ISSN No:-2456-2165

Clinical Evaluation and Comparison of Quality of Obturation and Instrumentation Time for Pulpectomy in Primary Molars With or Without a Magnifying Loupe: An Invivo Study

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Abstract:-

BACKGROUND: Use of magnification devices like a magnifying loupe has increased the proficiency and standard of dental care provided to a patient. There is not enough literature on use of magnifying loupes in pediatric dentistry despite of the number of advantages of using it. Its use in pedodontic treatment is often considered to evoke anxiety and non- corporation among the children which often limits its use in this field , which is not convincing . Thus this study aims to put forward the proper utilization of the benefits of magnification in endodontic procedures in children, with the help of suitable behavior management techniques.

AIM :. To clinically evaluate and compare the treatment time and the quality of obturation for pulpectomy in primary molars with or without a magnifying loupe.

MATERIALS AND METHODS : Children who require endodontic treatment in mandibular primary molars, with Frankel's Behavioral Rating Scale of Positive [Rating 3] or Definitely Positive [Rating 4] were selected for the study after obtaining informed consent from their parents. 20 participants from the age group of 4-10 years were selected based on the selection criteria and were divided into 2 groups randomly; Group 1 : Pulpectomy with loupes and Group 2 : Pulpectomy without loupes. The pulpectomy procedure was performed in both the groups by a single operator. In Group 1 there was no magnifying devices used whereas in Group 2 the procedure was done using a Galilean magnifying loupe of 2.5 x . Pulpectomy was done using manual instrumentation techniques in two visits. In the second visit obturation was done with Metapex as obturating material. The total treatment time taken for the instrumentation of the canals was be recorded using a stop watch by an assistant. A post obturation radiograph was then taken to determine the quality of obturation.

RESULTS: The data was analysed and inferential statistics like Chi square test and independent t test were used to compute the significant difference between the groups. A total of 20 children who met the inclusion criteria (11 girls and 9 boys) were included in the study. The mean age was 7.10 ± 1.8 years. The mean treatment time using a magnifying loupe was lesser compared to that done without loupes and was statistically significant. Whereas , the quality of obturation was better when the procedure was done with the loupes, but not statistically significant (P value - 0.30)

CONCLUSION : Taking into consideration the advantages of using loupes in endodontic treatment, pediatric dentists are recommended to utilize its benefits in daily clinical practice so as to render an effective and satisfactory treatment in shorter span of time, thereby gaining the confidence and cooperation of both the child and the parents.

Keywords:- *Component; Formatting; Style; Styling; Insert.*

I. INTRODUCTION

The furtherance in the evolution of new dental equipments have intensified the dentists' capability in diagnosing and performing better treatment on their patients in both surgical and non- surgical dental procedures. Use of magnification devices like a magnifying loupe has increased the proficiency and standard of dental care that is provided to a patient.[1]

The use of magnification as an aid for proper visualization in dental field backdate over a century.[2] It was in 1876 that Dr Edwin Saemisch, a German

ophthalmologist introduced simple binoculars to the surgical field. Gradually it was experimentally introduced in precision dentistry and modified and used effectively till date. It was in 1978 that Dr Harvey Apothekar and Dr Jako together put forward the idea of maximum magnification it the form of operating microscope in dental practice and in 1980[3], Dr Apothekar termed this as ' Micro Dentistry' [4]. In 1997 , Syngcuk Kim reported that the effectiveness and outcome of endodontics was drastically changed after the emergence of magnification into the field. Garry Carr reported in 1999 the ergonomic benefits of using the Galilean loupes in endodontics[.5] During dental treatment the visualization of the field is usually enhanced by adjusting the chair position and by bending closer to the operating field. But the disadvantage of these techniques is the limitation of human eye to refocus at a distance shorter than 10 – 12cm , also this strains eye and is ergonomically not acceptable. But the introduction of magnifying devices has eliminated the difficulty in proximity, accessibility, eye strains and ergonomics in dental practice[.2] Now in clinical dentistry , the operators are using high level of microscope assisted precision dentistry.

