present in BD and MTA. At 30 days, BD showed intense inflammatory infiltrates and a large number of macrophages when compared with NMP, MTA, and the control ($P \leq .05$). At 90 days, BD presented a thick fiber layer compared with NMP ($P \leq .05$).

CONCLUSION

NMP showed similar biocompatible behavior to MTA and BD.



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Biocompatibility of New Pulp-capping Materials NeoMTA Plus, MTA Repair HP, and Biodentine on Human Dental Pulp Stem Cells

PURPOSE

The aim of the present study was to evaluate the in vitro cytotoxicity of MTA Repair HP, NeoMTA Plus, and Biodentine, new bioactive materials used for dental pulp capping, on human dental pulp stem cells (hDPSCs).

METHODS

Biological testing was carried out in vitro on hDPSCs. Cell viability and cell migration assays were performed using eluates of each capping material. To evaluate cell morphology and cell attachment to the different materials, hDPSCs were directly seeded onto the material surfaces and analyzed by scanning electron microscopy. The chemical composition of the pulp-capping materials was determined by energy-dispersive X-ray and eluates were analyzed by inductively coupled plasma-mass spectrometry. Statistical differences were assessed by analysis of variance and Tukey test ($P < .05$).

RESULTS

Cell viability was moderate after 24 and 48 hours in the presence of MTA Repair HP and NeoMTA Plus, whereas at 48 and 72 hours, Biodentine showed higher rates of cell viability than MTA Repair HP and NeoMTA Plus ($P < .001$). A cell migration assay revealed adequate cell migration rates for MTA Repair HP and NeoMTA Plus, both similar to the control group rates, meanwhile the highest cell migration rate was observed in the presence of Biodentine ($P < .001$). Scanning electron microscope studies showed a high degree of cell proliferation and adhesion on Biodentine disks but moderate rates on MTA Repair HP and NeoMTA Plus disks. Energy-dispersive X-ray pointed to similar weight percentages of C, O, and Ca in all 3 materials, whereas other elements such as Al, Si, and S were also found.

CONCLUSION

The new pulp-capping materials MTA Repair HP, NeoMTA Plus, and Biodentine showed a suitable degree of cytocompatibility with hDPSCs, and good cell migration rates, although Biodentine showed higher rates of proliferation time-dependent.



TANOMARU-FILHO, MÁRIO & ANDRADE, A & RODRIGUES, E. & VIOLA, KENNIA & FARIA, GISELE & CAMILLERI, JOSETTE & GUERREIRO-TANOMARU, J. (2017). BIOCOMPATIBILITY AND MINERALIZED NODULE FORMATION OF NEO MTA PLUS AND AN EXPERIMENTAL TRICALCIUM SILICATE CEMENT CONTAINING TANTALUM OXIDE. INTERNATIONAL ENDODONTIC JOURNAL. 50 SUPPL 2. 10.1111/iej.12780.

Biocompatibility and mineralized nodule formation of Neo MTA Plus and an experimental tricalcium silicate cement containing tantalum oxide

PURPOSE

To evaluate the biocompatibility and mineral-ized nodule formation of an experimental tricalcium silicate cement with tantalum oxide (TSC/TaO₅) as radiopacifier, Neo MTA Plus (Avalon Biomed Inc., Bradenton, FL, USA) and MTA (Angelus, Londrina, PR, Brazil) on human osteoblast-like cells (Saos-2).

METHODS

Biocompatibility was evaluated by 3-(4,5-dimethyl-thiazoyl)-2,5-diphenyl-tetrazolium bromide (MTT) and neutral red (NR) assays, after exposure of Saos-2 to cement extracts at 1 : 1, 1 : 2, 1 : 4 and 1 : 8 dilutions for 24 h. Bioactivity was evaluated by alkaline phosphatase (ALP) activity, and calcium deposits were detected with alizarin red stain-ing (ARS). Statistical analysis was performed with analysis of variance and Bonferroni or Tukey post-test ($\alpha = 0.05$).

RESULTS

The MTT assay revealed lower cytotoxicity for NEO and MTA ($P < 0.05$), and higher for TSC/Ta₂O₅ at 1 : 1 and 1 : 2 dilutions when compared to serum-free medium – control ($P > 0.05$). At 1 : 4 dilution, the TSC/ Ta₂O₅ cytotoxicity was similar to the control ($P > 0.05$). At 1 : 8 dilution, cell viability was significantly greater than the control ($P < 0.05$). Saos-2 cell viability performed using the NR assay at all dilutions revealed no cytotoxic effect of MTA, NEO and TSC/Ta₂O₅. ALP activity at 1 and 3 days was similar to the control ($P > 0.05$). TSC/Ta₂O₅ had significantly greater ALP activity at 7 days when compared with the control ($P < 0.05$). All materials induced the production of mineralized nodules, and NEO produced significantly more mineralized nodules than MTA and TSC/Ta₂O₅ ($P < 0.05$).

CONCLUSION

Neo MTA Plus and TSC/Ta₂O₅ were biocompatible and induced ALP activity in Saos-2 cells. Both materials induced mineralized nodule formation by Saos-2 with Neo MTA Plus producing significantly more.



RODRIGUES, E. & CORNÉLIO, ANA & MESTIERI, LETICIA & FUENTES, A. & SALLES, LOISE & ROSSA JUNIOR, CARLOS & FARIA, GISELE & TANOMARU, JULIANE & TANOMARU-FILHO, MÁRIO. (2016). HUMAN DENTAL PULP CELLS RESPONSE TO MTA AND MTA PLUS: CYTOTOXICITY AND GENE EXPRESSION ANALYSIS. INTERNATIONAL ENDODONTIC JOURNAL. 50. 10.1111/iej.12683

Human dental pulp cells response to MTA and MTA Plus: Cytotoxicity and gene expression analysis

PURPOSE

To investigate the cytotoxicity, osteogenic bioactivity and mRNA expression of osteogenic markers of bone morphogenetic protein 2 (BMP-2), osteocalcin (OC) and alkaline phosphatase (ALP) induced by the extracts of set MTA Plus (MTA P) (Avalon Biomed Inc. Bradenton, FL, USA) in comparison with MTA (Angelus, Londrina, PR, Brazil) on human dental pulp cells (hDPCs).

METHODS

Cell viability was assessed by mitochondrial dehydrogenase enzymatic (MTT) assay, and the mechanism of cell death was evaluated by flow cytometry. Bioactivity was evaluated by alkaline phosphatase (ALP) assay and detection of calcium deposits with alizarin red staining (ARS). The gene expression of BMP-2, OC and ALP was quantified with real-time PCR. Statistical analysis was performed with analysis of variance and Bonferroni or Tukey post-test ($\alpha = 0.05$).

RESULTS

MTA and MTA P were not cytotoxic and did not induce apoptosis. MTA P had significant higher ALP activity in relation to MTA and the control ($P < 0.05$). MTA had a significantly higher percentage of mineralized area than MTA P ($P < 0.05$). The expression of BMP2 and OC mRNA was significantly higher in cells exposed to MTA than MTA P after 1 day ($P < 0.05$). At day 3, the mRNA expression of ALP was significantly higher in MTA P compared with MTA ($P < 0.05$).

CONCLUSION

MTA and MTA Plus were noncytotoxic, increased mineralization processes in vitro and induced the expression of osteogenic markers.



MESTIERI, LETICIA & CORNÉLIO, ANA & RODRIGUES, E. & SALLES, LOISE & BOSSO MARTELO, ROBERTA & TANOMARU, JULIANE & TANOMARU-FILHO, MÁRIO. (2015). BIOCOMPATIBILITY AND BIOACTIVITY OF CALCIUM SILICATE-BASED ENDODONTIC SEALERS IN HUMAN DENTAL PULP CELLS. JOURNAL OF APPLIED ORAL SCIENCE. 23. 467-471. 10.1590/1678-775720150170.

Biocompatibility and bioactivity of calcium silicate based endodontic sealers in human dental pulp cells.

PURPOSE

The aim of this study was to evaluate biocompatibility and bioactivity of these two calcium silicate-based sealers in culture of humandental pulp cells (hDPCs).

METHODS

The cells were isolated from third molars extracted from a 16-year-old patient. Pulp tissue was sectioned into fragments with approximately 1 mm³ and kept in supplemented medium to obtain hDPCs adherent cultures. Cell characterization assays were performed to prove the osteogenic potential. The evaluated materials were: MTA Plus (MTAP); MTA Fillapex (MTAF) and FillCanal (FC).Biocompatibility was evaluated with MTT and Neutral Red (NR) assays, after hDPCs exposure for 24 h to different dilutions of each sealer extract (1:2, 1:3 and 1:4). Unexposed cells were the positive control (CT). Bioactivity was assessed by alkaline phosphatase (ALP) enzymatic assay incells exposed for one and three days to sealer extracts (1:4 dilution). All data were analyzed by ANOVA and Tukey post-test ($p \leq 0.05\%$).

RESULTS

MTT and NR results showed suitable cell viability rates for MTAP at all dilutions (90-135%). Cells exposed to MTAF and FC (1:2 and 1:4 dilutions) showed significant low viability rate when compared to CT in MTT. The NR results demonstrated cell viability for all materials tested. In MTAP group, the cells ALP activity was similar to CT in one and three days of exposure to the material. MTAF and FC groups demonstrated a decrease in ALP activity when compared to CT at both periods of cell exposure.

CONCLUSION

The hDPCs were suitable for the evaluation of new endodontic materialsin vitro. MTAP may be considered a promising material for endodontic treatments.



TUNA, ELIF & GUVEN, YELIZ & DINCOL, MUZAFFER & AKTOREN, OYA. (2014). X-RAY DIFFRACTION ANALYSIS OF MTA-PLUS, MTA-ANGELUS AND DIAROOT BIOAGGREGATE. EUROPEAN JOURNAL OF DENTISTRY. 2. 211-215. 10.4103/2278-344X.130603.

X-ray diffraction analysis of MTA-Plus, MTA-Angelus and DiaRoot BioAggregate

PURPOSE

The purpose of this study was to investigate and compare the crystalline structures of recently released MTA Plus (MTAP), MTA Angelus (MTA-A), DiaRoot BioAggregate (BA) by X-ray diffraction (XRD) analysis.

METHODS

Phase analysis was carried out on powder and set forms of tested materials. The powder specimens placed into sample holders that were packed with a glass slide and the set samples prepared according to the manufacturer's instructions were placed into molds. The samples after being set for three days at 37°C and 100% humidity in an incubator were mounted onto the XRD machine and phase identification was accomplished using a search-match software program.

RESULTS

XRD findings indicated that major constituents of MTA-P were bismuth oxide, portlandite, dicalcium silicate and tricalcium silicate. The crystal structure of MTA-A were similar to those of MTA-P except for the absence of portlandite. Additionally, MTA-A had tricalcium aluminate differing from MTA-P. BA mainly differed from MTA-P and MTA-A by the radiopacifier (tantalum oxide-TO) in its composition.

CONCLUSION

The majority of constituents of the tested materials have shown similarity except for the presence of tricalcium aluminate in MTA-A and the inclusion of TO in BA. In addition, set MTA-P showed a strong peak of portlandite.



EID, ASHRAF & GOSIER, JOHNNY & PRIMUS, CAROLYN & HAMMOND, BARRY & SUSIN, LISIANE & PASHLEY, DAVID & TAY, FRANK. (2014). IN VITRO BIOCOMPATIBILITY AND OXIDATIVE STRESS PROFILES OF DIFFERENT HYDRAULIC CALCIUM SILICATE CEMENTS. JOURNAL OF ENDODONTICS. 40. 255-60. 10.1016/J.JOEN.2013.07.009

In vitro biocompatibility and oxidative stress profiles of different hydraulic calcium silicate cements.

PURPOSE

MTA Plus is a new calcium silicate cement with unknown cytotoxicity characteristics. The objectives of this study were to examine the effect of MTA Plus on the viability, apoptosis/necrosis profile, and oxidative stress levels of rat odontoblastlike cells.

METHODS

MDPC-23 cells were exposed to gray and white MTA Plus (GMTAP, WMTAP), gray and white ProRoot MTA (GMTA, WMTA) cements, or their eluents. The cells were evaluated for (1) cell viability by using XTT assay, (2) apoptosis/necrosis by using flow cytometry and confocal laser scanning microscopy, and (3) oxidative stress by measuring reactive oxygen species.

RESULTS

XTT assay showed that all test cements exhibited marked initial cytotoxicity that decreased with time. By the end of the third week, GMTAP and GMTA were comparable to untreated cells (negative control) in terms of cell viability, whereas WMTAP and WMTA were significantly lower than the untreated cells. Apoptosis/necrosis profiles of cells exposed to WMTAP and GMTAP were not significantly different from untreated cells, whereas cells exposed to WMTA and GMTA showed significantly less viable cells. All experimental groups exhibited reduction of intracellular reactive oxygen species formation compared with untreated cells, although cells exposed to WMTA were not significantly different from untreated cells.

CONCLUSION

Both the gray and white versions of MTA Plus possess negligible in vitro cytotoxic risks that are time and dilution dependent. They enrich the spectrum of hydraulic calcium silicate cements currently available to clinicians for endodontic applications.



Mineralization / Osteogenic

SISMANOGLU S, ERCAL P. EFFECTS OF CALCIUM SILICATE-BASED CEMENTS ON ODONTO/OSTEOGENIC DIFFERENTIATION POTENTIAL IN MESENCHYMAL STEM CELLS. AUST ENDOD J. 2022 MAR 1. DOI: 10.1111/AEJ.12615. EPUB AHEAD OF PRINT. PMID: 35229930.

Effects of calcium silicate-based cements on odonto/osteogenic differentiation potential in mesenchymal stem cells

PURPOSE

The objective of this study was to evaluate the biological effects and odonto/osteogenic differentiation potential of Biodentine, NeoMTA Plus and TheraCal LC in tooth germ-derived stem cells (TGSCs).

METHODS

GSCs were exposed to the material extracts. Biocompatibility was tested with MTS cell proliferation assay. Odonto/osteogenic differentiation was assessed with alkaline phosphatase (ALP) activity and mRNA gene expressions (RUNX2, DSPP and DMP-1). Scanning electronic microscopy/energy-dispersive X-ray (SEM/EDX) analysis and pH analysis were also performed for the materials. Data were evaluated using the one-way ANOVA and Tukey's tests. TGSCs remained viable after 7 days of incubation with all tested materials.

RESULTS

Biodentine and NeoMTA Plus showed high ALP activity and increased expression of RUNX2, DSPP and DMP-1 compared to that of TheraCal LC. All materials can induce odonto/osteogenic differentiation of MSCs in various levels.

CONCLUSION

Biocompatibility and odonto/osteogenic differentiation potential of Biodentine and NeoMTA Plus are similar and superior to that of TheraCal LC.



SUN Q, GUSTIN JW, TIAN FC, SIDOW SJ, BERGERON BE, MA JZ, TAY FR. EFFECTS OF PRE-MIXED HYDRAULIC CALCIUM SILICATE PUTTIES ON OSTEOGENIC DIFFERENTIATION OF HUMAN DENTAL PULP STEM CELLS IN VITRO. J DENT. 2021 MAY;108:103653. DOI: 10.1016/J.JDENT.2021.103653. EPUB 2021 MAR 30. PMID: 33798641.

