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RESEARCH ARTICLE

CERVICAL PULPOTOMY IN MATURE PERMANENT TOOTH WITH CARIOUS EXPOSURE: 3-YEAR-FOLLOW UP CASE REPORT

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Abstract

Objective. The objective of this case study is to manage irreversible pulpitis in a mature permanent molar with a conservative and cost-effective therapy, which is cervical pulpotomy.

Summary. A cervical pulpotomy was performed on the second permanent mandibular molar with an irreversible pulpitis in a 30-year-old female patient.Taking the age of the patient and the condition of the underlying pulp tissue into account, cervical pulpotomy was planned to preserve the vitality of the intact root pulps using MTA. Follow-up examinations at 1 month, 3 months, 6 months, 1 year and 3 years revealed positive clinical and radiological results. The high success rate reported in this clinical case also in all systematic reviews for pulpotomy suggests that this procedure can offer an alternative to root canal treatment in teeth with irreversible pulpitis.

Introduction:-

Management of carious teeth with signs and symptoms indicative of irreversible pulpitis by pulpectomy is traditionally invasive, but emerging evidence suggests cervical pulpotomy as successful treatment which aim to preserve the vitality of the pulp and its defensive functions against bacterial aggression. [1]

Several factors influence the success of this therapy such as age of patient, origin of pulp exposure, control of per-operative hemorrhage, choice of bioactive materials, creation of a dentinal bridge, and the quality of coronal restoration.

The aim of this article is to present a successful management of irreversible pulpitis with carious exposures by coronal pulpotomy in second mandibular permanent molar with 3-year follow-up.

Case Report

A 30-year-old female patient was referred to department of endodontics with a chief complaint of pain in the second right mature permanent molar. On clinical examination, there was presence of a large deep carious lesion.

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There was no history of swelling or medications. There was no tenderness on percussion, Diagnostic tests revealed lingering pain to hot and cold tests.

Radiographic examination revealed presence of a large radiolucency in the coronal portion of the involved tooth approaching the pulp with normal periodontal ligament space and lamina dura. There was no periapical lesion visible on the radiograph. After complete clinical and radiographic examination, a diagnosis of irreversible pulpitis was made in the involved tooth (Fig 1).

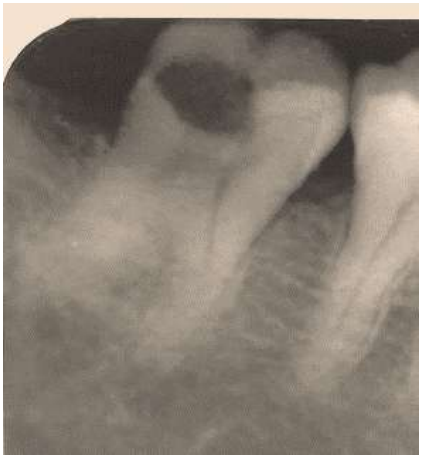

Figure 1:- Pre-operative radiograph of 47 showing a deep carious lesion.

The patient was treated with complete coronal pulpotomy with placement of MTA in the pulp chamber and resin-modified glass-ionomer liner (Fig 2). The crown was restored with composite after one week.

Figure 2:- Immediate post-operative radiograph after MTA pulpotomy covered with a layer of glass ionomer.

Long term outcome revealed a success of therapy at 3 months, 6 months 1 year and 3 years post-op (Fig 3-4-5-6).

Figure 3:- 3 Month follow-up.

Figure 4:- 6 Month follow-up.

Figure 5:- 12 Month follow-up.

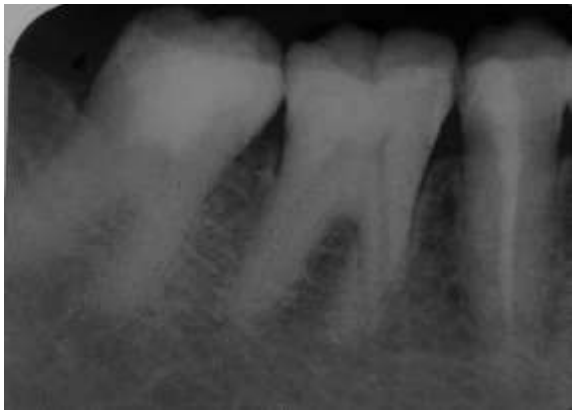

Figure 6:- 3 year follow-up.