The use of magnifying loupes increase the practitioner's visual perceptiveness and provide superior visualization of the operative field thereby providing an excellent diagnosis capability and perfect treatment outcomes.[6],[7] It not only helps in keen visualization of the canal orifices but also enable the clinician to find the presence of any fractures or cracks in the coronal and radicular portions of a crowned teeth[.7],[8] External root resorption can also be identified with a keen examination of the gingival margin clinically using these.[1] In long standing carious permanent teeth, the root canals or the pulpal floor can be sclerosed or calcified. In such cases it becomes very difficult for a clinician even with a deep clinical knowledge to locate the canal orifices.[9] This toil can be overcome by using a suitable magnifying device which provides a better visualization of the pulpchamber. The magnifying loupes aids in accessing and locating the canal orifices and also to detect accessory canals , if any. Due to the complex morphology of root canal systems, location and access to the canals plays a vital role. The loupe helps the operator to find the isthmuses, to identify C-shaped canals, and also part of the canals which is incompletely prepared. It also helps to check the efficiency of biomechanical preparation before obturating the teeth.[1] The magnifying loupes render both optical and ergonomic benefits. It improves operator's working posture making it more upright and brings down the tendancy to develop stress injuries, chronic neck and back pain due to incorrect working postures. The use of magnifying loupes is now a standard and acceptable practice in all dental specialities and is also obligatory for dental students in some institutions.[1]

There are many visual principles to be considered by an operator while wearing a loupe which includes the field of view, depth of the operating area, the angle of view and the configuration and design of the loupe.[10] Increase in magnification decreases the field of view (Shanelec D , 1992)[11].Though magnifying loupes are available till 6x magnification, it is recommended to use 2x – 2.5x by new users for visualization of more than one quadrant in day to day dental practise. For visualizing a single quadrant 3.5 x magnification can be used , but when it comes to 3.5 x the field is very much confined and deep , so can be used only in endodontic purposes. There are basically 2 types of loupes which are used : Galilean and Prismatic. The most commonly used one is Galilean which has a magnification of not more than 3.5x . Prismatic ones provide enhanced quality and visualization , but is heavier and costly. The lenses are fixed to the frames and adjusted according to the convenience and requirement of the operator. [10]

The studies done on the use of magnifying loupes in pediatric dentistry is limited. Though various preventive methods have been adopted in the field of pedodontics on dental caries , early loss of primary teeth due to caries is still a major hurdle. Initial carious cavity can be arrested or restored with suitable restorative materials, but if seen and treated at later stages more invasive methods will have to be adopted. The prime objective in this field is to preserve the integrity of the arch by retaining the deciduous dentition in the mouth till its physiological exfoliation takesplace. For symptomatic deciduous teeth with acute or chronic inflammation , pulpal necrosis , abscess or sinus opening, the treatment of choice is pulpectomy. This procedure includes the absolute removal of the coronal and radicular pulp , complete debridement, and biomechanical preparation of the canal space until it is sterile , succeeded by obturation using a satisfactory resorbable obturating material. The success of this procedure is highly based on the access canal location and biomechanical preparation of the canal space. Adequate cleaning, shaping and debridement of the rootcanals eliminates the infected pulp tissues and also creates a channel for the passage of the irrigating solution till the apical third of the rootcanal.[12],[13] Thus a perfect biomechanical preparation and irrigation helps to achieve a smooth and tapered rootcanal space thereby giving an optimal quality of obturation (Siqueira et al. 1997).[14] The endodontic treatment in primary teeth is more strenous because of the complex anatomy of the tooth , active remodelling of the root apex, closeness of the permanent tooth bud , and also most importantly to manage the behaviour of the child with suitable techniques. All these make pediatric endodontics more complicated and demanding (Garcia-Godoy 1987). [15]

There is not enough literature on use of magnifying loupes in pediatric dentistry despite of the number of advantages of using it in both surgical and non-surgical procedures. Also , few authors have reported that comparatively more time is taken while performing endodontic procedures using magnifying loupes. [16,17]Its use in pedodontic treatment is often considered to evoke anxiety and non- corporation among the children which often limits its use in this field , which is not convincing . The main purpose of this study is to compare the quality of obturation and the time for instrumentation for pulpectomy in primary molars with or without using the magnifying loupes. Thus this study aims to put forward the proper utilization of the benefits of magnification in endodontic procedures in

children, with the help of suitable behavior management techniques. Use of appropriate visual enhancement should be considered by all dental practitioners to make the practice of dentistry more precise, easier, and more enjoyable and also to render a satisfactory treatment to the patient. This formatter will need to create these components, incorporating the applicable criteria that follow.

II. AIMS AND OBJECTIVES

A. Aim:

To clinically evaluate and compare the treatment time and the quality of obturation for pulpectomy in primary molars with or without a magnifying loupe.