Effects of pre-mixed hydraulic calcium silicate putties on osteogenic differentiation of human dental pulp stem cells in vitro

PURPOSE

An experimental tricalcium silicate and dicalcium silicate-containing endodontic putty has been designed to overcome the issue of reduced shelf life after exposure to atmospheric moisture during repeated opening of the container for clinical retrieval. The present study examined the effects of this experimental hydraulic putty on the mineralogenic characteristics of osteogenic lineage-committed human dental pulp stem cells (hDPSCs), by comparing the cellular responses with a commercially available putty (EndoSequence BC RRM Putty).

METHODS

The osteogenic potential of hDPSCs that had been exposed to the putties was examined using quantitative reverse-transcription polymerase chain reaction for osteogenic gene expressions and western blot for osteogenic protein expressions. Alkaline phosphatase activity assay and alizarin red S staining were performed to detect changes in production of the intracellular enzyme and extracellular matrix mineralization respectively.

RESULTS

Osteogenic differentiation of the hDPSCs was significantly enhanced after exposure to the pre-mixed hydraulic putties, with no significant difference between these two examined putties

CONCLUSION

The experimental hydraulic tricalcium silicate putty enhances osteogenic differentiation of hDPSCs to the same extent as a commercially available tricalcium silicate putty.

The experimental hydraulic putty appears to be an alternative to the commercial putty when used for applications involving the regeneration of bone in endodontics. Animal models are required for validating its potential in enhancing osteogenesis in vivo.



MUTLUAY AT, MUTLUAY M. CHARACTERISATION OF THE CALCIUM SILICATE-BASED CEMENT-COMPOSITE INTERFACE AND THE BONDING STRENGTH WITH TOTAL-ETCH OR SINGLE/TWO-STAGE SELF-ETCH ADHESIVE SYSTEMS. AUST ENDOD J. 2021 DEC 20. DOI: 10.1111/AEJ.12600. EPUB AHEAD OF PRINT. PMID: 34928537.

Characterisation of the calcium silicate-based cement-composite interface and the bonding strength with total-etch or single/two-stage self-etch adhesive systems

ABSTRACT

Due to favourable biological and physical properties, calcium silicate-based cements (CSCs) are biocompatible materials used widely for vital pulp therapies. Sealing efficacy between the adhesive system and CSC determines the clinical success of treatment. This study aimed to evaluate the shear bond strength (SBS) of CSC to composite resin with different adhesive systems and to analyse the CSC-composite interface. Mineral trioxide aggregate (MTA) (ProRoot MTA; Dentsply Tulsa Dental, Tulsa, OK), Biodentine (Septodont, Saint-Maur-des-Fossés, France) and NeoMTA Plus (Avalon Biomed Inc., Bradenton, FL) samples ($n = 90$) were placed in the cavities and divided into three subgroups according to the adhesive family ($n = 10$). SBSs were measured using a universal testing machine. The interfaces were examined using a scanning electron microscope (SEM) ($\times 1000$). NeoMTA Plus showed significantly higher SBS values than MTA and Biodentine ($P < 0.0001$). The application of total-etch adhesive system over Biodentine and NeoMTA Plus provided the statistically highest bond strength ($P < 0.05$). However, when the SBS values of MTA subgroups were compared, different adhesive families applied over MTA did not make a significant difference in SBS values ($P > 0.05$). Based on SEM analyses, the specimens exhibit no gaps, cracks or delamination within the adhesive layer, which indicates a good adhesion between the CSC-composite interface in all subgroups. In conclusion, the different adhesive families used over CSC did not influence interfacial gap formation.



RODRÍGUEZ LOZANO, FRANCISCO JAVIER & LOZANO, ADRIAN & LOPEZ, SERGIO & GARCÍA-BERNAL, DAVID & SANZ, JOSÉ & GUERRERO-GIRONÉS, JULIA & LLENA, CARMEN & FORNER, L. & MELO, MARÍA. (2021). BIOMINERALIZATION POTENTIAL AND BIOLOGICAL PROPERTIES OF A NEW TANTALUM OXIDE (Ta₂O₅)—CONTAINING CALCIUM SILICATE CEMENT. CLINICAL ORAL INVESTIGATIONS. 10.1007/s00784-021-04117-x.

Biom mineralization potential and biological properties of a new tantalum oxide (Ta₂O₅)—containing calcium silicate cement

PURPOSE

The present study evaluated the biological effects and biomineralization potential of a new tantalum oxide (Ta₂O₅)—containing material designed for vital pulp therapy or perforation repair (NeoMTA 2), compared to NeoMTA Plus and Bio-C Repair.

METHODS

Human dental pulp stem cells (hDPSCs) were exposed to different eluates from NeoMTA Plus, NeoMTA 2, and Bio-C Repair. Ion release from each material was determined using inductively coupled plasma-optical emission spectrometry (ICP-MS). The biological experiments performed were MTT assays, apoptosis/necrosis assays, adhesion assays, migration assays, morphology evaluation, and reactive oxygen species (ROS) production analysis. Biomineralization was assessed by Alizarin red S staining. Finally, osteo/odontogenic gene expression was determined by real-time quantitative reverse-transcriptase polymerase chain reaction (RT-qPCR). Data were analyzed using one-way ANOVA followed by Tukey's multiple comparison test.

RESULTS

NeoMTA 2 displayed a significantly higher calcium release compared to the other materials ($p < 0.05$). When hDPSCs were cultured in presence of the different material eluates, all groups exhibited similar hDPSC viability and migration rates when compared to untreated cells. Substantial cell attachment and spreading were observed in all materials' surfaces, without significant differences. hDPSCs treated with NeoMTA 2 displayed an upregulation of ALP, Col1A1, RUNX2 ($p < 0.001$), ON, and DSPP genes ($p < 0.05$), and showed the highest mineralization potential compared to other groups ($p < 0.001$). Finally, the more concentrated eluates from these materials, specially NeoMTA Plus and NeoMTA 2, promoted higher ROS production in hDPSCs compared to Bio-C Repair and control cells ($p < 0.001$), although these ROS levels did not result in increased cell death.

CONCLUSION

The new tantalum oxide (Ta₂O₅)—containing material shows an adequate cytocompatibility and the ability to promote biomineralization without using chemical osteogenic inducers, showing great potential as a new material for vital pulp therapy. Clinical relevance NeoMTA 2 seems to be a promising material for vital pulp therapy. Further studies considering its biocompatibility and biomineralization potential are necessary.



RODRÍGUEZ-LOZANO FJ, COLLADO-GONZÁLEZ M, LÓPEZ-GARCÍA S, ET AL. EVALUATION OF CHANGES IN ION RELEASE AND BIOLOGICAL PROPERTIES OF NEOMTA-PLUS AND ENDOCEM-MTA EXPOSED TO AN ACIDIC ENVIRONMENT. INT ENDOD J. 2019;52(8):1196-1209. DOI:10.1111/iej.13107

Evaluation of changes in ion release and biological properties of NeoMTA-Plus and Endocem-MTA exposed to an acidic environment

PURPOSE

To analyse in vitro changes in ion release and biological properties of Endocem-MTA (Maruchi, Wonju, Korea) and NeoMTA-Plus (Avalon Biomed Inc, Bradenton, FL, USA) exposed to acidic or neutral environment on human dental periodontal ligament stem cells (hPDLSCs).

METHODS

Cell viability and wound healing assays were performed using eluates of each material. Cell death and changes in phenotype induced by the set endodontic sealer eluates were evaluated through flow cytometry. To evaluate cell attachment to the different materials, hPDLSCs were directly seeded onto the material surfaces and analysed by scanning electron microscopy. The chemical composition of the materials was determined by energy-dispersive X-ray (EDX), and ion release was evaluated by inductively coupled plasma-mass spectrometry. Statistical analysis was performed with analysis of variance and a Bonferroni or Tukey post-test ($\alpha < 0.05$).

RESULTS

The MTT assay revealed non-cytotoxic effects of NeoMTA-Plus and Endocem-MTA at pH 5.2 and 7.4. However, there were minor differences compared with the control, especially at pH 5.2, where both materials were associated with significantly greater cell viability ($P < 0.05$). In both environments, the materials stimulated hPDLSCs to migrate. hPDLSCs were attached to the bioactive cements, with multiple prolongations proliferated on the surface of the samples. Moreover, there were no changes to cell phenotype or apoptosis/necrosis rates, indicating that the acidic environment did not induce cell death. Prismatic crystalline structures were seen on the surface of the cements exposed to butyric acid and EDX analysis identified a marked peak of Ca^{2+} from NeoMTA-Plus and Endocem-MTA in acidic and physiological environments.

CONCLUSION

An acidic environment favoured the release of Ca^{2+} ions from both bioactive cements, and the cytotoxicity of these bioactive cements was low in both environments studied.



GANDOLFI MG, IEZZI G, PIATTELLI A, PRATI C, SCARANO A. OSTEOINDUCTIVE POTENTIAL AND BONE-BONDING ABILITY OF PROROOT MTA, MTA PLUS AND BIODENTINE IN RABBIT INTRAMEDULLARY MODEL: MICROCHEMICAL CHARACTERIZATION AND HISTOLOGICAL ANALYSIS. DENT MATER. 2017;33(5):E221-E238. DOI:10.1016/J.DENTAL.2017.01.017

Osteoinductive potential and bone-bonding ability of ProRoot MTA, MTA Plus and Biodentine in rabbit intramedullary model: Microchemical characterization and histological analysis.

PURPOSE

To study the in vivo osteoinductive potential, bone-bonding ability (bioactivity) and bone biomineralization of current hydraulic calcium silicate cements used as graft materials and placed in contact with medullary bone.

METHODS

ProRoot MTA, MTA Plus and Biodentine were used to fill surgical bone defects (2-mm diameter through the entire cortical thickness to reach the medullary bone) in the tibia of mature male rabbits. Tibiae were retrieved after 30 days and submitted to histological analysis and microchemical characterization using Optical Microscopy (OM) and

Environmental Scanning Electron Microscopy with Energy Dispersive X-ray analysis (ESEM-EDX). Bone neoformation and histomorphometric evaluations, degree of mineralization (by Ca/P, Ca/N and P/N ratios) and the diffusion of material elements were studied.

RESULTS

Bone neoformation was observed in response to all materials. No sign of necrosis were found on the walls of the preexisting cortical bone. No osteoclasts and no formation of fibrous tissue were evident. Sign of angiogenesis were present. EDX (element content, line profile and element mapping) showed the increase in Ca and P and decrease in C, S and N from the mature bone towards the mineralizing interface. Ca/P, Ca/N and P/N ratios showed differences in the degree of mineralization/maturation stage of bone. MTA Plus and ProRoot MTA exhibited close contact with the pre-existing bone and good bone-bonding with neoformed bone juxtaposed on the medullary side of the materials without interposed connective tissue or resorption lacunae or gaps. The materials showed a dense appearance with 100% of residual materials and no colonization by fluids and cells. No migration of Bi or Al material elements to the newly formed bone was found. Biodentine showed newly formed trabecular bone with marrow spaces and sparse traces of residual material ($\approx 9\%$).

SIGNIFICANCE

The in vivo osteoinductive properties with dynamic biomineralization processes around these calcium silicate materials extruded in medullary bone in appropriate animal model have been demonstrated by ESEM-EDX in association with OM. Good biocompatibility was evident as only slight inflammatory



infiltrate and no sign of necrosis at the interface with the pre-existing bone were found. MTA Plus and ProRoot MTA exhibited bioactive potential as they can bond to bone directly without interposed connective tissue. Biodentine was replaced by newly formed bone.

CLINICAL SIGNIFICANCE:

The results of the study demonstrate the capacity of calcium silicate cements to allow osteoid matrix deposition by activated osteoblasts and favour its biomineralization, and to achieve a direct bond between the (bioactive) materials surface and the mineralized bone matrix.



TOMÁS-CATALÁ CJ, COLLADO-GONZÁLEZ M, GARCÍA-BERNAL D, ET AL. COMPARATIVE ANALYSIS OF THE BIOLOGICAL EFFECTS OF THE ENDODONTIC BIOACTIVE CEMENTS MTA-ANGELUS, MTA REPAIR HP AND NEOMTA PLUS ON HUMAN DENTAL PULP STEM CELLS. INT ENDOD J. 2017;50 SUPPL 2:E63-E72. DOI:10.1111/iej.12859

Comparative analysis of the biological effects of the endodontic bioactive cements MTA-Angelus, MTA Repair HP and NeoMTA Plus on human dental pulp stem cells

PURPOSE

To evaluate the biological effects in vitro of MTA-Angelus (MTA-Ang; Angelus, Londrina, PR, Brazil), MTA Repair HP (MTA-HP; Angelus) and NeoMTA Plus (NeoMTA-P; Avalon Biomed Inc, Bradenton, FL, USA) on human dental pulp stem cells (hDPSCs).

METHODS

Cell viability and cell migration assays were performed using eluates of each material. To evaluate cell morphology and cell attachment to the different materials, hDPSCs were directly seeded onto the material surfaces and analysed by immunocytofluorescence and scanning electron microscopy, respectively. The chemical composition of the materials was determined by energy-dispersive X-ray (EDX), and eluates were analysed by inductively coupled plasma–mass spectrometry (ICP-MS). Statistical analysis was performed with the analysis of variance and Bonferroni or Tukey post-test ($\alpha < 0.05$).

RESULTS

Undiluted MTA-Ang, MTA-HP and NeoMTA-P displayed a significant increase in cell viability greater than that obtained using complete medium alone (control) (* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$). Moreover, a cell migration assay revealed cell migration rates after incubation with extracts of MTA-Ang, MTA-HP and NeoMTA-P that were similar to levels obtained in the control group. In addition, stretched cytoskeletal F-actin fibres were detected in the cells treated with the three material extracts. SEM studies revealed a high degree of cell proliferation and attachment on all three materials. EDX analysis demonstrated similar weight percentages of C, O and Ca in all three materials, whilst other elements such as Al, Si and S were also found.

CONCLUSION

MTA-Ang, MTA-HP and NeoMTA-P were associated with biological effects on hDPSCs in terms of cell proliferation, morphology, migration and attachment.



QI, YIPIN & LI, NAN & NIU, LI & PRIMUS, CAROLYN & LING, JUN-QI & PASHLEY, DAVID & TAY, FRANK. (2011). REMINERALIZATION OF ARTIFICIAL DENTINAL CARIES LESIONS BY BIOMIMETICALLY MODIFIED MINERAL TRIOXIDE AGGREGATE. ACTA BIOMATERIALIA. 8. 836-42. 10.1016/J.ACTBIO.2011.10.033.

Remineralization of artificial dentinal caries lesions by biomimetically modified Mineral Trioxide Aggregate

PURPOSE

fluoride-releasing restorative materials are available for remineralization of enamel and root caries. However, dentin remineralization is more difficult than enamel remineralization due to the paucity of apatite seed crystallites along the lesion surface for heterogeneous crystal growth. Extracellular matrix proteins play critical roles in controlling apatite nucleation/growth in collagenous tissues. This study examined the remineralization efficacy of mineral trioxide aggregate (MTA) in phosphate-containing simulated body fluid (SBF) by incorporating polyacrylic acid and sodium tripolyphosphate as biomimetic analogs of matrix proteins for remineralizing caries-like dentin.

METHODS

Artificial caries-like dentin lesions incubated in SBF were remineralized over a 6-week period using MTA or MTA containing biomimetic analogs in the absence or presence of dentin adhesive application. Lesion depths and integrated mineral loss were monitored with micro-computed tomography. Ultrastructure of baseline and remineralized lesions were examined by transmission electron microscopy.

RESULTS

Dentin remineralization was best achieved using MTA containing biomimetic analogs regardless of whether an adhesive was applied; dentinal tubules within the remineralized dentin were occluded by apatite. It is concluded that the MTA version employed in the study may be doped with biomimetic analogs for remineralization of unbonded and bonded artificial caries-like lesions in the presence of SBF.

