

## Awareness and Clinical Application of Chemo Mechanical Caries Removal Agent among General Dentists and Dental Specialists in the Era Of Covid-19 Pandemic: A Questionnaire Survey

Research Article

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### Abstract

**Background and Objectives:** Dental caries is treated using a high-speed hand-piece by dentists, but the aerosol producing nature of the hand-piece has become its major disadvantage in the era of Covid-19 pandemic. Chemo Mechanical Caries Removal (CMCR) agent is a minimal invasive, non-aerosol generating technique of caries removal. Hence, the present questionnaire survey was carried out to assess the awareness and clinical application of CMCR agent among general dental practitioners and various dental specialists.

**Materials and Methods:** A cross-sectional survey, consisting of twenty-two questions, was carried out via online platform. A total of 164 dentists contributed to the study. SPSS version 20 was used to analyse the collected data. Chi square test was applied to assess significance.

**Result:** Overall, 87.1% of the participants were aware of CMCR method among which 64.1% were Pedodontists. About 73.2% of dentists among participants accepted CMCR as an effective as well as alternative method of caries removal. Carisolv (33.5%) and papacarie (25%) were preferred by maximum number of participants.

**Conclusion:** Considering the potential advantages, it is strongly recommended to use CMCR agent as an alternative to conventional technique for caries removal.

**Keywords:** Chemo-Mechanical Caries Removal (CMCR) Agent; Covid-19; Minimal Intervention Dentistry (MID); Papacarie; Carisolv.

### Introduction

The global outburst of pneumonia like acute respiratory illness namely Corona Virus Disease-2019 (Covid-19), has altered the routine of health care professionals. It is considered as a pandemic fatal disease, caused by a zoonotic virus called Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) that transmits through both symptomatic and asymptomatic people via fomites and respiratory droplets produced during speech, coughing, sneezing, etc., [1, 2] Besides respiratory syndrome, multiorgan involvement has been reported such as diarrhea, myalgia, arthralgia,

myocarditis, liver injury etc., [3]

Dental centres are considered to be a reservoir of infections because dental health care professionals are subjected to considerable risk of contamination with numerous micro-organisms presumably due to close physical contact as well as direct contact to saliva, blood, respiratory secretions of patients. In addition, enormous amount of potentially infectious respiratory droplets (>5 µm diameter) and aerosols (≤5 µm diameter) arising from dental procedures while using ultrasonic and high-speed dental hand piece poses higher risk of contamination in the dental clinic. [4]

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According to the available data, Covid positive children were reported to present with milder or no symptoms. Lower systemic illness and superior immune system were the suggested reasons for better prognosis and lower mortality rate in children. Furthermore, the longer incubation period (0-14 days) and difficulty in establishing good hygiene practices, forcing us to consider children as potential carriers of Covid-19.[5]

Alternate non-aerosol techniques are required to eliminate dental caries in order to maintain adequate dental health and sound knowledge to clinically imply these techniques to prevent transmission of Covid-19 via dental set-up. Noise and vibrations produced by high-speed hand piece alters the thermal and pressure effects on pulp with resultant pain and pulpal irritation are considered as typical drawbacks of conventional method. Besides this, aerosol generation has been added as a major disadvantage in this pandemic.[4-6] Since most of the dental clinicians prefer high-speed hand piece for caries removal, the unanticipated emergence of Covid-19 has ceased the routine of dental field. In the light of current knowledge on Covid-19, personal protective equipment has been recommended as a preventive measure.[6] The need for non-aerosol generating methods is emphasized.

Chemo Mechanical Caries Removal (CMCR) agent is an excellent alternative, non-aerosol generating technique indicated in patients with deep dentinal carious lesions. It is introduced to overcome the drawbacks of high-speed hand-piece. The CMCR method utilizes an enzyme based chemical agent that dissolves the infected carious dentin and aids in easy removal based on minimal invasive dentistry. Caries excavation is confined to superficial necrotic infected dentin. CMCR is a non-invasive patient friendly method as it reduces pain, anxiety and discomfort to the patient. Hence, its usage is highly recommended in anxious, medically compromised patients and in pediatric population. CMCR was first described by Habib et al [7]., in 1975 using 5% sodium hypochlorite. At present, various chemo-mechanical caries removal agents available are Caridex, Carisolv, Papacarie, Caricare, Brix 3000.[8, 9]

The aim of the present study was to assess the awareness and the clinical use of CMCR agents among general dentists and dental specialists during the pandemic period.