B. Objectives :

1. To clinically evaluate and compare the instrumentation time taken for pulpectomy in primary molars with or without a magnifying loupe.
2. To clinically evaluate and compare the quality of obturation done after pulpectomy in primary molars with or without a magnifying loupe

III. METHODOLOGY

The current study was conducted in the Department of Pediatric and Preventive Dentistry at AJ Institute of Dental Sciences, Mangalore after receiving approval from the Ethical Committee [AJEC/REV/244/2018]. A total of 20 children between 4-10 years of age requiring pulpectomy in any one of the primary mandibular molars were selected and treatment was allocated randomly to the patients into one of the two groups; **Group 1**: pulpectomy with magnifying loupe and **Group 2:** pulpectomy without magnifying loupe .The protocol of the study was explained to the parents and the consent was obtained.

Inclusion Criteria:

1. Children aged 4-10 years.
2. Children whose parents give the consent for the treatment.
3. Children having vital or non-vital mandibular primary molar with necrotic pulp, abscess or sinus tract that require endodontic procedure.
4. Children with Frankel's Behavioral Rating Scale of Positive [Rating 3] or Definitely Positive [Rating 4]
5. Presence of adequate coronal tooth structure.
6. Minimum of two-thirds of root remaining.

Exclusion Criteria :

1. Children without assent
2. Children with systemic diseases or infections.
3. Children with children lacking cooperative ability and those with special healthcare needs.
4. Teeth which has already undergone pulpotomies.
5. Teeth with severe internal and external pathologic root resorption.

The pulpectomy procedure was performed in both the groups by a single operator. In Group 1 there was no magnifying devices used whereas in Group 2 the procedure was done using a Galilean magnifying loupe of 2.5 x . Pulpectomy was done using manual instrumentation techniques in two visits. At the first appointment, local anesthesia (with 2% adrenaline) was administered for the tooth indicated for pulpectomy and rubber dam isolation was done. Caries removal and access opening was done using No. 330 pear shaped bur. Coronal pulp was excavated using a sharp spoon excavator and the canals were located. The patency and accessibility of the canal was assessed using No. 10 size K file. Radicular pulp and the pulpal debri was removed with barbed broaches and the working length was determined by superimposing an endodontic instrument over the preoperative radiograph and keeping it 1 mm short of the radiographic apex and then taking a working length radiograph with the estimated working length using No.15 size K file . Cleaning and shaping of the root canals were carried out using hand K files. The files were used sequentially in a pullback direction up to a maximum size of 35–40. The biomechanical preparation was done on the distal canals till 35 size K files and on mesial canals till 30 size K files. Instrumentation was done using quarter pull turn technique. Continuous irrigation with 1 % sodium hypochlorite was done after using each hand file followed by saline irrigation throughout the procedure.[12] The total treatment time taken from access opening till completion of biomechanical preparation for each visit was recorded by a chairside assistant using a stop watch . The canals were then dried using sterile absorbent paper points. Access cavity was then restored with zinc oxide eugenol as temporary sealing cement.

At the second visit, the temporary restoration was removed and root canal was irrigated with 1% sodium hypochlorite and then dried with sterile paper points. Calcium hydroxide and iodoform paste (Metapex) was used for the canal obturation by using pressure syringe technique , inserting the syringe into the root canal near the apex and extruding the material using moderate pressure. The syringe was then slowly withdrawn and the paste was injected until it flows back into the pulp chamber. The paste was then slightly pushed with cotton pellets. Total treatment time was recorded.

A post obturation radiograph was then taken to determine the quality of obturation. The obturation quality was assessed by another pedodontist , who was blinded to the type of magnification and graded the quality of obturation as under filled if the obturation in canals more than 2mm short of the radiographic apex, optimally filled if one or more of the root canals, obturation ends at the radiographic apex and over filling if any of the canals show obturation outside the root (modification of Coll JA and Sadrian R) [18,19]. The access cavity was then restored with Type II GIC followed by stainless steel crown (3M ESPE).