Discussion:-

The traditional treatment of irreversible pulpitis is root canal therapy. The main reason for this option complete removal of pulp from the crown and roots [2]. For several years, this treatment is generally successful if it is well done, but it is a real challenge for clinicians owing to the complex procedure. [3] In addition, removal of the cameral pulp can also weaken the tooth, making it more susceptible to fracture and more vulnerable to dental caries [4]. These issues highlight the importance of developing new minimally invasive solutions that will allow us to preserve the pulp vitality of the tooth [3, 5].

In another way, the main objective of dental therapy is to preserve pulp vitality as long as possible. However, pulpectomy is only indicated in cases of pulp necrosis or severe pulpilitis (if bleeding persists).

The new classification of pulpitis proposed by Walters in 2017 focuses on the preservation of pulp vitality as long as the tooth is vital, and the inflammation is only moderate. Currently, endodontic treatment is limited to severe stages of pulpitis and pulp necrosis [6].

This case showed the success of cervical pulpotomy procedure pulpotomy using MTA for the treatment of an irreversible pulpitis. Clinical and radiographic controls was realized after 1, 3, 6, 12 months and 3 year.

Cervical pulpotomy is the treatment of choice for Moderate Pulpitis or severe pulpitis of mature permanent teeth. It is a vital pulp therapy procedure in which the coronal pulp is removed and the root pulp is preserved to maintain pulp vitality [2]. This is justified by the fact that in cases with irreversible pulpitis, pathological changes in the coronal pulp including inflammation or necrosis occurred only in the coronal pulp while the root pulp was viable, therfore, the root pulp should be retained during a pulpotomy, avoiding pulpectomy [5]. Accordingly, some of the advantages of cervical pulpotomy include [5.7].

1. Conservation of immunological functions and preservation of integral dental structure.
2. Facilitation of the operative protocol.
3. Avoidance of treatment complications related to root canal anatomy.
3. Causes few pain.
4. Economical and non-destructive technique.

The main criteria for the choice of this treatment approach is the pulpal diagnosis. The tooth must have an irreversible pulpitis [7]. Also, the correlation between clinical and histological status of the pulp varies from low to high [8,9].

In addition, factors that affect prognosis of cervical pulpotomy are age, Origin of pulp exposure, Control of peroperative hemorrhage, Choice of bioactive materials, Creation of a dentinal bridge, and the quality of coronal restoration. [8,10].

1) **Age:** Some authors suggested that a young pulp has a higher rate of cell regeneration, and a better potential for healing of pulp cells compared to an elderly patient's pulp [11,12,13], However, other studies have shown that cervical pulpotomy may be a better choice for elderly and young patients. These studies have demonstrated a high success rate in patients over 50 years of age. [7,14,15]. In this clinical case our patient was thirty years old.
2) **Origin of pulp exposure:** In this clinical case, the origin of the pulp damage was a carious lesion. In this regard, it is noteworthy that the prognosis after pulp exposure of traumatic origin is significantly better than after a carious lesion. The success rate was 92.2% with mechanical exposure and 33.3% with percent with carious exposure [16]
3) **Control of peroperative hemorrhage:** There is no reliable tool to help to evaluate the degree of progression of inflammation in the pulp. But the degree of pulp bleeding may be a reliable indicator of the degree of the pulp inflammation rather and not relying on the preoperative clinical signs and symptoms. Very abundant bleeding associated with difficulty in achieving hemostasis indicates severe pulpal inflammation [17]. The literature suggests that there are several methods to ensure hemostasis: rinsing the wound using sodium hypochlorite solution [17,18], hydrogen peroxide [17,19] physiologic saline solution [20] or pressure with a cotton pellet [21]. There are no scientific studies on the ideal method.

Although, rinsing with a concentrated sodium hypochlorite solution of 1.25% to 6% is recommended.
In the present case, hemostasis was achieved within 5 minutes using a 1.25% sodium hypochlorite solution, indicating our therapeutic choice.

In this respect if the bleeding has not stopped within 10 minutes, this suggests two possibilities: first, the inflamed pulp has not been completely removed and second, the pulp inflammation has already progressed to the root pulp. Therefore, the treatment plan must be modified and opted for the pulpectomy [17,22].

Regarding the color of the bleeding, In the absence of clinically available molecular tests of inflammation, the color and intensity of pulp bleeding is a marker of inflammation and capacity to recover after treatment. [19, 23].