CONCLUSION

Within the limits of the present study, it may be concluded that the present version of MTA may be doped with biomimetic analogs for remineralization of unbonded and adhesive-bonded artificial caries-like lesions in the presence of SBF. Incorporation of biomimetic analogs in modified MTA provides a potential delivery system for realization of the goal of biomimetic remineralization of dentin and widens the scope of MTA applications in dentistry.



Sealing Ability / Fracture Resistance/ leakage

VO K, DANIEL J, AHN C, PRIMUS C, KOMABAYASHI T. CORONAL AND APICAL LEAKAGE AMONG FIVE ENDODONTIC SEALERS. J ORAL SCI. 2022 JAN 19;64(1):95-98. DOI: 10.2334/JOSNUSD.21-0433. EPUB 2021 DEC 29. PMID: 34980828.

Coronal and apical leakage among five endodontic sealers

PURPOSE

The aim of this study was to use dye penetration to measure apical and coronal leakage simultaneously in single-canal teeth that had been treated endodontically using a single-cone obturation technique.

METHODS

One hundred single-canal, extracted human teeth were cleaned and shaped with ProTaper NEXT rotary files to size-X5 (50/.06), then randomly assigned to five sealer groups for single-cone gutta-percha obturation. The teeth were soaked in 0.6% rhodamine B at 37°C for seven days, then the roots were ground mesiodistally and the maximum apical and coronal dye penetration was measured. Differences in leakage among the sealer groups were examined using the Kruskal-Wallis test. Pairwise comparisons were made using the Mann-Whitney test with Bonferroni correction.

RESULTS

The mean values (mm) of dye penetration for AH Plus, Pulp Canal Sealer, NeoSEALER Flo, EndoSequence BC, and Super-Bond RC Sealer were 0.200, 0.300, 0.675, 0.850, and 0.900 apically, whereas 1.675, 2.075, 4.800, 6.500, and 4.125 coronally. Pairwise comparisons showed significant apical differences between AH Plus/Super-Bond RC Sealer ($P = 0.047$) and significant coronal differences between AH Plus/NeoSEALER Flo ($P = 0.001$), AH Plus/EndoSequence BC ($P < 0.01$), AH Plus/Super-Bond RC Sealer ($P < 0.01$), Pulp Canal Sealer/NeoSEALER Flo ($P = 0.010$), Pulp Canal Sealer/EndoSequence BC ($P < 0.01$), and Pulp Canal Sealer/Super-Bond RC Sealer ($P < 0.01$).

CONCLUSION

Coronal leakage was worse than apical leakage for all sealers. AH Plus exhibited the least leakage apically and coronally; Super-Bond RC Sealer showed the most leakage apically, and EndoSequence BC showed the most leakage coronally.



DELIKAN, EBRU & AKSU, SEÇKİN. (2020). COMPARISON OF THE SEALING ABILITY OF APICAL PLUG MATERIALS IN SIMULATED OPEN APICES: AN IN VITRO STUDY. JOURNAL OF ORAL RESEARCH AND REVIEW. 12. 70. 10.4103/JORR.JORR_41_19.

Comparison of the sealing ability of apical plug materials in simulated open apices: An in vitro study

PURPOSE

The aim of this study was to evaluate the microleakage of apical plugs made of four different materials in simulated immature teeth.

METHODS

Ninety extracted single-rooted teeth were selected and randomly divided into six groups according to the materials used: NeoMTA, EndoSequence Bioceramic Root Repair Material Fast Set Putty (BC RRM-FS), Biodentine, Endo Repair, negative control, and positive control group. Microleakage was evaluated by using a stereomicroscope to assess the penetration of methylene blue solution. Data were analyzed using descriptive statistics and Pearson's Chi-square test ($P < 0.05$).

RESULTS

EndoRepair group showed the highest leakage, and NeoMTA group exhibited the best sealing ability of apical plugs. The sealing ability of Biodentine was similar to NeoMTA and BC RRM-FS. On the other hand, the sealing ability of BC RRM-FS significantly lower than NeoMTA, but it provided a better sealing than EndoRepair.

CONCLUSION

According to the results of this study, NeoMTA and Biodentine can be used safely as apical plug material in single-session apexification in immature teeth. The BC RRM-FS, on the other hand, provided an acceptable sealing, although not as successful as the NeoMTA. However, the sealing properties of Endo Repair need to be improved.



AKTEMUR TÜRKER S, UZUNOĞLU E, DENİZ SUNGUR D, TEK V. FRACTURE RESISTANCE OF TEETH WITH SIMULATED PERFORATING INTERNAL RESORPTION CAVITIES REPAIRED WITH DIFFERENT CALCIUM SILICATE-BASED CEMENTS AND BACKFILLING MATERIALS. J ENDOD. 2018;44(5):860-863. DOI:10.1016/J.JOEN.2018.01.019

Fracture Resistance of Teeth with Simulated Perforating Internal Resorption Cavities Repaired with Different Calcium Silicate-based Cements and Backfilling Materials

PURPOSE

This study assessed the fracture resistance (FR) of teeth with simulated perforating internal resorption cavities repaired with different calcium silicate-based cements (CSCs) and backfilling materials.

METHODS

Ninety-six mandibular premolar teeth were used. Twelve of the teeth were assigned as negative control group. Remaining roots were instrumented with rotary files, and standardized internal resorption cavities were prepared on the middle half of roots with burrs. Twelve of the samples were not further interfered and were assigned as a positive control group. The apical 4 mm of the remaining 72 root canals was obturated with single-cone technique and divided into 6 groups according to CSCs used for repairing of cavities and backfilling materials as follows: MTA + MTA, MTA + gutta-percha/sealer, Biodentine + Biodentine, Biodentine + gutta-percha/sealer, MTA Plus + MTA Plus, and MTA Plus + gutta-percha/sealer. Specimens were embedded in acrylic resin and then subjected to fracture testing. The forces when the fracture occurred were analyzed with analysis of variance and Bonferroni tests at $P = .05$.

RESULTS

No significant difference was found among CSCs irrespective of backfilling materials ($P > .05$). Groups MTA + gutta-percha/sealer, Biodentine + gutta-percha/sealer, and MTA Plus + gutta-percha/sealer showed significantly lower FR compared with groups MTA + MTA, Biodentine + Biodentine, and MTA Plus + MTA Plus, respectively ($P < .05$). The highest FR was observed in group Biodentine + Biodentine, and the lowest was in group MTA Plus + gutta-percha/sealer. FR of positive control group was statistically lower than groups completely filled with CSCs ($P < .05$), whereas FR of negative control group was statistically higher than the groups combined with gutta-percha and sealer ($P < .05$).

CONCLUSION

The backfilling with CSCs may be preferable material rather than gutta-percha/sealer combination for the roots with perforated internal resorptions.



ALSUBAIT, SARA. (2017). EFFECT OF SODIUM HYPOCHLORITE ON PUSH-OUT BOND STRENGTH OF FOUR CALCIUM SILICATE-BASED ENDODONTIC MATERIALS WHEN USED FOR REPAIRING PERFORATIONS ON HUMAN DENTIN: AN IN VITRO EVALUATION. THE JOURNAL OF CONTEMPORARY DENTAL PRACTICE. 18. 289-294. 10.5005/JP-JOURNALS-10024-2033.

Effect of Sodium Hypochlorite on Push-out Bond Strength of Four Calcium Silicate-based Endodontic Materials when used for repairing Perforations on Human Dentin: An in vitro Evaluation

PURPOSE

This study aimed to evaluate the push-out bond strength of NeoMTA Plus (NMTA), EndoSequence root repair material fast set putty (ERRMF), biodentine (BD), and ProRoot white mineral trioxide aggregate (PMTA) when used as perforation repair materials after exposure to 2.5% sodium hypochlorite (NaOCl) during the early setting phase.

METHODS

Horizontal midroot sections were prepared from single-rooted human teeth. Sections ($n = 144$) were randomly divided into four groups: PMTA, BD, NMTA, and ERRMF. Materials were condensed and allowed to set for 10 minutes. The groups were further divided into two subgroups. The NaOCl group included specimens that were immersed in 2.5% NaOCl for 30 minutes, and the control group included specimens on which a wet cotton pellet was placed over the test material. After 48 hours, the highest force applied to the materials at the time of dislodgement was recorded. Slices were then examined under a digital microscope to evaluate the nature of the bond failure. The surfaces of two specimens from each subgroup were observed by scanning electron microscopy. Data were statistically analyzed with two-way and one-way analysis of variances, independent t-tests, and chi-square tests. The statistical significance was set at 0.05.

RESULTS

In NaOCl-treated groups, PMTA showed a significantly higher push-out bond strength than the other three materials ($p = 0.00$). In the control groups, the bond strength of BD was significantly higher than that of PMTA, ERRMF, and NMTA ($p < 0.05$). Compared with the control group, NaOCl treatment significantly increased the push-out bond strength of PMTA ($p = 0.00$) and ERRMF ($p = 0.00$) and significantly reduced the bond strength of BD ($p = 0.00$) and NMTA ($p = 0.03$). None of the specimens showed an adhesive type of failure. The majority of the samples exhibited a cohesive failure type. Morphological observations revealed that the surfaces exhibited cubic crystals. In ERRMF, the crystals were few in number. Sodium hypochlorite enhanced the crystallization of NMTA.

CONCLUSIONS

The push-out bond strengths of PMTA and ERRMF were significantly increased after exposure to 2.5% NaOCl in the early setting phase, and those of BD and NMTA were significantly decreased.



TÜRKER, SEVİNÇ & UZUNOĞLU-ÖZYÜREK, EMEL & BILGIN, BURCU. (2016). COMPARATIVE EVALUATION OF PUSH-OUT BOND STRENGTH OF NEO MTA PLUS WITH BIODENTINE AND WHITE PROROOT MTA. JOURNAL OF ADHESION SCIENCE AND TECHNOLOGY. 1-7. 10.1080/01694243.2016.1219443.

Comparative evaluation of push-out bond strength of Neo MTA Plus with Biodentine and white ProRoot MTA.

PURPOSE

The aim of this in vitro study was to evaluate the bond strength of a new calcium silicate cement, Neo MTA Plus (Avalon Biomed Inc. Bradenton, FL, U.S.A) by comparing ProRoot MTA and Biodentine.

METHODS

Sixty dentin slices were instrumented to achieve a diameter of 1.3 mm. Group 1: white ProRoot MTA, group 2: Biodentine, group 3: Neo MTA Plus – G (powder mixed with gel), group 4: Neo MTA Plus – W (powder mixed with distilled water) were loaded into cavities. The push-out bond strength values were measured. Data were analyzed using Welch ANOVA with Bonferroni correction $p = 0.05$. Failure modes (adhesive, cohesive, and mixture) were analyzed.

RESULTS

The highest bond strength value was recorded in Neo MTA Plus mixed with gel (5.23 ± 1.78 MPa), whereas white ProRoot MTA (2.57 ± 0.66 MPa) had the lowest. Bond strength values of Neo MTA Plus mixed either with gel or with distilled water were statistically different from both white ProRoot MTA and Biodentine (2.61 ± 0.70 MPa) ($p < 0.05$). Adhesive failure was predominantly observed in all groups.

CONCLUSIONS

Neo MTA Plus could be considered as alternatives to the ProRoot MTA and Biodentine due to its better performance in bonding to root dentin.



ANJU, P. K. ., PURAYIL, T. P. ., GINJUPALLI, K. ., & BALLAL, N. V. . (2022). EFFECT OF CHELATING AGENTS ON PUSH-OUT BOND STRENGTH OF NEOMTA PLUS TO ROOT CANAL DENTIN. PESQUISA BRASILEIRA EM ODONTOPEDIATRIA E CLÍNICA INTEGRADA, 22, E210058. RETRIEVED FROM <https://revista.uepb.edu.br/PBOCI/article/view/955>.

Effect of Chelating Agents on Push-Out Bond Strength of NeoMTA Plus to Root Canal Dentin

PURPOSE

To evaluate and compare the effect of 17% Ethylenediaminetetraacetic Acid (EDTA), 9% Etidronic acid (HEDP), and 7% Maleic acid (MA) on the push-out bond strength of NeoMTA Plus sealer to the coronal, middle, and apical thirds of root canal dentin.

METHODS

Forty single-rooted human maxillary central incisors were selected and decoronated to 12 mm long root fragments. Working length was established and root canals were then enlarged up to rotary Protaper F3. After each instrumentation, the root canal was irrigated with 2.5% NaOCl. For the final irrigation regimen, the specimens were divided into 4 groups (n=10) and treated with EDTA, HEDP, MA or Saline. Root canals were coated with NeoMTA Plus sealer, and obturation was done with single cone obturation technique. Subsequently, three horizontal sections were taken from the coronal, middle and apical thirds of each specimen, and POBS was measured using a universal testing machine. The type of bond failures was assessed under a stereomicroscope. Statistical analysis was done with One-way ANOVA with Tukey's Post hoc analysis.

RESULTS

MA and EDTA showed the highest POBS. There was no significant difference in bond strength between MA and EDTA ($p>0.05$). HEDP and Saline showed lower POBS. Among all the four groups, the coronal third showed the highest values, followed by middle and apical thirds.

CONCLUSIONS

The type of chelating agent used during the root canal treatment significantly affects the bond strength of NeoMTA Plus to the root canal dentin.



GOVINDARAJU, LOKHASUDHAN & NEELAKANTAN, PRASANNA & GUTMANN, JAMES. (2016). EFFECT OF ROOT CANAL IRRIGATING SOLUTIONS ON THE COMPRESSIVE STRENGTH OF TRICALCIUM SILICATE CEMENTS. CLINICAL ORAL INVESTIGATIONS. 21. 10.1007/s00784-016-1922-0.

Effect of root canal irrigating solutions on the compressive strength of tricalcium silicate cements.

PURPOSE

The aim of this study was to evaluate the effect of root canal irrigants on the compressive strength of hydraulic tricalcium silicate cements.

METHODS

Specimens ($n = 60$) of tricalcium silicate materials-Group 1: White ProRoot mineral trioxide aggregate (MTA), Group 2: NeoMTA Plus, Group 3: White MTA Angelus, and Group 4: Biodentine were exposed to one of the solutions ($n = 20$): Phosphate buffered saline (PBS; control), 3 % NaOCl, or 17 % EDTA for 5 min while being suspended in PBS. Compressive strength values were evaluated after 7 days of storage. The data were statistically analyzed by two-way ANOVA and Tukey's multiple comparison test ($P = 0.05$).

RESULTS

Biodentine (BD) showed significantly higher compressive strength than the other materials ($P < 0.05$) in the control group. When exposed to NaOCl, compressive strength of WMTA and WMTA-A decreased significantly ($P < 0.05$), while EDTA decreased the compressive strength of all the cements compared to the control ($P < 0.05$). There was no significant difference in the compressive strength of BD and NMTA-P when exposed to NaOCl or EDTA.

CONCLUSIONS

Biodentine and NeoMTA Plus did not show a significant reduction in compressive strength when exposed to NaOCl. EDTA reduced the compressive strength of the cements tested.

CLINICAL SIGNIFICANCE

Tricalcium silicates were differentially influenced by root canal irrigants. It is essential to understand the composition of these materials prior to clinical use. Traces of irrigants from the root canal wall must be thoroughly removed.