ISSN No:-2456-2165

Fig 1 : Operator doing pulpectomy procedure with magnifying loupe

Fig 2 : Galilean magnifying loupes : flip up (2.5 X)

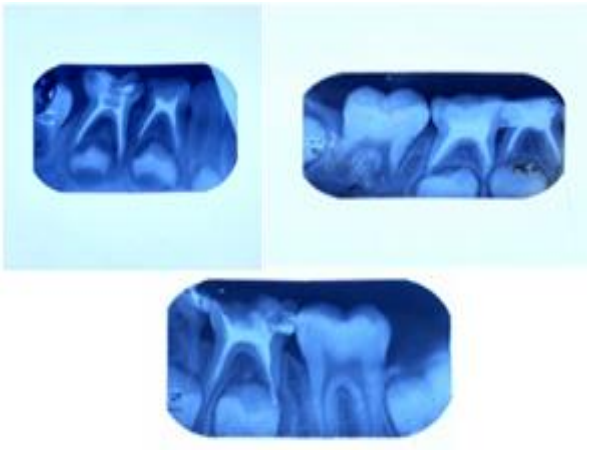
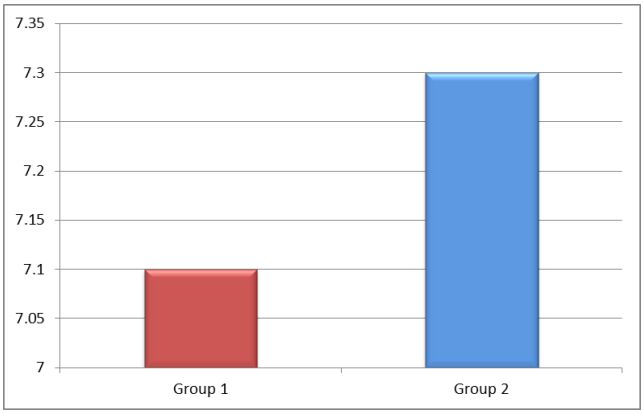


Fig 3 : Immediate postoperative radiographs showing different quality of obturation: a) optimal filling ; b) under filling ; c) over filling.

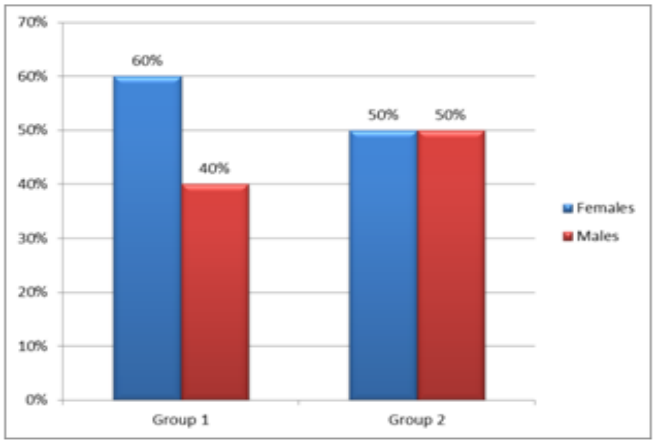
IV. RESULTS:

A total of 20 children who met the inclusion criteria (11 girls and 9 boys) were included in the study. The mean age was 7.10 ± 1.8 years [Table 1 and Fig 1] . The distribution of participants according to gender is tabulated in [Table 2 and Fig 2], wherein non normal distribution was seen in Group 1 where 60 % were females and 40 % males, but in Group 2 there was an equal distribution of the subjects seen. Comparison of the groups by independent t test showed that the mean treatment time without using a magnifying loupe was 41.60 ± 4.06 minutes (totalling the time taken during both visits) which was greater compared to Group 1 (31.60 ± 5.9 minutes)and was statistically significant. [Table 3 & Fig 3] Data was subjected to normalcy test (Shapiro-wilk test). Data showed non normal distribution. Hence non-parametric tests (Mann-whitney) were applied.

For Group 2, without using magnifying loupes, 70% of the teeth were optimally filled, whereas 20% were under and 10 % overfilled , respectively. Whereas in Group 1, 80% of the cases were optimally and 20% were overfilled [Table 4 & Fig 4].Therefore, the quality of obturation was better when the procedure was done with the loupes, but not statistically significant (P value - 0.30)