Choice of bioactive materials:
Calcium hydroxide has been considered as the most widely used biomaterial for pulpotomy, but over time it has been found to have some disadvantages, such as its high pH, which leads to pulpal necrosis of the surface, lack of bonding with the dentine layer and its dissolution. In addition, histological analysis of the barrier formed when calcium hydroxide is used shows a porous structure that allows the penetration of bacteria. This can possibly lead to further inflammation, which can aggravate pulpal inflammation and thus lead to treatment failure [24].These previously mentioned disadvantages have affected the clinical efficacy of calcium hydroxide. Studies have shown a relatively very low success rate ranging between 32% (after 1 year) and 33% (after 3 years) [25,26,27].

Several materials have been proposed for pulp capping in recent years. Bioceramic materials are the most used in Vital pulp therapy especially Calcium silicate cement (Biodentine) and mineral trioxide aggregate (MTA). The dentin bridge formed after capping with MTA and Biodentine is thicker and has no porosity [24].

In a systematic review by Li et al. 2019, the clinical and radiographic success rate at 12 months with MTA pulpotomy was higher than $Ca(OH)_2$ pulpotomy [28]. Similarly, in another study, the results of pulpotomy with MTA in mature permanent teeth showed success rates of 100% after one year and 92.7% after three years [29].

Regarding Biodentine, it presents a therapeutic success comparable to that of MTA. Clinically, it preserves positive sensitivity test responses without tooth discoloration. Radiographically, it allows the formation of a dentin bridge as well as a periapical healing [8]. Furthermore, Biodentine is able to induce the proliferation and biomineralization of pulp cells [30].

So, the MTA and the Biodentine have become an alternative to calcium hydroxide owing to excellent biocompatibility and superior sealing efficiency. In addition, the physical properties of MTA and Biodentine offer a very good prognosis [31]

Another study compared the chemical composition of the layer formed to protecting the root pulp using four pulp capping materials. It was shown that the calcium concentration is different according to the material used: 33.7% for Biodentine, 17% for ProRoot MTA, 15.1% for Dycal, and finally 3.6% for TheraCal. This means that Biodentine offers the best layer formation following by the MTA [32].
In the present case, we have opted for MTA as the material for capping the root pulp.

Creation of a dentinal bridge:
In this case,a radiographic control after 3 years revealed the formation of a thick and rigid dentinal bridge by using MTA. The creation of a dentinal bridge after the realization of a cervical pulpotomy is a success sign of therapy.

In study comparing TheraCal, ProRoot MTA and Biodentine as capping materials, there was a complete dentinal bridge formation in 11% with TheraCal and 56% with Proroot MTA of cases, which is statistically significant ($P = 0.001$). In the ProRoot MTA and Biodentine groups a complete dentin bridge was formed by differentiated odontoblast cells, while more than half of the teeth in the TheraCal group had an Incomplete bridge. The dentin bridge observed with Biodentine was thicker than with MTA [33].

Comparison between coronal pulpotomy and other vital pulp therapies:
The success rate of coronal pulpotomy was highest (95.5%) at 12-month follow-up as compared to direct pulp capping (94.7%) and miniature pulpotomy (91.4%) [34]

A systematic review has suggested that the success rate of pulpotomy (partial pulpotomy (99.4%) and pulpotomy cervical (99.3%) is higher than of direct pulp capping (73%) [17]

The quality of coronal restoration:
The coronal restoration must be a good sealing, to have a good tightness, as well as the crown restorative material, in order to prevent bacterial leakage to the root pulp [7,11,35].

For our patient, we made an immediate coronal restoration with glass ionomer cemenr and after one week a composite resin restoration was made.

A study has demonstrated that the success rate after a good coronary restoration. The survival rate without any complementary treatment was estimated to be 82%. Two of the 17 treated teeth required root canal treatment for pain control and one for prosthetic reasons (lingual fracture of the tooth). So, the coronal restoration is the key to success [35].

Due to the fragility of the tooth structure after pulpotomy, the occurrence of fractures was also analyzed among the different restorations: the prosthetic crown is the ideal choice (HR = 1.0, reference category), followed by resin composite[36]

Conclusion:-

In accordance to the favorable results of our case, a reasonable argument supporting mature tooth in cases of irreversible pulpitis can be stated. Biomaterials such as MTA and Biodentine with pulp healing properties may challenge the complete philosophy of our conventional endodontic treatment. Case selection including age, status of pulp and control of bleeding; however, remains an important criterion for the same.