NEELAKANTAN, PRASANNA & NANDAGOPAL, MUGUNTH & SHEMES, HAGAY & WESSELINK, PAUL. (2015). THE EFFECT OF ROOT DENTIN CONDITIONING PROTOCOLS ON THE PUSH-OUT BOND STRENGTH OF THREE CALCIUM SILICATE SEALERS. INTERNATIONAL JOURNAL OF ADHESION AND ADHESIVES. 60. 10.1016/J.IJADHADH.2015.04.006.

The effect of root dentin conditioning protocols on the push- out bond strength of three calcium silicate sealers.

PURPOSE

To compare the effects of irrigation protocols on the push-out bond strength of calcium silicate materials at two different time periods (7-days and 3-months).

METHODS

Root canals (n=300) were irrigated with one of the following (n=60): group 1 (3% NaOCl–17% EDTA); group 2 (17% EDTA–3% NaOCl); group 3 (1:1 mixture of 6% NaOCl and 18% etidronic acid); group 4 (3% NaOCl–QMix 2in1); group 5 (3% NaOCl–2% chlorhexidine). Specimens were subdivided into three subgroups (n=20): A, Endosequence BC sealer [EBC]; B, MTA Plus [MTA-P]; C, Tech Biosealer Endo [TECH]. Specimens were suspended in phosphate buffered saline [PBS] for 7 days or 3 months (n=10 per sealer). Push-out bond strength was measured and data were analyzed (P=0.05).

RESULTS

MTA-P: showed the highest bond strength at both time periods, when NaOCl+EA was used as an irrigant. This was not significantly different from the strength produced when NaOCl–QMix was used for 7 days (P>0.05). There was no significant difference between the bond strengths of the three materials when irrigated with group 1, 2 or 5 (P>0.05), but these groups showed significantly lower bond strengths than groups 3 and 4 (P<0.05). While the bond strength of EBC and MTA-P in specimens irrigated with groups 3 and 4 improved significantly with time [P<0.05], this was not true for TECH.

CONCLUSIONS

Push-out bond strength of calcium silicate cements was differentially influenced by irrigation protocol and time. MTA Plus showed the highest bond strength at both time periods, when root canals were irrigated with NaOCl+EA. The bond strength of Tech Biosealer Endo did not improve with time immaterial of the irrigation protocols.



WALSH, RYAN & WOODMANSEY, KARL & GLICKMAN, GERALD & HE, JIANING. (2014). EVALUATION OF COMPRESSIVE STRENGTH OF HYDRAULIC SILICATE-BASED ROOT-END FILLING MATERIALS. JOURNAL OF ENDODONTICS. 40. 10.1016/j.joen.2013.11.018.

Evaluation of compressive strength of hydraulic silicate- based root-end filling materials.

PURPOSE

Hydraulic silicate cements such as mineral trioxide aggregate (MTA) have many clinical advantages. Newer hydraulic silicate materials have been developed that improve on the limitations of mineral trioxide aggregate such as the long setting time and difficult handling characteristics. The purpose of this study was to examine the effect of saline and fetal bovine serum (FBS) on the setting and compressive strength of the following hydraulic silicate cements: ProRoot MTA (white WMTA; Dentsply International, Tulsa Dental Specialties, Johnson City, TN), EndoSequence Root Repair Material (Brasseler USA, Savannah, GA), MTA Plus (MTAP; Avalon Biomed Inc, Bradenton, FL), and QuickSet (QS; Avalon Biomed Inc, Bradenton, FL).

METHODS

Samples of root-end filling materials were compacted into polyethylene molds. Samples were exposed to FBS or saline for 7 days. A universal testing machine was used to determine the compressive strengths.

RESULTS

QS had significantly lower compressive strength than all other materials ($P < .001$). White MTA and MTAP mixed with liquid had lower compressive strengths after exposure to FBS compared with saline ($P = .003$). ERRM, MTAP mixed with gel, and QS were not affected by the exposure to FBS.

CONCLUSIONS

New silicate-based root-end filling materials, other than QS, have compressive strength similar to MTA. Within the limits of this study, premixed materials and those mixed with antiwashout gel maintain their compressive strength when exposed to biological fluids.



FORMOSA, L & MALLIA, BERTRAM & CAMILLERI, JOSETTE. (2013). PUSH-OUT BOND STRENGTH OF MTA WITH ANTIWASHOUT GEL OR RESINS. INTERNATIONAL ENDODONTIC JOURNAL. 47. 10.1111/IEJ.12169.

Push-out bond strength of MTA with antiwashout gel or resins.

PURPOSE

Assessment of the push-out bond strength of four MTA-based formulations for use as root-end filling materials.

METHODS

MTA Plus mixed with (i) water ('MTA-W'); (ii) a proprietary water-based antiwashout gel ('MTA-AW'); (iii) Superbond C&B chemically curing resin ('MTA-Chem'); and (iv) Heliobond light-curing resin ('MTA-Light') was tested. Root slices 3 mm thick human had a 1.5 mm diameter hole drilled centrally and were treated with 17% EDTA for 60s. Forty specimens divided into groups 1-4 were prepared and filled with MTA-W, MTA-AW, MTA-Chem and MTA-Light, respectively. Groups 3 and 4 were etched with 37% phosphoric acid for 60s, and bonding agent was applied to the dentine surface. Specimens were stored for 28 days in Hanks' Balanced Salt Solution at 37 °C. Push-out strength was tested with a punch and die (punch diameter 1.3 mm, die diameter 2.0 mm, punch speed 1 mm min⁻¹). Stereomicroscopy was used to classify failure mode (adhesive, cohesive or mixed type).

RESULTS

The resulting push-out strengths were 5.1 MPa (MTA-W), 4.3 MPa (MTA-AW), 4.7 MPa (MTA-Chem) and 11.0 MPa (MTA-Light). MTA-W had higher push-out strength than MTA-AW ($P = 0.022$). The same was noted for MTA-Light relative to the other materials ($P < 0.05$). All materials exhibited adequate push-out strengths compared with MTA-W. Failure was predominantly mixed, except for MTA-Chem (predominantly adhesive).

CONCLUSIONS

All materials exhibited adequate push-out strength. Previous studies have shown the new formulations have additional advantages including increased washout resistance and faster setting time, making them promising for future dental applications.



CALCIUM HYDROXIDE DIFFUSION & RELEASE OF CALCIUM IONS/

GANDOLFI, MARIA & SIBONI, FRANCESCO & PRIMUS, CAROLYN & PRATI, CARLO. (2014). ION RELEASE, POROSITY, SOLUBILITY, AND BIOACTIVITY OF MTA PLUS TRICALCIUM SILICATE. JOURNAL OF ENDODONTICS. 40. 10.1016/J.JOEN.2014.03.025

Ion release, porosity, solubility, and bioactivity of MTA Plus tricalcium silicate.

PURPOSE

The aim of this study was to evaluate MTA Plus (Prevest Denpro Limited, Jammu, India, for Avalon Biomed Inc) material's properties, namely calcium release, the pH change, solubility, water sorption, porosity, surface morphology, and apatiteforming ability after immersion in simulated body fluid.

METHODS

Two tricalcium silicate powders (MTA Plus and ProRoot MTA; Dentsply Tulsa Specialties, Tulsa, OK) and Dycal (Dentsply Caulk, Milford, DE) were tested. After incubation at 37°C and 99% relative humidity, calcium and hydroxyl ion release were tested up to 28 days in deionized water at 37°C. Water absorption, interconnected pores, apparent porosity, and solubility were measured after 24 hours of immersion in deionized water at 37°C. The morphologic and elemental analysis of the materials' surfaces were examined using an environmental scanning electron microscope/energy dispersive x-ray analysis after storage at 37°C for 1-28 days in simulated body fluid using the ISO 23317 method.

RESULTS

All 3 materials created an alkaline pH within 3 hours, which continued for 28 days. MTA Plus had a higher ion release than ProRoot MTA and Dycal; the use of the MTA Plus gel enhanced the initial calcium release and the increase of the pH. Both MTA materials were more porous, water soluble, and water sorptive than Dycal and more bioactive. After aging in simulated body fluid, MTA Plus material caused precipitation of an apparent calcium phosphate layer.

CONCLUSION

MTA Plus showed improved reactivity and prolonged capability to release calcium and increase the local pH to alkaline values in comparison with ProRoot MTA. These pronounced ion-releasing properties are interlinked with its noticeable porosity, water sorption, and solubility and with the formation of calcium phosphorus minerals. The finer calcium silicate powder may explain the higher ion release, water sorption, porosity, and solubility of MTA Plus compared with ProRoot MTA. For clinicians, MTA Plus represents a lower-cost bioactive tricalcium silicate material with interesting chemical physical properties that could be a convenient alternative to the conventional calcium silicate mineral trioxide aggregate-like cements.



HEALING

TAHA NA, AL-KHATIB H. 4-YEAR FOLLOW-UP OF FULL PULPOTOMY IN SYMPTOMATIC MATURE PERMANENT TEETH WITH CARIOUS PULP EXPOSURE USING A STAINPROOF CALCIUM SILICATE-BASED MATERIAL. J ENDOD. 2022 JAN;48(1):87-95. DOI: 10.1016/J.JOEN.2021.09.008. EPUB 2021 SEP 24. PMID: 34563506.

4-Year Follow-up of Full Pulpotomy in Symptomatic Mature Permanent Teeth with Carious Pulp Exposure Using a Stainproof Calcium Silicate-based Material

PURPOSE

This study aimed to assess the pulpal and restorative outcome of full pulpotomy in symptomatic mature permanent teeth with carious pulp exposure over 4 years.

METHODS

Under local anesthesia, full pulpotomy was performed using the aseptic technique and a stainproof calcium silicate-based material (NeoMTA Plus; Avalon Biomed Inc, Bradenton, FL). The pain level was scored preoperatively and at 1 week posttreatment. Clinical and radiographic evaluation was performed at 6 months, 1, 2, and 4 years. Kaplan-Meier survival analysis and Cox proportional hazards regression were used to analyze the data. Failed cases were classified as endodontic or restorative failure.

RESULTS

Full pulpotomy was completed in 109 teeth in 90 patients with an age range of 14-60 years (mean = 25 years). The study sample available for follow-up was 100 teeth in 86 patients with a recall rate above 90%. Preoperative pulp diagnosis was reversible pulpitis in 39 teeth and irreversible pulpitis in 61 teeth. The cumulative survival rates of pulpotomy were generally high (ie, 98%, 97.4%, 93%, and 83.8% at 6 months and 1, 2, and 4 years, respectively). The overall mean survival time of pulpotomy was 3.89 years (95% confidence interval, 3.84-3.95). The mean survival time was significantly higher for patients aged ≤ 25 years. However, in the multivariate analysis, the only significant predictor of pulpotomy failure was severe preoperative pain. Over the 4 years, 23 cases failed; only 10 of 23 failures were classified as endodontic failure, and the success of pulpotomy can be assumed to be 90%.

CONCLUSION

Full pulpotomy in cariously exposed pulp of mature permanent teeth sustained a high success rate over 4 years. The coronal seal is crucial for long-term survival.



ALSANOUNI, MUNERAH & BAWAZIR, OMAR. (2019). A RANDOMIZED CLINICAL TRIAL OF NEOMTA PLUS IN PRIMARY MOLAR PULPOTOMIES. PEDIATRIC DENTISTRY. 15;41. 107-111.

A Randomized Clinical Trial of NeoMTA Plus in Primary Molar Pulpotomies

PURPOSE

The purpose of this study was to compare the success of pulpotomies in primary molars using a new type of mineral trioxide aggregate (MTA; NeoMTA Plus) with a conventional MTA (ProRoot MTA) as a pulpotomy medicament in primary molars.

METHODS

Eighty primary teeth in 28 patients were divided randomly, with 40 teeth in a control group (ProRoot MTA) and 40 teeth in an experimental group (NeoMTA Plus). A standardized pulpotomy technique was performed for each tooth. Clinical and radiographic follow-up examinations were conducted at three, six, and 12 months.

RESULTS

At 12 months, the clinical success for ProRoot MTA was 97.4 percent (38 out of 39) and the radiographic success was 94.9 percent (37 out of 39); for NeoMTA Plus, the clinical success was 100 percent (40 out of 40) and the radiographic success was 97.5 percent (39 out of 40). No significant differences were found between the two groups at all follow-up evaluations.

CONCLUSION

NeoMTA Plus showed a high percent success, similar to that of ProRoot MTA. NeoMTA Plus is a potential pulpotomy medicament for primary teeth.



QUINTANA RM, JARDINE AP, GRECHI TR, ET AL. BONE TISSUE REACTION, SETTING TIME, SOLUBILITY, AND pH OF ROOT REPAIR MATERIALS. CLIN ORAL INVESTIG. 2019;23(3):1359-1366. DOI:10.1007/s00784-018-2564-1.

Bone tissue reaction, setting time, solubility, and pH of root repair materials

PURPOSE

This study aims to compare the bone tissue reaction, setting time, solubility, and pH of NeoMTA Plus, Biodentine (BD), and MTA Angelus (MTA-A).

METHODS

Initial and final setting times ($n = 7$) and solubility up to 7 days ($n = 11$) were evaluated in accordance with ASTM C266–15 and ANSI/ADA Specification No. 57, respectively. pH ($n = 10$) was measured up to 28 days. Bone tissue reactions in 48 rats' femur were histologically analyzed after 7, 30, and 90 days. ANOVA and Tukey's tests compared setting time, solubility, and pH data; bone reactions data were compared by Kruskal-Wallis and Dunn's tests.

RESULTS

NeoMTA Plus had longer initial and final setting times than MTA-A and BD ($P < 0.05$). At 7 days, BD showed the highest solubility, similar to NeoMTA Plus ($P > 0.05$) and different from MTA-A ($P < 0.05$). NeoMTA Plus had a progressive mass loss over time; at 7 days, it was significantly different from the initial mass ($P < 0.05$). BD showed higher pH in the periods assessed when compared to the other materials ($P < 0.05$). Bone tissue repair had no differences between groups in each experimental period ($P > 0.05$). All groups presented no difference from 30 to 90 days ($P > 0.05$) and had better bone repair at 90 days than at 7 days ($P < 0.05$).

CONCLUSION

NeoMTA Plus, BD, and MTA-A showed satisfactory setting time, high mass loss, alkaline pH, and allowed bone repair.



WALSH RM, WOODMANSEY KF, HE J, SVOBODA KK, PRIMUS CM, OPPERMAN LA. HISTOLOGY OF NEOMTA PLUS AND QUICK-SET2 IN CONTACT WITH PULP AND PERIRADICULAR TISSUES IN A CANINE MODEL. J ENDOD. 2018;44(9):1389-1395. DOI:10.1016/J.JOEN.2018.05.001

Histology of NeoMTA Plus and Quick-Set2 in Contact with Pulp and Periradicular Tissues in a Canine Model.

PURPOSE

The purpose of this study was to compare the healing of pupal and periapical tissues in dogs after exposure to NeoMTA Plus and Quick-Set2 after pulpotomy and root-end surgery procedures.

METHODS

Seventy-two teeth (36 for each procedure) in 6 beagle dogs received pulpotomy or root-end surgery using either NeoMTA Plus or Quick-Set2. The dogs were sacrificed at 90 days, and the teeth and surrounding tissues were prepared for histologic evaluation. Sixty teeth were evaluated and scored histologically (29 with pulpotomies and 31 with root-end resections). Specimens were scored for inflammation, quality and thickness of dentin bridging, pulp tissue response, cementum and periodontal ligament formation, and apical bone healing.

RESULTS

Both materials displayed favorable healing at 90 days. The only significant difference was the quality of dentin bridge formation in pulpotomies using NeoMTA Plus compared with Quick-Set2.