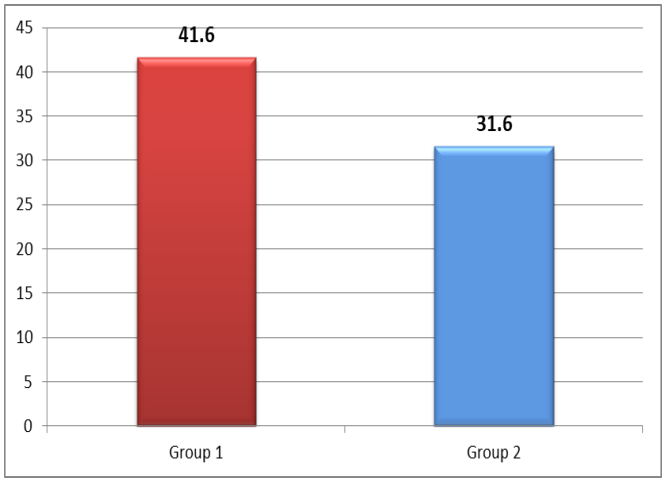


Graph 1: Comparison Of Age between The Groups

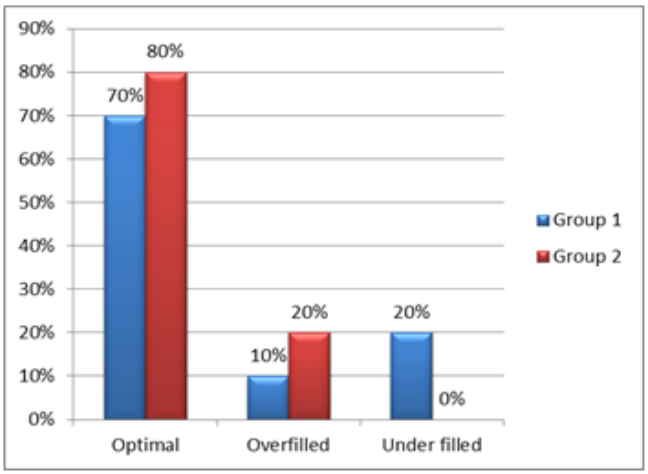


Graph 2 : Gender wise distribution of the children

ISSN No:-2456-2165



Graph 3: Comparison Of Treatment Time Between The Groups



Graph 4: Distribution of the subjects based on the quality of obturation

		Minimum	Maximum	Mean	S.D	Mean diff	P value
Age	Group 1	5	10	7.10	1.853	-0.20	0.79
	Group 2	5	10	7.30	1.494		

Table 1: Comparison of The Age Groups Using Independent Sample T Test

		GROUPS		**Total**
		Group 1	**Group 2**	
Females	Count	6	5	11
	Percent	60.0%	50.0%	55.0%
Males	Count	4	5	9
	Percent	40.0%	50.0%	45.0%
Total	Count	10	10	20
	Percent	100.0%	100.0%	100.0%
Chi-square value- 0.20				
P value- 0.65				

Table 2: Gender-wise distribution of the subjects

		Minimum	Maximum	Mean	S.D	Mean diff	P value
Treatment	Group 1	36	50	41.60	4.061	10.0	0.00*
	Group 2	25	41	31.60	5.929		

Table 3: Comparison Of Treatment time among the Groups Using Independent Sample t Test
Significant*

ISSN No:-2456-2165

		GROUPS		Total
		GROUP 1	GROUP 2	
Optimal	Count	7	8	15
	Percent	70.0%	80.0%	75.0%
Overfilled	Count	1	2	3
	Percent	10.0%	20.0%	15.0%
Under filled	Count	2	0	2
	Percent	20.0%	0.0%	10.0%
Total	Count	10	10	20
	Percent	100.0%	100.0%	100.0%
Chi-square value- 2.40				
P value- 0.30				

Table 4 : Distribution of the subjects based on quality of obturation

V. DISCUSSION

There is a fundamental change seen in approaching an infected primary teeth from extraction to endodontic treatment, ie either by pulpectomy or pulpotomy so as to maintain the natural space available in the dental arch (Pinkham and Casamassimo 2005)[20] in pediatric dentistry. The intention of endodontic treatment in primary teeth is complete removal and debridement of the pulpal tissue and obturating it with a suitable, biocompatible and resorbable material.[21] Providing a satisfactory and quality treatment in shortest time possible is the goal of all dental operators.[12] The evolution and extensive use of magnification in precision dentistry has improved the quality and outcome of endodontic procedures by providing good optical and instrumentation accessibility to the operator[22,23] , most commonly used magnifying aids in root canal therapy being magnifying loupes, surgical microscopes [24,25]and endoscopes[26,27]

In pediatric dentistry, many new endodontic equipments and techniques have been evolved to make the procedure easy and effective.[18] Most modern innovations in dental machineries have made the treatment more easy and accessible in those areas which are difficult to trackdown , thereby enhancing the efficiency and standard of endodontic therapy.[23] Accompanying these equipments , utilization of sharply delineated lighting and magnification has proved to make the treatment more effective (Kim 1997, Cohen 20060[28,29]

Since the use of magnifying loupes in pediatric dentistry is very scarce, the present study has compared the instrumentation time and obturation quality of pulpectomy with and without using loupes. The study results have shown a significant difference in the treatment time while working with a loupe of 2.5 x magnification, though the quality of obturation was slightly enhanced , but not statistically significant.