Conflicts of interest
The author(s) declare(s) that there is no conflict of interest regarding the publication of this article.

Bibliographie:-

1. Sadaf, D. (2020). Success of Coronal Pulpotomy in Permanent Teeth with Irreversible Pulpitis: An Evidence-based Review. Cureus, 12(1)
2. Soni HK. Biodentine Pulpotomy in Mature Permanent Molar: A Case Report. J Clin Diagn Res JCDR. juill 2016;10(7):ZD09-ZD11.
3. Cushley S, Duncan HF, Lappin MJ, Tomson PL, Lundy FT, Cooper P, et al. Pulpotomy for mature carious teeth with symptoms of irreversible pulpitis: A systematic review. J Dent. sept 2019;88:103158.
4. Caplan DJ, Cai J, Yin G, White BA. Root Canal Filled Versus Non-Root Canal Filled Teeth: A Retrospective Comparison of Survival Times. J Public Health Dent. juin 2005;65(2):90-6.
5. Wolters WJ, Duncan HF, Tomson PL, Karim IE, McKenna G, Dorri M, et al. Minimally invasive endodontics: a new diagnostic system for assessing pulpitis and subsequent treatment needs. Int Endod J. 2017;50(9):825-9.
6. Wolters, W. J., et al. "Minimally invasive endodontics: a new diagnostic system for assessing pulpitis and subsequent treatment needs." *Int Endod J* 50.9 (2017): 825-829.
7. Simon S, Perard M, Zanini M, Smith AJ, Charpentier E, Djole SX, et al. Should pulp chamber pulpotomy be seen as a permanent treatment? Some preliminary thoughts. Int Endod J. janv 2013;46(1):79-87.
8. Chinadet W, Sutharaphan T, Chompu-inwai P. Biodentine™ Partial Pulpotomy of a Young Permanent Molar with Signs and Symptoms Indicative of Irreversible Pulpitis and Periapical Lesion: A Case Report of a Five-Year Follow-Up. Case Rep Dent. 12 sept 2019;:1-5.
9. Garfunkel A, Sela J, Ulmansky M. Dental pulp pathosis: Clinicopathologic correlations based on 109 cases. Oral Surg Oral Med Oral Pathol. 1 janv 1973;35(1):110-7.
10. Tsukiboshi M, Ricucci D, Siqueira JF. Mandibular Premolars with Immature Roots and Apical Periodontitis Lesions Treated with Pulpotomy: Report of 3 Cases. J Endod. sept 2017;43(9S):S65-74.
11. H.E. Alqaderi, S.A. Al-Mutawa, M.A. Qudeimat, MTA pulpotomy as an alternative to root canal treatment in children's permanent teeth in a dental public health setting, J. Dentist. 42 (2014) 1390–1395.
12. A.J. Sloan, R.J. Waddington, Dental pulp stem cells: what, where, how? Int. J. Paediatr. Dent. 19 (2009) 61–70.
13. K. Matsuzaka, T. Muramatsu, A. Katakura, K. Ishihara, S. Hashimoto, M. Yoshinari, et al., Changes in the homeostatic mechanism of dental pulp with age: expression of the core-binding factor alpha-1, dentin sialoprotein, vascular endothelial growth factor, and heat