CONCLUSION

Quick-Set2 and NeoMTA Plus had similar effects on inflammation, pulp response, periodontal ligament and cementum formation, and apical tissue healing in dogs. NeoMTA Plus had superior dentin bridge quality compared with Quick-Set2.



COSTA, FÁBIO & GOMES, PEDRO & FERNANDES, MARIA. (2015). OSTEOGENIC AND ANGIOGENIC RESPONSE TO CALCIUM SILICATE-BASED ENDODONTIC SEALERS. JOURNAL OF ENDODONTICS. 42. 10.1016/J.JOEN.2015.09.020

Osteogenic and Angiogenic Response to Calcium Silicate-based Endodontic Sealers.

PURPOSE

Calcium silicate-based endodontic sealers are reported to favor the regeneration of periradicular tissues, a process requiring concerted osteogenic and angiogenic events. This study compared 4 calcium silicate-based sealers for the effects of their extracts on osteogenic and angiogenic cell behavior.

METHODS

Extracts from ProRoot MTA (Dentsply Tulsa Dental, Tulsa, OK), MTA Plus (Prevest Denpro Limited, Jammu City, India), MTA Fillapex (Angelus, Londrina, PR, Brazil), and Biodentine (Septodont, Saint-Maur-des-Fosses, France) were prepared from freshly mixed sealers (0.1 g/cm²)/mL extraction medium) and diluted (1:2-1:20). The sealers were compared for the dose- and time-dependent effects on the proliferation and differentiation of human mesenchymal stem cells (hMSCs) and human umbilical vein endothelial cells (HUVECs). An ex vivo osteogenic assay (regeneration of neonatal mice parietal bone defects) and an in vivo angiogenesis assay (chorioallantoic membrane assay) were performed.

RESULTS

Diluted extracts from MTA ProRoot and MTA Plus had evident stimulatory effects on the proliferation of hMSCs, alkaline phosphatase activity, and ex vivo regeneration of bone defects. They also increased HUVEC growth; allowed normal tubularlike network organization; and, in vivo, did not affect angiogenesis. Comparatively, Biodentine also elicited a favorable response on hMSCs and HUVECs, but the overall osteogenic and angiogenic outcome was slightly lower. MTA Fillapex exhibited the highest toxicity in hMSCs and HUVECs and, unlike the other sealers, only allowed a partial regeneration of bone defects.

CONCLUSION

The sealers caused dose- and time-dependent effects on the osteoblastic and endothelial response, eliciting similar cytocompatibility profiles. Results suggest that the induction of both osteogenic and angiogenic events may contribute to the sealers' regenerative outcome.



Flow / Tubular penetration

AKSEL, HACER & ARSLAN, ELIFCAN & PURALI, NUHAN & UYANIK, MEHMET & NAGAS, EMRE. (2019). EFFECT OF ULTRASONIC ACTIVATION ON DENTINAL TUBULE PENETRATION OF CALCIUM SILICATE-BASED CEMENTS. MICROSCOPY RESEARCH AND TECHNIQUE. 82. 10.1002/JEMT.23209.

EFFECT OF ULTRASONIC ACTIVATION ON DENTINAL TUBULE PENETRATION OF CALCIUM SILICATE-BASED CEMENTS

PURPOSE

This study investigated the dentinal tubule penetration of mineral trioxide aggregate (MTA), NeoMTA Plus and Biodentine placed by either manual condensation or ultrasonic activation in simulated open apex model.

METHODS

Standardized divergent open apex models were created using palatal roots of 60 human maxillary molars and divided into six groups according to the used cements and activation methods ($n = 10$): MTA-manual condensation, MTA-ultrasonic activation, NeoMTA Plus-manual condensation, NeoMTA Plus-ultrasonic activation, Biodentine-manual condensation, Biodentine-ultrasonic activation. For the measurement of penetration, the cements were mixed with 0.1% Rhodamin B and 6-mm apical portions of each root canal were obturated in an orthograde direction. The roots were embedded into acrylic blocks, and 1-mm-thick sections were obtained at 3 mm from the apex. Specimens were mounted onto glass slides and scanned under a confocal laser scanning microscope (CLSM) and stereomicroscope. Dentinal tubule penetration areas, depth and percentage were measured using LSM and ImageJ software. The data were analyzed using two-way analysis of variance (anova) with Bonferroni correction ($\alpha = 0.05$).

RESULTS

No correlation was found between stereomicroscope and CLSM analyses ($p > .05$). CLSM analysis showed no significant differences between MTA, NeoMTA Plus, and Biodentine groups when manual condensation was used ($p > .05$). Ultrasonic activation did not increase the tubular penetration of MTA, NeoMTA Plus or Biodentine as compared to manual condensation of each material ($p > .05$). MTA, NeoMTA Plus and Biodentine showed similar tubular penetration when manual condensation was used. Ultrasonic activation of these cements had no effect on tubular penetration of each material as compared to the manual condensation counterparts.



WALSH RM, HE J, SCHWEITZER J, OPPERMAN LA, WOODMANSEY KF. BIOACTIVE ENDODONTIC MATERIALS FOR EVERYDAY USE: A REVIEW. GEN DENT. 2018;66(3):48-51.

Bioactive endodontic materials for everyday use: a review

PURPOSE

Bioceramic materials are at the forefront of modern dentistry. Bioactive bioceramic endodontic materials promote pulpal and periapical tissue healing and are easy to use. Dentists can choose among many endodontic materials, depending on their needs. This article highlights the major differences among commercially available bioactive tricalcium silicate bioceramics, commonly known as mineral trioxide aggregate materials, to enable dentists to make appropriate decisions in the selection of these materials.

METHODS

To circumvent the handling challenges of the powder-water mixture, some newer products have introduced alternative mixing solutions. MTA Plus (Prevest DenPro), Grey MTA Plus (Avalon Biomed), NeoMTA Plus (Avalon Biomed), and MTA Flow (Ultradent Products) may be mixed with sterile water, but each kit includes a water-based gel. Mixing the gel with the powder allows a clinician to vary the consistency from a puttylike mixture to a thinner viscosity, such as that found AH Plus Sealer (Dentsply Sirona). With these products, the handling of the material is improved. Washout resistance has also been demonstrated for some of these products.

RESULTS

Despite its smaller particle size compared to some other MTA-type materials (including NeoMTA), EndoSequence BC Sealer did not show superior tubule penetration.

CONCLUSION

With nearly equivalent tubule penetration in both the middle and apical thirds of canals, both EndoSequence BC Sealer and NeoMTA were found to be suitable for endodontic obturation. NeoMTA contains tantalum oxide and does not discolor dentin, even with exposure to sodium hypochlorite. Having an understanding of the properties, advantages, and disadvantages of various tricalcium silicate-based materials will enable dentists to make informed treatment decisions.



McMICHAEL, GREER & PRIMUS, CAROLYN & OPPERMAN, LYNNE. (2016). DENTINAL TUBULE PENETRATION OF TRICALCIUM SILICATE SEALERS. JOURNAL OF ENDODONTICS. 42. 10.1016/J.JOEN.2015.12.012.

Dentinal Tubule Penetration of Tricalcium Silicate Sealers.

PURPOSE

The treatments for which mineral trioxide aggregate (MTA)-based materials can be used in dentistry are expanding. Smaller particle size and easier handling properties have allowed the advent of tricalcium silicate sealers including EndoSequence BC Sealer (Brasseler USA, Savannah, GA), QuickSet2 (Avalon Biomed, Bradenton, FL), NeoMTA Plus (Avalon Biomed), and MTA Fillapex (Angelus, Londrina, Brazil). The objective of this study was to measure the tubule penetration with these sealers using continuous wave (CW) and single-cone (SC) obturation techniques.

METHODS

Eighty single-rooted teeth were randomly divided into 8 groups of 10 and obturated with 1 of the previously mentioned sealers mixed with trace amounts of rhodamine using either the CW or SC technique. Teeth were sectioned at 1 mm and 5 mm from the apex and examined under a confocal laser microscope. The percentage of sealer penetration and the maximum sealer penetration were measured.

RESULTS

The tricalcium silicate sealers penetrated tubules as deep as 2000 μm (2 mm). The percentage of sealer penetration was much higher 5 mm from the apex, with many specimens having 100% penetration for both SC and warm vertical techniques. MTA Fillapex, a resin-based sealer with less than 20% MTA particles, had significantly greater tubule penetration with a warm vertical technique versus the SC technique at the 1-mm level.

CONCLUSION

Within the limitations of this study, the CW and SC techniques produced similar tubule penetration at both the 1-mm and the 5-mm level with the tricalcium silicate sealers BC Sealer, QuickSet2, and NeoMTA Plus/



Color stability

KESKIN, CANGUL & SARIYILMAZ, EVREN. (2018). COLOR STABILITY OF NEOMTA PLUS AND MTA PLUS WHEN MIXED WITH ANTI-WASHOUT GEL OR DISTILLED WATER. MEANDROS MEDICAL AND DENTAL JOURNAL. 19. 296-301. 10.4274/MEANDROS.60362.

Color Stability of NeoMTA Plus and MTA Plus when Mixed with Anti-washout Gel or Distilled Water

PURPOSE

This study aims to evaluate the effect of the special anti-washout gel mixing agent on the color stability of mineral trioxide aggregate (MTA) Plus and NeoMTA Plus in contact with distilled water, ethylenediaminetetraacetic acid (EDTA) and sodium hypochlorite (NaOCl).

METHODS

One set of three specimens was mixed using the anti-washout gel and the other set of three specimens was mixed using distilled water. Then, one specimen from each group was immersed in distilled water, 5% NaOCl or EDTA solutions for 24 hours. The color change of each specimen was assessed using spectrophotometer. The data were evaluated statistically with two-way ANOVA and post-hoc Tukey tests.

RESULTS

It was found that there was no statistically significant differences among the color changes of the MTA Plus and NeoMTA Plus mixed with either distilled water or gel when immersed in distilled water and EDTA ($p > 0.05$). Immersion to NaOCl resulted in the highest discoloration in all materials compared to their immersion to distilled water and EDTA. MTA Plus mixed with distilled water showed significantly greatest discoloration after contact with NaOCl ($p < 0.05$). MTA Plus mixed with gel showed the highest color stability regardless of the solution type.

CONCLUSION

Mixing with MTA Plus and NeoMTA Plus powder with the special anti-washout gel within their kits contributes to the color stability of the materials



MERAJI, NAGHMEH & BOLHARI, BEHNAM & SEFIDEH, MARYAMREZAZADEH & NIAVARZI, SOHEIL. (2019). PREVENTION OF TOOTH DISCOLORATION DUE TO CALCIUM-SILICATE CEMENTS: A REVIEW. DENTAL HYPOTHESES. 10. 4. 10.4103/DENTHYP.DENTHYP_22_19

Prevention of Tooth Discoloration Due to Calcium-Silicate Cements: A Review

PURPOSE

Mineral trioxide aggregate (MTA) and other calcium silicate cement similar to that are widely used in endodontic treatments. One of the widely emphasized disadvantages of these cements are the induction of tooth discoloration. The purpose of this study was to investigate the mechanisms of tooth discoloration caused by MTA and MTA-like cements and debate different methods suggested for preventing it.

METHODS

An electronic search was performed using databases such as Google Scholar, PubMed, PubMed Central, Science Direct, and Scopus by using keywords such as “mineral trioxide aggregate”, “calcium-silicate”, “tooth discoloration”, and “prevention”.

RESULTS

Several methods for preventing tooth discoloration caused by MTA and MTA-like cements have been proposed including the application of dentin bonding agents on dentinal walls, use of cements containing radiopacifying agents other than bismuth oxide, and addition of zinc oxide to those cements containing bismuth oxide.

CONCLUSION

Most studies have shown that none of these methods can completely inhibit tooth discoloration but can decrease it to some length.



CAMILLERI, JOSETTE. (2015). STAINING POTENTIAL OF NEO MTA PLUS, MTA PLUS, AND BIDENTINE USED FOR PULPOTOMY PROCEDURES. JOURNAL OF ENDODONTICS. 41. 10.1016/J.JOEN.2015.02.032.

Staining Potential of Neo MTA Plus, MTA Plus, and Biodentine Used for Pulpotomy Procedures

PURPOSE

Mineral trioxide aggregate (MTA) used for pulpotomy procedures in immature permanent teeth can reduce treatment to 1 session as opposed to classic calcium hydroxide therapy, which necessitates multiple appointments. The main disadvantage of MTA use is crown discoloration after treatment. The aim of this study was to characterize 3 materials that are used for pulpotomy procedures in immature permanent teeth and assess their color stability in the presence of sodium hypochlorite solution.

METHODS

Hydrated Neo MTA Plus (Avalon Biomed Inc, Bradenton, FL), MTA Plus (Avalon Biomed Inc), and Biodentine (Septodont, Saint-Maur-des-Fossés, France) were characterized after immersion in Hank's balanced salt solution for 1 day and 28 days using a combination of scanning electron microscopy, energy-dispersive spectroscopy, and X-ray diffraction analysis. The color stability of the 3 materials in contact with water or sodium hypochlorite was evaluated by photography, spectrophotometry, and X-ray diffraction analysis.

RESULTS

All the materials hydrated and produced calcium hydroxide as a by-product of hydration at early age. All materials interacted with synthetic tissue fluid, forming a calcium phosphate phase. MTA Plus exhibited discoloration in contact with sodium hypochlorite.

CONCLUSION

All the materials tested are suitable to be used in the treatment of immature teeth because they all produced calcium hydroxide, which is necessary to induce dentin bridge formation and continued root formation. Neo MTAPlus and Biodentine are suitable alternatives to MTA, and they do not exhibit discoloration.



Physicochemical properties of NeoMTA

BOSAID, F., AKSEL, H. & AZIM, A.A. INFLUENCE OF ACIDIC pH ON ANTIMICROBIAL ACTIVITY OF DIFFERENT CALCIUM SILICATE BASED—ENDODONTIC SEALERS. CLIN ORAL INVEST (2022).

Influence of acidic pH on antimicrobial activity of different calcium silicate based—endodontic sealers

PURPOSE

To investigate the antibacterial activity of calcium silicate—based sealers (CSBSs) against *Enterococcus faecalis* biofilm in a neutral or acidic condition.

METHODS

Dentin cylinders (4 mm length) were prepared and infected with 3-week-old *E. faecalis*. The samples were filled with BioRoot RCS (BR), EndoSequence BC (ES), and NeoMTA Plus (NMTA) and incubated in either neutral or acidic conditions for 7 days ($n=10/\text{group}$). Sterile or infected samples alone were used as the positive and negative control. The root canal sealers were removed after 7 days, and the remaining bacteria on dentinal walls were determined by colony-forming units (CFUs/ml), and three samples from each group were visualized under a confocal laser scanning microscope (CLSM). The pH was also measured ($n=3/\text{group}$) after 4 h and 7 days of incubation at 37°C in both conditions.

RESULTS

In the neutral condition, all sealers significantly decreased the log-CFU values ($p<0.05$), while in the acidic condition, the log-CFU reduction was less for ES and NMTA, but a higher reduction was observed in BR ($p<0.05$). The antibacterial activity of CSBSs was similar in neutral conditions ($p>0.05$), and BR showed a greater antibacterial effect than ES and NMTA in the acidic condition ($p<0.05$). The pH of BR, ES, and NMTA ranged from 8.2 to 8.8 in the neutral condition in the presence of dentin after 7 days. However, acidic conditions reduced the pH values to 7.8 for BR, 6.0 for ES, and 5.8 for NMTA.