In this study, the operator and the treatment protocol were standardized to reduce the bias. The pediatric dentist found the use of loupes more effective and useful , rendering the patients an effective and satisfactory treatment. Though a magnification of more than 3.5 x is recommended for endodontic treatment[10], due to the random movements shown by the children during the procedure,which makes the re focusing of the operating field difficult , 2.5 x magnification was used in this study. Also , 2.5 x is the magnification recommended for new users while operating with the loupes.[10]

An absolute and complete access opening is of paramount importance for a successful root canal treatment procedure. Also , the major source of endodontic treatment failure is the incapacity to locate and effectively treat all the rootcanals, which may lead to re infection or even persistence of the infection[30-32] In this study, the treatment time taken for the procedure was significantly less when done with the loupes. This can be due to enhanced field of vision which not only helps the clinician to locate the canals in the access cavity, but also helps to perform each step of the procedure more accurately and precisely in shorter span of time.

The duration of each appointment plays a very important role on a child's behaviour (Rosa et al ,2014).[33] Visual enhancement with the loupes have helped the appointments to be shorter, thereby maintaining the positive behaviour. The shorter treatment time with the use of loupes will create a positive impact on children's behaviour and co-operation through out the treatment . It has also reported to reduce the operator's fatigueness (Musale and Mujawar 2014).[34] Wong et al reported that the treatment time during rootcanal procedure is dependent on the type of canal system, pain present pre operatively , the visit, use of loupes and the operator's experience . Multiple appointments have shown an increase in treatment time which is due to the time required to remove the temporary restoration in the second visit and to sterile and dry the canal with paper points before obturation[1].

The quality of obturation is considered as a key element in determining the success rate of endodontic procedures[35]. In this study an enhanced obturation quality was observed when treated with loupes but it was not statistically significant. The operator found that working with loupes enhanced the accessibility and instrumentation of the canal . The improvement in obturation can be because the use of magnifying loupe, which helps in detailed visualization of the canals, makes the instrumentation more precise, thereby enhancing the obturation quality.

Previous studies in endodontics have shown that magnifying aids like the microscopes, loupes or endoscopes enable the visualization and detection of minute structures , invisible to the naked eye.[36-41] It is stated that these magnifying devices can be used to improve the treatment outcome since all stages of the root or periapical management can be done more accurately with these.[23] But, there is a considerable insufficiency in clinical comparative studies on the end results of performing procedures with and without magnifying aids in endodontic treatment in pediatric dentistry. This probably can be because of difficulty in focusing on the operating field due to random movements of the child being restless, and also few children are apprehensive to the new techniques and new equipments which are employed.

Musculoskeletal disorder (MSD) is apparently a threat and frequent hurdle faced at workplaces.[42] Dentists are considered to be at highrisk for these disorders due to highly required visual demand in the operation field which demands firm and stable postures.[43] A major population of dentists suffer from chronic neck and back pain [44] , which makes correct posture mandatory for an operator to follow.[45,46]According to Behle and Perrin , the use of loupes and microscopes has been shown to improve clinicians' working posture and therefore reduce the occurrence of repetitive stress injuries related to bad posture[47,48]. There are many evidences in literature that supports the statement that use of loupes keeps the operator in correct posture there by eliminating muscle aches.[49,50,51]. Though for a pedodontist, following a proper ergonomic design is practically difficult, in this study use of loupes in cooperative patients has been advantageous in reducing fatigueness both by maintaining correct posture and also by reducing the treatment time.

In endodontics, magnifying devices helps in locating the canal orifices and hidden canals , in perforation repair , retrieving broken file [52],removing fractured post [53], etc. Inspite of these advantages, it is reported that working with loupes might cause potential risks to eye and headache when used continuously for longer time [10]. Its reported that operators take longer time to get aquainted with the use of loupes in clinical practice [17].

VI. CONCLUSION

Taking into consideration the advantages of using loupes in endodontic treatment, pediatric dentists are recommended to utilize its benefits in daily clinical practice so as to render an effective and satisfactory treatment in shorter span of time, thereby gaining the confidence and cooperation of both the child and the parents.

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