shock protein 27 messenger RNAs, J. Endodontics 34 (2008) 818–821.
14. S. Asgary, M.J. Eghbal, J. Ghoddusi, Two-year results of vital pulp therapy in permanent molars with irreversible pulpitis: an ongoing multicenter randomized clinical trial, Clin. Oral Investig. 18 (2014) 635–641
15. I.H. Barngkgei, E.S. Halboub, R.S. Alboni, Pulpotomy of symptomatic permanent teeth with carious exposure using mineral trioxide aggregate, Iranian Endododontic J. 8 (2013) 65–68.
16. Al-Hiyasat, A. S., Barrieshi-Nusair, K. M., & Al-Omari, M. A. (2006). The radiographic outcomes of direct pulp-capping procedures performed by dental students: a retrospective study. *The Journal of the American Dental Association*, *137*(12), 1699-1705.
17. Aguilar P.&Linsuwanont P.: Vital pulp therapy in vital permanent teeth with cariously exposed pulp: a systematic review. J Endod 2011, 37(5), 581-587
18. DeRosa T. A retrospective evaluation of pulpotomy as an alternative to extraction. Gen Dent 2006;54:37–40
19 . Matsuo T, Nakanishi T, Shimizu H, Ebisu S. A clinical study of direct pulp capping applied to carious-exposed pulps. J Endod1996;22:551–6.
20. Barrieshi-Nusair KM, Qudeimat MA. A prospective clinical study of mineral trioxide aggregate for partial pulpotomy in cariously exposed permanent teeth. J Endod 2006;32:731–5.
21. El-Meligy OA, Avery DR. Comparison of mineral trioxide aggregate and calcium hydroxide as pulpotomy agents in young permanent teeth (apexogenesis). Pediatr Dent 2006;28:399–404.
22. Qudeimat, M. A., Alyahya, A., Hasan, A. A., &Barrieshi-Nusair, K. M. (2017). Mineral trioxide aggregate pulpotomy for permanent molars with clinical signs indicative of irreversible pulpitis: a preliminary study. International endodontic journal, 50(2), 126-134.
23. Duncan, Galler, et al. European Society of Endodontology position statement: Management of deep caries and the exposed pulp. *International Endodontic Journal*, (2019). *52*(7), 923-934.
24. Solomon, Faizuddin, et al.. Coronal pulpotomy technique analysis as an alternative to pulpectomy for preserving the tooth vitality, in the context of tissue regeneration: a correlated clinical study across 4 adult permanent molars. *Case reports in dentistry*, *2015*
25. Dammaschke, T., Leidinger, J., & Schäfer, E. (2009). Long-term evaluation of direct pulp capping—treatment outcomes over an average period of 6.1 years. Clinical Oral Investigations, 14(5), 559–567.
26. Al-Hiyasat, A. S., Barrieshi-Nusair, K. M., & Al-Omari, M. A. (2006). The radiographic outcomes of direct pulp-capping procedures performed by dental students. The Journal of the American Dental Association, 137(12), 1699–1705.
27. Bjørndal, L, Reit, C, Bruun, G, Markvart, M, Kjaeldgaard, M, Näsman, P, Gluud, C. (2010). Treatment of deep caries lesions in adults: randomized clinical trials comparing stepwise vs. direct complete excavation, and direct pulp capping vs. partial pulpotomy. European Journal of Oral Sciences, 118(3), 290–297.
28. Li Y, Sui B, Dahl C, et al.: Pulpotomy for carious pulp exposures in permanent teeth: a systematic review and meta-analysis. J Dent. 2019;84:1–8
29. Taha NA, Ahmad MB, Ghanim A :Assessment of mineral trioxide aggregate pulpotomy in mature permanent teeth with carious exposures.. Int Endod J. 2017;50:117–125
30. M. Zanini, J. M. Sautier, A. Berdal, and S. Simon, "Biodentine induces immortalized Murine pulp cell differentiation into odontoblast-like cells and stimulates biomineralization," Journal of Endodontics, vol. 38, no. 9, pp. 1220–1226, 2012.
31. Mandeep, K. A. U. R. (2017). MTA versus Biodentine: Review of literatura with a comparative analysis. Journal of Clinical and Diagnostic Research, 11(8), 01-05.
32. Gong V, França R. Nanoscale chemical surface characterization of four different types of dental pulp-capping materials. J Dent. 2017 Mar;58:11-18.
33. Bakhtiar, H., Nekoofar, M. H, Aminishakib, P, Abedi, F, Moosavi, F. N, Esnaashari, E.& About, I. (2017). Human pulp responses to partial pulpotomy treatment with TheraCal as compared with Biodentine and ProRoot MTA: a clinical trial. Journal of endodontics, 43(11), 1786-1791.
34. Asgary S, Hassanizadeh R, Torabzadeh H, Eghbal: Treatment outcomes of 4 vital pulp therapies in mature molars. MJ. J Endod. 2018; 44:529–535.

35. Simon S, Perard M, Zanini M, Smith AJ, Charpentier E, Djole SX, et al. Should pulp chamber pulpotomy be seen as a permanent treatment? Some preliminary thoughts. Int Endod J. janv 2013;46(1):79-87.
36. Kunert, G. G., Kunert, I. R., da Costa Filho, L. C., & de Figueiredo, J. A. P. (2015). Permanent teeth pulpotomy survival analysis: retrospective follow-up . *Journal of Dentistry, 43(9), 1125–1131.*2015.