CONCLUSION

All CSBSs showed similar antibacterial activity in neutral conditions, while acidic pH had a reducing antibacterial effect on CSBSs.

SRINIVAS PUSHPALA. (2021). PHYSICOCHEMICAL AND BIOLOGICAL PROPERTIES OF NEOMTA PUTTY.

Physicochemical and biological properties of NeoMTA Putty

PURPOSE

This study aimed to evaluate the physicochemical and biological properties of NeoPutty (NP; Avalon BioMed) in comparison to EndoSequence BC Root Repair Material (BCRRM; Brasseler) and ProRoot MTA (Dentsply).

METHODS

Setting time, radiopacity, pH, solubility, and calcium ion release were tested following ISO-6876 recommendations. Human periodontal ligament fibroblast (HPLF) cells were treated with each sealer and cytotoxicity was evaluated using XTT assay. Data analysis was performed using ANOVA and Tukey multiple comparison test.

RESULTS

NP initial and final setting times were shorter than BCRRM, but longer than PRMTA ($P < 0.0001$). NP (10.05 ± 1.7 mm of Al) was less radiopaque than BCRRM (14 ± 1.15 mm of Al; $P = 0.007$). PRMTA was the most alkaline cement at 3 and 24 hours followed by BCRRM and NP ($P < 0.0001$). At 48 hours NP was the most alkaline cement ($P < 0.05$). No difference was observed between PRMTA and BCRRM ($P = 0.23$). At 72 hours and 7 days there was no statistically significant difference between the sealers. There was no significant difference in the solubility of the tested materials ($P = 0.17$). All tested materials released calcium, with NP showing the highest release (111.9 ± 22.9 ppm), followed by BCRRM (109.12 ± 19.9 ppm), and ProRoot MTA (39.27 ± 15.2 ppm). All tested materials were non-cytotoxic to HPLF cells ($P < 0.0001$).

CONCLUSION

Overall NP had similar physicochemical results as BCRRM and PRMTA but had differing biological properties. More studies will need to be conducted to assess biological properties of NP.



ABBOUD, K.M., ABU-SEIDA, A.M., HASSANIEN, E.E. & TAWFIK, H.M. (2021) BIOCOMPATIBILITY OF NEOMTA PLUS® VERSUS MTA ANGELUS AS DELAYED FURCATION PERFORATION REPAIR MATERIALS IN A DOG MODEL. BMC ORAL HEALTH, 21(1), 1–11.

Present status and future directions: Hydraulic materials for endodontic use

OBJECTIVE

Hydraulic materials are used in Endodontics due to their hydration characteristics namely the formation of calcium hydroxide when mixing with water and also because of their hydraulic properties. These materials are presented in various consistencies and delivery methods. They are composed primarily of tricalcium and dicalcium silicate, and also include a radiopacifier, additives and an aqueous or a non-aqueous vehicle. Only materials whose primary reaction is with water can be classified as hydraulic.

PURPOSE

Review of the classification of hydraulic materials by Camilleri and the literature pertaining to specific uses of hydraulic cements in endodontics namely intra-coronal, intra-radicular and extra-radicular. Review of the literature on the material properties linked to specific uses providing the current status of these materials after which future trends and gaps in knowledge could be identified.

METHODS

The literature was reviewed using PUBMED, and for each clinical use, the in vitro properties such as physical, chemical, biological and antimicrobial characteristics and clinical data were extracted and evaluated.

RESULTS

A large number of publications were retrieved for each clinical use and these were grouped depending on the property type being investigated.

CONCLUSION

The hydraulic cements have made a difference in clinical outcomes. The main shortcoming is the poor testing methodologies employed which provide very limited information and also inhibits adequate clinical translation. Furthermore, the clinical protocols need to be updated to enable the materials to be employed effectively.



FERRARI ESTEVES TORRES, FERNANDA & PERINOTO, PATRICIA & BOSSO MARTELO, ROBERTA & CHÁVEZ-ANDRADE, GISSELLE & TANOMARU-FILHO, MÁRIO. (2020). INFLUENCE OF POWDER-TO-GEL RATIO ON PHYSICOCHEMICAL PROPERTIES OF A CALCIUM SILICATE SEALER. ODOVTOS - INTERNATIONAL JOURNAL OF DENTAL SCIENCES. 337-345. 10.15517/IJDS.2020.42998.

Influence of Powder-to-Gel Ratio on Physicochemical Properties of a Calcium Silicate Sealer

PURPOSE

Differences in liquid-to-powder ratio can affect the properties of calcium silicate-based materials. This study assessed the influence of powder-to-gel ratio on physicochemical properties of NeoMTA Plus.

METHODS

Setting time (minutes), flow (mm and mm²), pH (at different periods), radiopacity (mm Al) and solubility (% mass loss) were evaluated using the consistencies for root repair material (NMTAP-RP; 3 scoops of powder to 2 drops of gel) and root canal sealer (NMTAP-SE; 3 scoops of powder to 3 drops of gel), in comparison to Biodentine cement (BIO) and TotalFill BC sealer (TFBC). Statistical analysis was performed using one-way ANOVA and Tukey tests ($\alpha=0.05$).

RESULTS

BIO had the shortest setting time, followed by NMTAP-RP and NMTAP-SE. TFBC showed the highest setting time and radiopacity. BIO, NMTAP-RP, and NMTAP-SE had similar radiopacity. All materials promoted an alkaline pH. NMTAP-RP/SE presented lower solubility than BIO and TFBC. Regarding the flow, TFBC had the highest values, followed by NMTAP-SE, and NMTAP-RP. BIO had the lowest flow.

CONCLUSION

NMTAP in both powder-to-gel ratios showed high pH and low solubility. The increase in the powder ratio decreased the setting time and flow. These findings are important regarding the proper consistency and work time to clinical application.



FORMOSA, L.M. & MALLIA, BERTRAM & CAMILLERI, JOSETTE. (2012). MINERAL TRIOXIDE AGGREGATE WITH ANTI-WASHOUT GEL - PROPERTIES AND MICROSTRUCTURE. DENTAL MATERIALS : OFFICIAL PUBLICATION OF THE ACADEMY OF DENTAL MATERIALS. 29. 10.1016/J.DENTAL.2012.11.009.

Mineral trioxide aggregate with anti-washout gel-properties and microstructure

PURPOSE

One of the problems encountered clinically when using mineral trioxide aggregate (MTA) as a root-end filling material is washout immediately after placement. A novel MTA is supplied with an anti-washout gel that replaces the mixing water. The aim of this research was to characterize and assess the properties of a novel MTA mixed with an anti-washout liquid.

METHODS

MTA Plus mixed with either water (MTA-W) or an anti-washout gel (MTA-AW) was investigated. Un-hydrated and set materials were characterized by scanning electron microscopy (SEM), energy X-ray dispersive analysis (EDX), X-ray diffraction analysis (XRD) and Fourier transform infrared spectroscopy (FT-IR) after being stored dry or immersed in Hank's balanced salt solution (HBSS). The chemical and physical properties of the set materials were then investigated.

RESULTS

The MTA Plus was composed of tricalcium silicate, dicalcium silicate and bismuth oxide. The anti-washout gel used was water-based and FT-IR plots showed the presence of an organic additive. Both materials immersed in HBSS displayed the presence of reaction by-product with MTA-W exhibiting a high-intensity calcium hydroxide peak on X-ray diffraction. The X-ray diffractograms of all materials following hydration demonstrated the reduction in peak intensity of the tri- and dicalcium silicate. Hydroxyapatite deposits were evident on the surfaces of both materials in contact with HBSS. The pH of the leachate was similar for both materials. MTA-AW exhibited lower levels of calcium ions in solution and reduced fluid uptake in the early stages of reaction. The anti-washout gel reduced the setting time of the cement and enhanced the compressive strength. The radiopacity of both materials was approximately 8 mm aluminum.

SIGNIFICANCE

The use of the water-based anti-washout material instead of the standard water with MTA affects the hydration and properties of the set material



FORMOSA, L & MALLIA, BERTRAM & CAMILLERI, JOSETTE. (2012). A QUANTITATIVE METHOD FOR DETERMINING THE ANTIWASHOUT CHARACTERISTICS OF CEMENT-BASED DENTAL MATERIALS INCLUDING MINERAL TRIOXIDE AGGREGATE. INTERNATIONAL ENDODONTIC JOURNAL. 46. 10.1111/J.1365-2591.2012.02108.X

A quantitative method for determining the antiwashout characteristics of cement-based dental materials including mineral trioxide aggregate.

PURPOSE

To introduce and assess a novel method for measuring washout resistance of cement-based dental materials, including mineral trioxide aggregate (MTA), to qualitatively verify the results with a clinical simulation and to evaluate the washout resistance of a new root-end filling material.

METHODS

A method for assessment of washout resistance of root-end filling materials was developed by adapting the CRD-C 661-06 (a method for evaluating the resistance of freshly mixed concrete to washout in water), to permit testing of dental cements. White Portland cement (PC), MTA-Plus mixed with either water or a polymer-based antiwashout gel (MTA-AW), MTA-Angelus, IRM and amalgam were tested with either distilled water or HBSS as washout media. Additionally, the washout resistance was tested qualitatively by spraying the test materials at the terminus of simulated canals with a metered jet of water.

RESULTS

A mass loss of 2-7% for PC, 0.4-4% for MTA-Plus, -0.9% for MTA-AW, 5-10% for MTA-Angelus and 0% for IRM and amalgam was recorded with the modified CRD-C 661-06 method. No significant difference was found between using water and HBSS as washout media for the same material. The results of the modified CRD-C 661-06 method were similar to those obtained on the simulated canals.

CONCLUSION

The modified CRD-C 661-06 method provided repeatable results that were comparable to the simulated clinical method. The antiwashout gel used with MTA-Plus reduced the material washout and was similar to IRM and amalgam.



COST ESTIMATE / MTA AFFORDABILITY COMPARSION

ABUKABBOS H, TOMAR S, GUELMANN M. COST ESTIMATES FOR BIOACTIVE CEMENT PULPOTOMIES AND CROWNS IN PRIMARY MOLARS. PEDIATR DENT. 2018;40(1):51-55

Cost Estimates for Bioactive Cement Pulpotomies and Crowns in Primary Molars

PURPOSE

To explore cost-effective options for pulpotomy, chamber fillings, and crowns in primary molars using bioactive cements.

METHODS

Thirty extracted primary molars were divided into five groups, each having two sets of three teeth (one first molar and two second molars). Pulpotomy and restorative options were randomly assigned: Biodentine plus Ketac Molar; NuSmile NeoMTA plus Tempit LC; NeoMTA Plus plus Fuji IX; MTA Angelus plus IRM capsule; MTA Flow plus IRM powder and liquid. After mixing one dose, pulp chambers of the first molar and one second molar were filled with a two-millimeter layer of bioactive cement and filling material (protocol A). The other second molar's chamber was solo filled by a single mixed dose of bioactive cement (protocol B). The cost for each material was calculated independently, regardless of the group to which they belonged. A market assessment for primary molar crowns was performed, and a comparison table was produced

RESULTS

For protocol A, the lowest mean cost per tooth (LMC) was obtained for NeoMTA cements and IRM powder and liquid; for solo bioactive cement pulp chamber filling, protocol (B), LMC was obtained for NeoMTA cements. Zirconia crowns were the costliest.

CONCLUSION

NeoMTA-type cements were the most cost-effective option for single-tooth pulpotomy. Zirconia crowns had the highest cost per tooth.



Retreatment

CARRILLO CA, KIRKPATRICK T, FREEMAN K, MAKINS SR, ALDABBAGH M, JEONG JW. RETRIEVABILITY OF CALCIUM SILICATE-BASED ROOT CANAL SEALERS DURING RETREATMENT: AN EX VIVO STUDY. J ENDOD. 2022 JUN;48(6):781-786. DOI: 10.1016/j.joen.2022.02.009. EPUB 2022 FEB 25. PMID: 35219747.

Retrievability of Calcium Silicate–based Root Canal Sealers During Retreatment: An Ex Vivo Study

PURPOSE

The retrievability of calcium silicate–based sealers (CSSs) during nonsurgical retreatment has been equivocal. This study compared the retrievability of 3 different CSSs using 1 of 3 different solutions or no solution.

METHODS

A total of 130 extracted teeth with a straight canal were decoronated to a standardized root length. The canals were instrumented to 35/.04 and divided into 3 groups (BC: EndoSequence BC sealer; EBC: EdgeBioceramic; NEO: NeoSEALERFlo), and each group was further divided into 4 subgroups (6% sodium hypochlorite; 5% acetic acid; carbonated water; no solution). After sealer placement, each master gutta-percha cone was placed intentionally 2 mm short of the working length (WL) to ensure the apical 2 mm was filled only with sealer. After storage for 21 days at 37 °C and 100% humidity, retreatment was performed until apical patency was obtained. The operator was blinded to the CSS and solution used. Data were analyzed using analysis of variance to compare apical patency rates and the mock chair-times.

RESULTS

Overall success rates for apical patency in BC, EBC, and NEO were 63.64%, 69.77%, and 100%, respectively. There was significantly higher apical patency rate in NEO than BC and EBC. The chair-time for NEO was significantly shorter than BC ($P = .05$) and EBC sealer ($P = .001$). There was no significant difference in the chair-time between BC and EBC sealer groups.

CONCLUSION

BC, EBC, and NEO sealers in a straight canal were consistently retrievable when no solution was used. Compared with no solution, the retrievability of BC, EBC, and NEO decreased when solutions were used.



TAVARES KIMC, PINTO JC, SANTOS-JUNIOR AO, DUARTE MAH, GUERREIRO-TANOMARU JM, TANOMARU-FILHO M. EFFECT OF ADDITIONAL APICAL PREPARATION ON RETREATMENT OF CURVED ROOT CANALS FILLED WITH DIFFERENT SEALERS. EUR J DENT. 2022 SEP 8. DOI: 10.1055/s-0042-1750693. EPUB AHEAD OF PRINT. PMID: 36075266.

Effect of Additional Apical Preparation on Retreatment of Curved Root Canals Filled with Different Sealers

PURPOSE

This study assessed the influence of additional apical preparation on material removal during retreatment of curved root canals filled with different sealers.

METHODS

Twelve mesial roots of mandibular molars with two separate canals and curvature between 25 and 35 degrees were selected. The working length was established 1-mm short of the apical foramen, and all the root canals were prepared using ProDesign R (PDR) 25/0.06. After preparation, the root canals were divided in two groups ($n = 12$) and filled by continuous wave condensation technique with NeoMTA Plus or AH Plus. All the root canals were retreated using rotary ProDesign Logic RT 25/0.08, reciprocating PDR 25/0.06 and apical preparation with PDR 35/0.05. Additional apical preparation was performed with ProDesign Logic (PDL) 50/0.01. The samples were scanned using a Skycan 1176 micro-computed tomography (micro-CT), voxel size 8.74 μm , before and after the retreatment procedures. Percentages of remaining filling material were evaluated.

RESULTS

Percentage of remaining filling material was similar between the root canals filled with NeoMTA Plus or AH Plus sealer after retreatment using PDR 35/0.05, and after additional apical preparation using PDL 50/0.01 ($p > 0.05$). However, PDL 50/0.01 significantly decreased the percentage of remaining filling material in the apical third after the additional apical preparation for both sealers ($p < 0.05$).

CONCLUSION

NeoMTA Plus or AH Plus did not influence the retreatment of curved root canals. ProDesign Logic 50/0.01 promoted greater filling material removal in the apical third.



