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# Non-Surgical Management of Blunderbuss Root Apices by Chemical Debridement and High-Viscosity Silicate Based Apical Plug

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**Abstract**

Endodontic ttreatment of Blunderbuss open apices requires meticulous handling by a dentist in a clinic. These canals pose challenges due to fragile canal walls and complete absence of a tangible hard tissue resistance for termination of their obturation.

Calcium Hydroxide has been efficaciously used for apexifying open apices. It, however, is no more a material of choice for clinicians as it takes quite a long time for closing an apex. Calcium silicate-based materials have shown better performance to accomplish apical closure in shorter time but owing to its low viscosity, its compaction in an open apex is difficult. A putty-like silicate cement has now been developed to be easily placed and form an impervious to fluid apical plug.

Disinfection in such canals is another encounter a dentist comes across as mechanical debridement of existing thin canal walls may prove fatal. Intracanal instrumentation with cutting capability may further weaken them. In this case, therefore, maximum disinfection was achieved with irrigating solution of 2.5% Sodium Hypochlorite.

**Keywords:** endodontic infection, NaOCl, root canal irrigation, root canal disinfection

## 1. Introduction

A root canal known as Blunderbuss canal is the one that has divergent walls with a funnel shaped open-apex wider than the coronal aspect of the canal. In adult teeth, long standing untreated periapical lesions cause resorption of the apical root area that alters normal anatomy of the area and creates challenges for an operating a dentist to perform conventional root canal procedure. Difficulty in achieving an impervious apical seal, recording exact working length (WL) and existing thin canals walls, which are susceptible to fracture, are the principal impediments in gaining successful outcome. Such clinical cases require either a surgical approach with retrograde root filling or a non-surgical endodontic treatment. As Periapical Surgery is considered as last option, less invasive conservative approach is preferred by the patients. The endodontic treatment that can close the open apex for its tight-sealed obturation is termed as Apexification which has traditionally been performed using long term intracanal application of Calcium Hydroxide $Ca(OH)_2$. Moreover, the root-end calcific barrier formed by $Ca(OH)_2$ is very fragile and porous which can break during obturation of the rest part of the canal.

To shorten the time needed by long-term $Ca(OH)_2$ therapy, nonsurgical single step apexification procedure has been advocated. It involves application of Calcium Silicate based materials-Mineral Trioxide Aggregate (MTA), in the apex. It releases $Ca(OH)_2$ which is compatible with periapical tissue.

Satisfactory placement and compaction of these materials in the cases with wide open apices is a burdensome

procedure to carry out (Sharma & *et al.,* 2016). This problem arises due to MTA's fluidy consistency and long setting time (Zuolo & Zuolo, 2016). To overcome this deficiency, silicate based cement with shorter setting time was developed that showed some better manipulation characteristics but superiority of the two materials remained questionable (Kaur & *et al.,* 2017). Unlike conventional MTA, a highly viscous Silicate based material having putty-like consistency is now being marketed to be compacted in the apical area with ease and is claimed to be bioactive, antibacterial, non-staining, and healing promoters (Rodríguez-Lozano & *et al.,* 2020). This case report describes a non-surgical management of a wide open apex preventing prolonged treatment time after disinfecting it through plentiful chemical irrigation and intracanal agitation.

**2. Case Report**

A 28-year-old female came with chief complaint of mild pain, swelling and pus discharge from one of her upper front teeth. Pain and swelling used to subside when there was a discharge of pus from the lesion. History revealed that the tooth had been traumatized and broken years ago and was at that time treated for presenting symptoms and restored with a tooth colored material by her dentist. Intraoral examination showed presence of a sinus tract associated with blackened upper right central Incisor (tooth # 11). Thermal and electrical pulp testing presented negative response. Periapical radiograph revealed periapical radiolucency in the apical area of tooth # 11 causing foraminal and periforaminal resorption with thin and slightly diverging root canal walls mirroring a classical image of a Blunderbuss canal (Figure. 1).

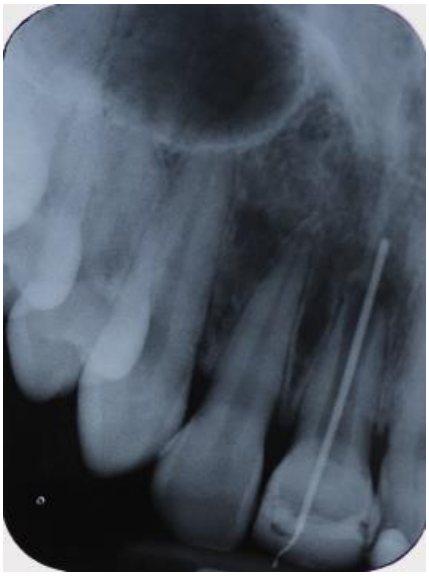

Figure 1. Tooth # 11 with Blunderbuss canal

It led to diagnosis of necrosed pulp with Chronic Apical Abscess. Medical history was normal and no abnormality was detected during extraoral examination.

Endodontic treatment was performed over two visits under local anesthesia and rubber dam isolation. At first visit, access cavity was prepared and canal was irrigated with Sodium Hypochlorite (NaOCl) 2.5% using a premarked needle. Working length was estimated using initial periapical radiograph and confirmed with a subsequent working length radiograph. Pus was drained from the abscess through the root canal. As the canal walls were already thin and mechanical debridement may have weakened them further and liable to fracture, it was decided to lightly clean them with Hedstrom file # 80 and irrigation of the canal was used as key method to clean the canal. To achieve comprehensive disinfection, the root canal system was copiously irrigated with NaOCl 2.5% for 30 minutes of the 45-minute-visit. Irrigation of the canal was performed painstakingly using syringe with needle and a sonic device (Endoactivator: Dentsply). Though many researchers recommend final rinse with Chlorhexidine but to keep the procedure simple and easy, merely NaOCl was used in this case. The canal was dried with paper point and dressed with $Ca(OH)_2$ for 2 weeks.