General articles on MTA

AMINOSHARIAE A, PRIMUS C, KULILD JC. TRICALCIUM SILICATE CEMENT SEALERS: DO THE POTENTIAL BENEFITS OF BIOACTIVITY JUSTIFY THE DRAWBACKS? J AM DENT ASSOC. 2022 MAR 5:S0002-8177(22)00026-5. DOI: 10.1016/J.ADAJ.2022.01.004. EPUB AHEAD OF PRINT. PMID: 35260235.

Tricalcium silicate cement sealers: Do the potential benefits of bioactivity justify the drawbacks?

PURPOSE

Grossman described the ideal properties of root canal sealers. The International Organization for Standardization and American National Standards Institute and American Dental Association have codified some of his requirements in ISO 6876 and ANSI/ADA 57, respectively. In this narrative review, the authors combined the ideal Grossman properties and requirements of these standards, emphasizing the newer tricalcium silicate cement sealers. This chemical matrix for such sealers was developed on the basis of the success of bioactive mineral trioxide aggregate-type (tricalcium silicate cement) materials for enhanced sealing and bioactivity.

METHODS

The authors searched the internet and databases using Medical Subject Heading terms and then conducted a narrative review of those articles involving the tricalcium silicate cement endodontic sealers.

RESULTS

Ninety-four articles were identified that discussed tricalcium silicate cement sealers. Tricalcium silicate cement sealers are partially antimicrobial and have bioactivity, which may presage improved biological sealing of the root canal system. Most other properties of tricalcium silicate cement sealers are comparable with traditional root canal sealers.

CONCLUSION

Within the limitations of this review, tricalcium silicate cement endodontic sealers met many of the criteria for ideal properties, such as placement, antimicrobial properties, and bioactivity, but limitations were noted in solubility, dimensional stability (shrinkage and expansion), and retrievability.

PRACTICAL IMPLICATIONS

Tricalcium silicate-based cements have been commercialized as bioactive, bioceramic endodontic sealers. Warm, cold, and single-cone obturation techniques are usable, depending on the commercial product. Some sealers can cause discoloration and are not easily retrievable, particularly when used to completely obturate a canal.



HADIS, MOHAMMED & CAMILLERI, JOSETTE. (2020). CHARACTERIZATION OF HEAT RESISTANT HYDRAULIC SEALER FOR WARM VERTICAL OBTURATION. DENTAL MATERIALS. 36. 10.1016/J.DENTAL.2020.05.008.

Characterization of heat resistant hydraulic sealer for warm vertical obturation

PURPOSE

Warm vertical compaction of gutta-percha is a technique that is used by most specialists for root canal obturation. The sealers currently available exhibit irreversible chemical changes when heated. New biologically active sealers that do not sustain irreversible changes when heated are an attractive alternative to be used with warm vertical compaction obturation technique. The aim of this study was to measure the heat generated by warm vertical compactors inside the root canal, characterize a newly developed root canal sealer at different temperatures and verify its suitability at the actual temperature window used clinically.

METHODS

The typical temperatures generated by two heat carriers in a root canal were assessed by thermocouples. Two premixed root canal sealers TotalFill BC and HiFlow BC (FKG, Switzerland) were allowed to set and they were characterized by scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS) and X-ray diffraction analysis (XRD) immediately after setting and by XRD after 28 days in physiological solution. The ion leaching in solution was assessed by inductively coupled plasma (ICP). The organic component was extracted in acetone and assessed by Fourier transform infrared spectroscopy (FT-IR) for both the unset sealer and sealer subjected to different temperatures. The heat profiles of both sealers were investigated by FT-IR and thermographic analysis.

RESULTS

None of the devices tested achieved the temperatures set on the dial. The highest temperatures were coronal followed by apical for both devices. The sealers were identical except for the vehicle. The inorganic components included tricalcium silicate, dicalcium silicate and zirconium oxide. No calcium hydroxide was produced by any of the sealers after immersion in physiological solution but calcium was released in solution. The chemistry of both sealers was modified when heated but both recovered when cooled.

CONCLUSION

The heat carriers were unreliable and the heat generated inside the canal was not the same as the temperature set on the dial. Since both sealers had identical chemistry save for minimal modifications to the organic component and were both resistant to heat, TotalFill BC sealer is recommended for use with warm vertical compaction technique as it is cheaper and as effective as the HiFlow.



QU, WEI & BAI, WEI & LIANG, YU-HONG & GAO, XUE-JUN. (2016). INFLUENCE OF WARM VERTICAL COMPACTION TECHNIQUE ON PHYSICAL PROPERTIES OF ROOT CANAL SEALERS. JOURNAL OF ENDODONTICS. 42. 10.1016/J.JOEN.2016.08.014.

Influence of Warm Vertical Compaction Technique on Physical Properties of Root Canal Sealers

PURPOSE

The aim of this study was to evaluate the influence of warm vertical compaction on the physical properties of root canal sealers.

METHODS

The physical properties of 4 sealers (zinc oxide -eugenol [ZOE], AH Plus [Dentsply International, York, PA], RoekoSeal [Roeko/Coltene/Whaledent, Langenau, Germany], and iRoot SP [Innovative Bioceramix, Vancouver, Canada]) were tested. The setting time and flow of these sealers were measured at standard and high temperatures using ISO 6876 (2012) specifications. The percentage of voids in each sealer after complete setting at 37°C and 140°C was analyzed under a stereoscopic microscope.

RESULTS

The setting time of ZOE sealer increased significantly from 144.0 ± 4.1 minutes to 274.2 ± 7.4 minutes when the temperature increased from 37°C to 140°C, whereas there was a significant reduction in the other 3 sealers. At 37°C, the setting time of AH Plus, iRoot SP, and RoekoSeal was 543.8 ± 16.4 , 245.8 ± 15.9 , and 49.3 ± 1.5 minutes, and at 140°C the setting time decreased significantly to 12.9 ± 0.7 , 14.2 ± 0.6 , and 2.7 ± 0.4 minutes ($P < .05$). The flow of AH Plus increased when the temperature changed from 25°C to 140°C ($P < .05$), whereas the flow reduced for RoekoSeal and iRoot SP (for RoekoSeal from 24.8 ± 0.9 to 12.4 ± 1.3 mm and for iRoot SP from 22.9 ± 0.9 to 13.3 ± 1.5 mm) ($P < .05$). However, the flow of ZOE sealer was unaffected by the high temperature. ZOE sealer and iRoot SP exhibited a reduction of porosity at a high temperature ($P < .05$).

CONCLUSION

Warm vertical compaction influenced some properties (the setting time, flow, and porosity) of 4 sealers. A significant reduction of setting time and flow was found in RoekoSeal and iRoot SP sealers at a high temperature.



LEE, YUAN-LING & LIN, FENG-HUEI & WANG, WEN-HSI & RITCHIE, HELENA & LAN, W.-H & LIN, C.-P. (2007). EFFECTS OF EDTA ON THE HYDRATION MECHANISM OF MINERAL TRIOXIDE AGGREGATE. JOURNAL OF DENTAL RESEARCH. 86. 534-8. 10.1177/154405910708600609.

Effects of EDTA on the Hydration Mechanism of Mineral Trioxide Aggregate

ABSTRACT

Ethylenediaminetetraacetic acid (EDTA) is commonly used during the preparation of obstructed root canals that face a high risk of root perforation. Such perforations may be repaired with mineral trioxide aggregate (MTA). Due to EDTA's ability to chelate calcium ions, we hypothesized that EDTA may disrupt the hydration of MTA. Using scanning electron microscopy and energy-dispersive x-ray spectroscopy, we found that MTA specimens stored in an EDTA solution had no crystalline structure and a Ca/Si molar ratio considerably lower than those obtained for specimens stored in distilled water and normal saline. Poor cell adhesion in EDTA-treated MTA was also noted. X-ray diffraction indicated that the peak corresponding to portlandite, which is normally present in hydrated MTA, was not shown in the EDTA group. The microhardness of EDTA-treated specimens was also significantly reduced ($p < 0.0001$). These findings suggest that EDTA interferes with the hydration of MTA, resulting in decreased hardness and poor biocompatibility.

CONCLUSION

In conclusion, our hypothesis that EDTA may disrupt the hydration of MTA was proven. EDTA inhibits the hydration of MTA by chelating calcium ions released from the tricalcium complex, which is the principal ingredient of MTA. Furthermore, the physical properties of MTA were weaker, and cell adhesion to materials was poorer, after EDTA treatment. The EDTA solution used was detrimental to the hydration of MTA and the biocompatibility of MTA. Thus, before applying MTA to form an apical plug or repair a root canal perforation, the practitioner should ensure that EDTA has been completely removed by flushing the area with copious amounts of distilled water.



BOYADZHIEVA, ELENA & DIMITROVA, S. & FILIPOV, IVAN & ZAGORCHEV, PLAMEN. (2017). SETTING TIME AND SOLUBILITY OF PREMIXED BIOCERAMIC ROOT CANAL SEALER WHEN APPLICATED WITH WARM GUTTA PERCHA OBTURATION TECHNIQUES. IOSR JOURNAL OF DENTAL AND MEDICAL SCIENCES. 16. 125-129. 10.9790/0853-160303125129.

Setting Time And Solubility of Premixed Bioceramic Root Canal Sealer when Applicated with warm Gutta Percha obturation Techniques

ABSTRACT

Endodontic sealers are used for obturation of the root canal system in combination with heat-softened gutta-percha in order to achieve hermetic seal throughout the canal and its irregularities. During warm condensation of gutta-percha, high temperatures are also applied to the root canal sealer which may potentially lead to change in their physical properties. Both setting time and solubility of a premixed bioceramic sealer were investigated through laboratory testing. The material was subjected to two temperature regimes. We did not find significant differences in the tested physical parameters under two temperature conditions. The choice of the most suitable endodontic sealer should be consistent with the specific clinical situation as well as with the obturation technique. Different environmental conditions may occur in variation the physical and chemical properties of the sealers that may result in endodontic failure.

CONCLUSION

The choice of the most suitable endodontic sealer should be consistent with the specific clinical situation as well as with the obturation technique. Different environmental conditions may occur in variation physical and chemical properties of the sealers that may result in endodontic failure. The laboratory experiments conducted by our team showed some differences in the setting time and solubility of Well Root ST in two different temperature conditions. These differences are not statistically significant which means further investigation and more tests are required for establishing bioceramic sealers compatibility warm condensation techniques.



KOMABAYASHI, TAKASHI & COLMENAR, DAVID & CVACH, NICHOLAS & BHAT, APARNA & PRIMUS, CAROLYN & IMAI, YOHJI. (2020). COMPREHENSIVE REVIEW OF CURRENT ENDODONTIC SEALERS. DENTAL MATERIALS JOURNAL. 10.4012/DMJ.2019-288.

Comprehensive review of current endodontic sealers

ABSTRACT

Endodontic sealers for non-surgical root canal treatment (NSRCT) span many compositions and attributes. This comprehensive review discusses current types of endodontic sealers by their setting reaction type, composition, and properties: zinc oxide-eugenol, salicylate, fatty acid, glass ionomer, silicone, epoxy resin, tricalcium silicate, and methacrylate resin sealers. Setting time, solubility, sealing ability, antimicrobial, biocompatibility, and cytotoxicity are all aspects key to the performance of endodontic sealers. Because sealing ability is so important to successful outcomes, the relative degree of microleakage among all the relevant sealers was calculated by way of a meta-analysis of relevant literature.

CONCLUSION

The bioactivity of the MTA-like materials leads one to prescind about bone cements and bone grafting. The combination of resorbable porous materials and tri/dicalcium silicate materials may augment the potential uses of such materials. Remineralization of dentin or treatment of dentine hypersensitivity remains an elusive goal and tri/dicalcium silicate ceramics that elute calcium ions may be useful for such a purpose [246-249], for instance, in combination with hydrophilic resins that enable release of those ions from a polymerized resin matrix [250, 251]. Using tri/dicalcium silicates as a base under cavities may be a future trend to reduce invasive treatments in deeply decayed teeth [252], and perhaps delay or avoid immediate endodontic orthograde therapy.



PRIMUS, CAROLYN & TAY, FRANKLIN & NIU, LI. (2019). BIOACTIVE TRI/DICALCIUM SILICATE CEMENTS FOR TREATMENT OF PULPAL AND PERIAPICAL TISSUES. ACTA BIOMATERIALIA. 96. 10.1016/J.ACTBIO.2019.05.050.

Bioactive Tri/dicalcium Silicate Cements for Treatment of Pulpal and Periapical Tissues

ABSTRACT

Over 2500 articles and 200 reviews have been published on the bioactive tri/dicalcium silicate dental materials. The indications have expanded since their introduction in the 1990s from endodontic restorative and pulpal treatments to endodontic sealing and obturation. Bioactive ceramics, based on tri/dicalcium silicate cements, are now an indispensable part of the contemporary dental armamentarium for specialists including endodontists, pediatric dentists, oral surgeons and for general dentists. This review emphasizes research on how these materials have conformed to international standards for dental materials ranging from biocompatibility (ISO 7405) to conformance as root canal sealers (ISO 6876). Potential future developments of alternative hydraulic materials were included. This review provides accurate materials science information on these important materials.

CONCLUSION

The bioactivity of the MTA-like materials leads one to prescind about bone cements and bone grafting. The combination of resorbable porous materials and tri/dicalcium silicate materials may augment the potential uses of such materials. Remineralization of dentin or treatment of dentine hypersensitivity remains an elusive goal and tri/dicalcium silicate ceramics that elute calcium ions may be useful for such a purpose [246-249], for instance, in combination with hydrophilic resins that enable release of those ions from a polymerized resin matrix [250, 251]. Using tri/dicalcium silicates as a base under cavities may be a future trend to reduce invasive treatments in deeply decayed teeth [252], and perhaps delay or avoid immediate endodontic orthograde therapy.



VON ARX, THOMAS & JENSEN, SIMON & JANNER, SIMONE & HÄNNI, STEFAN & BORNSTEIN, MICHAEL. (2019). A 10-YEAR FOLLOW-UP STUDY OF 119 TEETH TREATED WITH APICAL SURGERY AND ROOT-END FILLING WITH MINERAL TRIOXIDE AGGREGATE. JOURNAL OF ENDODONTICS. 10.1016/J.JOEN.2018.12.015.

A 10-year Follow-up Study of 119 Teeth Treated with Apical Surgery and Root-end Filling with Mineral Trioxide Aggregate

PURPOSE

The objective of this clinical study was to assess the long-term outcome (clinical signs/symptoms and radiographic healing) of teeth treated with apical surgery and mineral trioxide aggregate (MTA) for root-end filling.

METHODS

One hundred ninety-five patients were recalled 1, 5, and 10 years after apical surgery for clinical and radiographic examinations. Three calibrated observers evaluated the periapical radiographs independently. The evolution of the cases over time was analyzed. Healing classification of teeth was divided into "healed" versus "not healed" teeth using well-established clinical and radiographic healing criteria. The potential influence of sex, age, type of treated tooth, type of MTA, and first-time versus repeat surgery on healing outcome was statistically analyzed.

RESULTS

The inception cohort included 195 teeth. The dropout rate after 10 years amounted to 39% ($n = 76$). Of the 119 teeth available for the 10-year analysis, 97 teeth were classified as healed (81.5%). No significant differences were found with regard to the rate of healed cases for the subcategories of the parameters of age, sex, type of MTA, and first-time or repeat surgery. Concerning the type of treated tooth, the rate of healed maxillary molars (95.2%) differed significantly ($P = .035$) from the rate of healed maxillary premolars (66.7%). The predictive value of the cases classified as healed at 1 year and remaining so over the 10-year observation period was 86.8%.

CONCLUSION

This 10-year follow-up study of teeth treated with apical surgery and MTA as root-end filling material showed an acceptable rate of healed cases. Many of the lost teeth had been extracted because of longitudinal root fractures during the observation period.



ASAWAWORARIT, WIDCHA & PINYOSOPON, THITAPA & KIJSAMANMITH, K.. (2019). COMPARISON OF APICAL SEALING ABILITY OF BIO-CERAMIC SEALER AND EPOXY RESIN-BASED SEALER USING THE FLUID FILTRATION TECHNIQUE AND SCANNING ELECTRON MICROSCOPY. JOURNAL OF DENTAL SCIENCES. 15. 10.1016/J.JDS.2019.09.010

Comparison of apical sealing ability of bioceramic sealer and epoxy resin-based sealer using the fluid filtration technique and scanning electron microscopy

PURPOSE

A perfect sealing of root canal system is essential for pre-venting ingress of bacteria from the oral environment. The purpose of this study was to evaluate the apical sealing ability of bioceramic (EndoSequence BC Sealer[®]) and epoxy resin-based (AH Plus[®]) sealers at 24 h, 7 days and 4 weeks.

METHODS

Forty two extracted human upper anterior teeth were sectioned to leave the root 15-mm long, then all the roots were instrumented using a set of ProTaper[®] rotary instruments. Four roots were selected randomly as controls, and the remaining 38 roots were randomly divided into 2 groups of 19 roots each: group 1: EndoSequence BC Sealer[®] and gutta-percha, and group 2: AH Plus[®] and gutta-percha using a multiple wave condensation technique. The apical sealing ability of the filled root canal was measured using the fluid filtration method with 200 mmHg (26.67 KPa) above atmospheric pressure at 24 h, 7 days and 4 weeks. Scanning electron microscopy (SEM) was used to assess the adaptation and penetration of the sealers. The apical microleakage between 2 groups was compared using Student's t-test. $P < 0.05$ was considered statistically significant.

RESULTS

EndoSequence BC Sealer[®] had significantly better sealing ability than AH Plus[®] at all test periods ($P < 0.001$). SEM showed EndoSequence BC Sealer[®] had better penetration into dentinal tubules.

CONCLUSION

Bioceramic sealer could promote proper sealing of root canals obturated with multiple wave condensation.



GIACOMINO CM, WEALLEANS JA, KUHN N, DIOGENES A. COMPARATIVE BIOCOMPATIBILITY AND OSTEOGENIC POTENTIAL OF TWO BIOCERAMIC SEALERS. J ENDOD. 2019;45(1):51-56. DOI:10.1016/J.JOEN.2018.08.007

Comparative Biocompatibility and Osteogenic Potential of Two Bioceramic Sealers

PURPOSE

Endodontic sealers have traditionally been used to seal dentinal tubules, creating a homogenous interface between the obturation material and the dentinal walls. However, bioceramic sealers have potential added benefits because of their bioactivity. After adequate endodontic therapy, osseous healing is largely dependent on the differentiation and activity of osteoblasts. We hypothesized that EndoSequence BC Sealer (Brasseler, Savannah, GA) and ProRoot ES (Dentsply Tulsa Dental Specialties, Johnson City, TN) have superior biocompatibility and osteogenic potential compared with Roth (Roth International, Chicago, IL) and AH Plus (Dentsply DeTrey GmbH, Konstanz, Germany) sealers

METHODS

A murine osteoblast precursor cell line (IDG-SW3) was exposed to a wide range of concentrations for each of the sealers for 7 days. The relative cell viability was determined by luminescence assay based on adenosine triphosphate quantification (CellTiter-Glo [Promega, Madison, Wisconsin]). The osteogenic potential was determined by fluorescence microscopy of DMP-1 expression, alizarin red staining, and real-time reverse transcription polymerase chain reaction with primers specific for known markers of osteogenesis such as DMP-1, ALP, and Phex. Data were analyzed with 2-way analysis of variance or 1-way analysis of variance with the Bonferroni post hoc test.

RESULTS

Both bioceramic sealers have excellent biocompatibility even at high concentrations. Conversely, cell death was detected when Roth and AH Plus were used at concentrations 100× lower than the bioceramic groups. Importantly, both bioceramic sealers significantly enhanced osteoblastic differentiation although greater responses were noted with EndoSequence BC Sealer. This was evidenced by increased DMP-1 expression, robust up-regulation of osteogenic marker gene expression, and superior mineral deposition. Osteoblastic differentiation and function were significantly impaired when Roth or AH Plus sealer was used.

CONCLUSION

EndoSequence BC Sealer and ProRoot ES were significantly more biocompatible and promoted osteoblastic differentiation, a bioactivity not found in AH Plus and Roth sealers.



Increasing Use of Bioceramics in Endodontics: A Narrative Review

PURPOSE

Successful outcomes of root canal treatment, in addition to a multitude of factors, also depends on the prevention of reinfection of the root canal space. The ultimate goal of root canal treatment is prevention or healing of apical periodontitis. The use of biologically active materials to seal root canal systems has been extensively proposed in contemporary endodontics to realise this goal. There are several commercial formulations of bioceramics available based on minor variations in composition which could have potentially important changes in properties in the clinical situation. This narrative review serves to provide brief information on the different formulations of bioactive ceramics that are available to a dentist.

METHODS

Gray MTA Plus/ MTA Plus is a powder and liquid/ gel system. The powder consists of fine inorganic substance similar to that of ProRoot MTA. Liquid or gel may be used for cavity liner/base, pulp capping, pulpotomy, root apexification, resorption/perforation repair or root-end filling material. The water-based gel (with water soluble thickening agents and polymer) imparts washout resistance and faster setting, which the liquid does not. The manufacturer recommends mixing the powder with gel into a syrupy, stringy consistency when used as a root canal sealer during obturation. NeoMTA Plus is a powder-gel system. The powder components are an extremely fine powder primarily tricalcium and dicalcium silicate, quite similar to that of white ProRoot MTA, but contains no bismuth oxide in order to prevent tooth staining. Tantalum oxide is used as the radiopacifier.

RESULTS

The manufacturer claims that this material achieves washout resistance in less than three minutes (MTA Plus is about five minutes), thus allowing continuation of the restorative procedure. Also it has a 20-minute working time and a 50-minute setting time when mixing to a putty consistency. Thus, the setting time of both MTA Plus and NeoMTA Plus are depending on the consistency of the mixed material. The setting time of MTA Plus was found retarded when in contact with fluids; about 128 minutes in dry condition and about 1,052 minutes in contact with physiological solution. While the hydration of the core material was not affected by contact with the different solutions but the periphery exhibited microcracking, leaching of calcium hydroxide, partial decalcification of calcium silicate hydrate, and interaction with a physiological solution resulted in inhibition of hydration. The compressive strength was significantly lower when MTA Plus mixed with liquid was exposed to the biological fluid compared with saline. However the material mixed with gel was not affected in this condition.

CONCLUSION

Although there has been increasing use of the bioceramic products, i.e. cements and sealers, in endodontics since the introduction of MTA and evident proof of its clinical outcomes, further studies are still required in the area of root canal sealer.



NEELAKANTAN P, BERGER T, PRIMUS C, SHEMESH H, WESSELINK PR. ACIDIC AND ALKALINE CHEMICALS' INFLUENCE ON A TRICALCIUM SILICATE-BASED DENTAL BIOMATERIAL. J BIOMED MATER RES B APPL BIOMATER. 2019;107(2):377-387. DOI:10.1002/jbm.b.34129

Acidic and alkaline chemicals' influence on a tricalcium silicate-based dental biomaterial

PURPOSE

The aim of this study was to determine the effect of five common chemical agents used in root canal preparation (sodium hypochlorite/NaOCl, ethylene diaminetetraacetic acid/EDTA, mixture of sodium hypochlorite and etidronic acid/NaOCl + EA, mixture of EDTA and Chlorhexidine/QMix, or saline) on a commercial tricalcium silicate (MTA Plus).

METHODS

Samples were analyzed using scanning electron microscopy with energy dispersive spectroscopy, X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy and Inductively coupled plasma techniques to see effects of phases formed and calcium ion release.

RESULTS

Specimens immersed in NaOCl and NaOCl + EA had strong peaks for calcium hydroxide, but materials exposed to EDTA and QMix had lesser XRD peaks for calcium hydroxide.

CONCLUSION

The calcium hydroxide peak in the XRD indicates hydration of tricalcium silicate and formation of amorphous calcium silicate hydrate. Calcium released from samples immersed in EDTA and NaOCl was less than in NaOCl + EA and QMix solutions. Fewer calcium phosphate crystals and less calcium hydroxide were observed with the samples in NaOCl, EDTA and QMix, which could have an important impact as it negatively influences the bioactivity.



BALLULLAYA, SRINIDHI & VINAY, VUSURUMARTHI & THUMU, JAYAPRAKASH & DEVALLA, SRIHARI & PRIYADARSHINI, B.I. & BALLA, SAGARIKA. (2017). STEREOMICROSCOPIC DYE LEAKAGE MEASUREMENT OF SIX DIFFERENT ROOT CANAL SEALERS. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 11. ZC65-ZC68. 10.7860/JCDR/2017/25780.10077.

Stereomicroscopic Dye Leakage Measurement of Six Different Root Canal Sealers

PURPOSE

The present study was done for evaluating microleakage in different root canal sealers.

METHODS

Sixty extracted human single rooted teeth were used in this in-vitro study. Sealers tested for microleakage in this study were zinc oxide eugenol based sealer, Sealapex, AH Plus, MTA Plus, EndoRez, Endosequence BC. All the specimens were examined under stereomicroscope for microleakage and the obtained data were statistically analysed using One-way ANOVA test and Tukey's multiple comparison tests using the software GraphPad Prism 7.02.

RESULTS

The Endosequence BC group showed the least dye leakage and the highest leakage was seen in Zinc oxide Eugenol based sealer.

CONCLUSION

Bio ceramic sealers being hydrophilic show better sealing ability compared to resin based and eugenol based sealers.



LIMA, STELLA & SALIVA, POLIANA & REZENDE TAIA (2019). IMPROVEMENT OF REPARATIVE BIO CERAMICS IN ENDODONTICS – A CRITICAL REVIEW. JOURNAL OF SCIENTIFIC & TECHNICAL RESEARCH DOI: 10.26717/BJSTR.2020.24.004059.

Improvement of Reparative Bioceramics in Endodontics- A Critical Review

ABSTRACT

The advent of bioceramics materials increases the possibility of reparative and regenerative processes in dentistry, and more precisely, in endodontics. Bioceramics materials presents biocompatibility, bioactivity, resistance to leakage, sealing ability, and biomineralization activity. Mineral trioxide aggregate (MTA) is a gold standard bioceramic material indicated for reparative procedures presenting high clinical success. MTA is used for pulp capping, pulpotomy, apexification, perforation, root resorption repair, regenerative endodontics, and apical surgery. The emergence of MTA demonstrated great potential in endodontic therapies, and modifications and improvements of this bioceramic gave rise to many other materials. New bioceramic materials are now available in several countries with distinct compositions. Although there is a concern regarding the modification of compounds and formulation of bioceramic materials for reaching better properties, distinct products produce the same effects of reduced leakage, biological activity, sealing ability, marginal adaptation and bridge formation. The biological properties of bioceramic materials are well defined in literature, but new formulations must be evaluated in longitudinal clinical cases, and systematic reviews and meta-analysis are needed to compare these products better. The present review demonstrates a summary of bioceramics properties, applications, improvements, and future directions in endodontics to maintain tooth longevity.



KUNERT M, LUKOMSKA-SZYMANSKA M. BIO-INDUCTIVE MATERIALS IN DIRECT AND INDIRECT PULP CAPPING-A REVIEW ARTICLE. MATERIALS (BASEL). 2020;13(5):1204. PUBLISHED 2020 MAR 7. DOI:10.3390/MA13051204

Bio-Inductive Materials in Direct and Indirect Pulp Capping —A Review Article

ABSTRACT

The article is aimed at analyzing the available research and comparing the properties of bio-inductive materials in direct and indirect pulp capping procedures. The properties and clinical performances of four calcium-silicate cements (ProRoot MTA, MTA Angelus, RetroMTA, Biodentine), a light-cured calcium silicate-based material (TheraCal LC) and an enhanced resin-modified glass-ionomer (ACTIVA BioACTIVE) are widely discussed. A correlation of in vitro and in vivo data revealed that, currently, the most validated material for pulp capping procedures is still MTA. Despite Biodentine's superiority in relatively easier manipulation, competitive pricing and predictable clinical outcome, more long-term clinical studies on Biodentine as a pulp capping agent are needed. According to available research, there is also insufficient evidence to support the use of TheraCal LC or ACTIVA BioACTIVE BASE/LINER in vital pulp therapy.



HAMDY BADRELDIN; ALAA ISMAEL; SAMY EL BAYOUMY. "EFFECT OF MTA ON TWO TYPES OF FURCAL PERFORATION IN PRIMARY MOLARS : A PROSPECTIVE CLINICAL TRIAL.". AL-AZHAR JOURNAL OF DENTAL SCIENCE, 24, 3, 2021, 325-329. DOI: 10.21608/AJDSM.2020.42409.1116

Effect of MTA on two types of furcal perforation in primary molars : A prospective clinical trial.

ABSTRACT

Pulpectomy and pulpectomy usually are the most common techniques used in pulp therapy for primary teeth and despite the relative ease of performing this techniques iatrogenic errors may. furcal perforation of common errors can be occurred during performing pulp therapy in primary molars. two types of furcal perforation were selected according to time factor elapsed since their occurrence (recent and long standing) and these types of perforation treated with MTA. This study was directed to evaluate the ability of MTA to treat furcal perforation in primary molars regarding the time factor

Subjects and Methods: thirty patients were selected 15 with accidentally recently (group A) furcally perforated molars and 15 with long standing old perforation (group B), and the two types sealed with MTA and then completed by conventional pulp therapy treatment either by pulpectomy or pulpectomy for group A , and pulpectomy for group B, then they followed up clinically and radiographically for 12 months.

Result: there was statistically significant difference in success incidence between the two groups ($p=0.014$); being higher in recent perforation. For long standing perforation; 10 patients out of 15 patients (66.7%) showed success; while in recent perforation; 15 patients (100%) showed success.

Conclusion : recent type of perforation which repaired at the same visit has a higher success rate and better prognosis than old type or long standing in primary molars.



PRIMUS, CAROLYN & GUTMANN, JAMES & TAY, FRANKLIN & FUKS, ANNA. (2021). CALCIUM SILICATE AND CALCIUM ALUMINATE CEMENTS FOR DENTISTRY REVIEWED. JOURNAL OF THE AMERICAN CERAMIC SOCIETY. 105. 10.1111/JACE.18051.

Calcium silicate and calcium aluminate cements for dentistry reviewed

ABSTRACT

Calcium silicate cements were identified as excellent materials for dentistry, particularly for dental procedures contacting the dental pulp or root system. Both calcium silicate and calcium aluminate cements cause the biomineralization (precipitation of hydroxyapatite [HA] phenomena and shield dental tissues from the underlying cement (a foreign body material). The cements also elute ions to stimulate cytokines that contribute to the healing of the dental pulp or in the tissue surrounding the root of a tooth. The cements serve as a foundation for other dental restorative materials. This paper reviews the cement phases, properties, in vivo reactions, and clinical benefits from the use of calcium silicate and calcium aluminate ceramic cements.