At second visit, the patient was clinically asymptomatic, the sinus had healed and radiolucency showed a decline. A premeasured endodontic plugger was employed to place a 5.0mm plug of Bioceramic RRM to obturate the apical part of the canal (Figure.2).

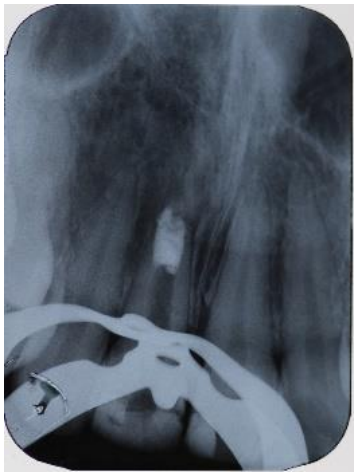

Figure 2. Apical plug formed

Great care was exercised to avoid extrusion of the material beyond the apex. It is a premixed, highly radiopaque, extremely viscous, and insoluble material based on calcium silicate. Its initial pH is 10 which increases in 3 hours to 12. Once the material was set, fiber post was placed followed by core buildup (Figure. 3).

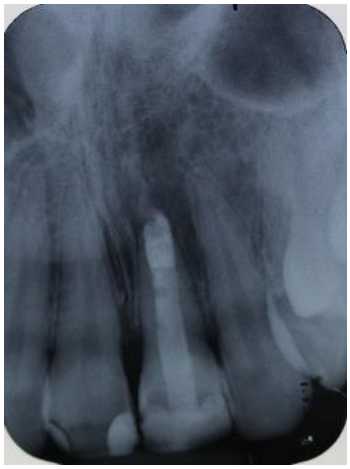

Figure 3. Periapical healing, fiber post inserted

**3. Discussion**

The disinfection of a root canal system is carried out so that the periradicular tissues become insusceptible to bacterial attack from within the tooth and the surrounding bone stays healthy. This objective is achieved by enlarging canal diameter with intracanal instruments of increasing diameter and irrigating the canal with an efficient irrigating solution. Instrumentation in a canal, understandably compromises the radicular strength and in the Blunderbuss canals where canal walls were already weak and slim, extensive mechanical cleaning was not possible in this case. To eliminate bacterial load, major emphasis was on its abundant irrigation of the infected and very lightly debrided canal mechanically. NaOCl was chosen for irrigation as various irrigants have been tried and recommended but NaOCl has been found the most used and effective irrigating solution (Walmsley & Williams, 1989). It dissolves organic tissue, physically flushes debris and acts as bactericidal and lubricating agent (Orstavik & Haapasalo, 1990). Another fundamental factor which increases the efficacy of an endodontic irrigant is the volume used during irrigation. Higher volume reduces greater intracanal microbial load (Prada & *et al.,* 2019). Keeping this in mind, we continuously irrigated the canal for more than 30 minutes using conventional syringe and needle method. To facilitate the NaOCl reach the full length of root, rigorous coronoapical movements of the irrigating needle were performed to agitate the solution within the canal (Paragliola & *et al*., 2010) Enhancement of disinfection was made further possible by using a sonic device as it shows powerful and better debridement efficacy than needle irrigation alone (Van der Sluis & et al., 2007). These

devices require vibrations greater than 10,000 cpm to produce cavitation effect which permits tremendous canal disinfection (Lovato & Sedgley, 2011).

The concentration of NaOCl has been debatable among endodontists. In this case, merely NaOCl of 2.5% was utilized keeping in mind that it is contact time and regular irrigation that matters more than its concentration (Baker & *et al.,* 1975). Moreover, use of high strength NaOCl reduces flexural strength and elasticity of dentin of the canal walls and produces more cytotoxicity (Grigoratos & *et al.,* 2001) Even in low concentration, it gives caustic effects when comes in contact with vital tissues. A study suggests to continually replenish a canal with 15 ml of NaOCl for 12 minutes along with instrumentation (Ramada & *et al*., 1983). In this case, however, canal was irrigated with 20 ml for 30 minutes as instrumentation was almost negligible as Ramada's study recommends that increasing the quantity of NaOCl produces a cleaner canal.

In blunderbuss apices, an intraradicular material is required which should be biocompatible, bioactive antibacterial, highly radiopaque with easy handling and excellent sealing ability (Camilleri, 2020). Available silicate based cements like MTA and Biodentine have miserably failed to produce the required impervious apical seal. A leaky seal in an apical area becomes a source of reinfection in the periapical area and subsequent failure of the endodontic treatment. Bioceramic RRM, therefore, was used in this case. It is a hydraulic cement with putty-like consistency that makes its handling incredibly superior to other silicate based cements. This cement like other silicate based cements sets by interaction with $H_2O$ and can be placed within a wet canal but drying before complete setting is mandatory. Further reactions occurs with periapical tissue fluid, blood, radicular dentine, surrounding bone and the irrigant used (Sedgley & *et al.,* 2004). Bioceramic RRM formed a perfect apical plug to avoid future canal reinfection and is showing good performance for the last few years. A recent Swiss study has also revealed similar results of success (von Arx T & *et al.,* 2020).

## 4. Conclusion

The effective disinfection of a root canal can be best achieved with the appropriate volume and intracanal time of action of the NaOCl with minimal mechanical instrumentation.

Bio-C Repair simplifies application of the material in the open apices and facilitates the successful management of teeth having Blunderbuss root canals. It efficiently seals an open apex and promotes healing in the periapical tissues thus prevents apical periodontitis.

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