## Methodology

This research was conducted by a research student from the Department of Pedodontics and Preventive Dentistry, Sri Siddhartha dental college, Tumkur, Karnataka, India. This is a cross sectional questionnaire survey conducted between first week of October 2020 and second week of November 2020.

The validity of the questionnaire was formed by using content validity, Face Validity, Concurrent and Construct validity.

Content validity was conducted through 5 board members who were expert of the subject. Each question was evaluated by rating a) its relevance to the topic and b) its understandability. Each answer was assessed regarding its c) completeness and d) significance for the related question. The four attributes (a-d) of the questions and answers were rated on a 4-point scale (1 = not relevant/meaningless; 4 = highly relevant/meaningful). Also, the

experts were asked to assess whether the items covered all important aspects or if there were missing components. The experts could also comment on every item.

Face validity was done by distributing the questionnaire and the response was concluded by the investigator.

Concurrent validity was measured using a correlation of  $r=0.54$  indicating it being acceptable.

The internal consistency of the questionnaire was measured through Cronbach's Alpha.

Considering 10 items. The  $Q1+Q2+Q3+..Q41=$  COMPOSITE SCORE

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$

N = the number of items.

- $\bar{c}$  = average covariance between item-pairs.
- $\bar{v}$  = average variance.

$r=0.731$  indicating a good homogeneity (i.e) 73% of the questions can be said to be reliable.

The study population included in this study consists of undergraduates, post graduates belonging to various dental specialists and dental practitioners who were registered under Dental Council of India (DCI). The survey questions were distributed through an online link via social media platforms such as WhatsApp, Telegram and Facebook. The study data were obtained by internet e-survey results established by Google Forms.

The survey consisted of a total of twenty-two questions in two parts:

1. First part comprised of five close-ended questions about demographic information (age, gender) and clinical practice (no of years in clinical practice, institution, specialty)
2. Second part questioned the knowledge on CMCR and alternative techniques on deep dentinal caries removal. It comprised of ten close-ended questions and seven open-ended questions.

## Statistical analysis

Descriptive statistics were obtained by downloading excel sheet in google form. Frequency distribution and percentage were calculated for each variable. Data were analysed using the statistical package for social science version 20 (SPSS version 20). In addition to descriptive statistical methods (Frequency distribution), the Chi-Square test was performed for the comparison of the qualitative variables.

## Result

A total of 163 dentists participated in this survey. Their socio-demographic details are described in table 1. Overall, 52.1% of the participants were aged between 18-40, 46.6% were between 26-40 and 1.2% belongs to the age group 41-55. Majority were female (81%) and few male (19%) dentists participated. Clinical

experience of 81.6% of the participants was less than 5 years. 93.9% dentists belong to private institutions and 6.1% belong to government institution. 57.7% were Pedodontists, 23.3% were general dentists and only 19% belonged to other specialties.

Maximum number of participants (87.1%) were aware of CMCR technique (Graph-1). The responses of the 12.9% of participants who were unaware about CMCR agents were excluded from the statistical analysis. Most of the participants (52.4%) stated that they gained information about CMCR through books and journals. Other primary sources of information were webinar (10.3%), faculty (13%), friends (13%), conferences (5.6%) and conventions (5.6%) (Graph-2). Minimal invasiveness (38.4%) was the most common reason for preference of CMCR indicated by participants whereas expensiveness (25.3%) and insufficient knowledge (24.1%) were among the most common reasons given for not preferring CMCR. Awareness and reasons for preferences of the participants for CMCR is enumerated in table 2.

Although majority of the dentists (87.1%) were familiar of Chemo Mechanical caries removal agent, only 9.2% of the participants utilize CMCR in their regular clinical practice. 5.6% of participants are utilizing CMCR based on the patient's attitude, 19.7% rarely use CMCR and 65.5% have never used CMCR in their practice (Graph-3). Of total respondents, 9.1% began CMCR application during Covid crisis [Table 3] (Graph-4).

When questioned about the effectiveness of CMCR, 62.7% of the respondents stated that CMCR is an effective method in dental caries excavation. Though 23.2% of the respondents stated that

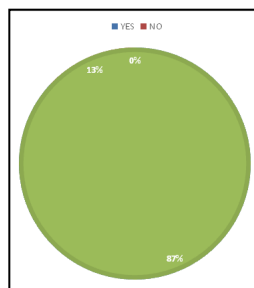
patients are not aware of the procedure, 36.6% appreciated good patient acceptance followed by extremely good (12%) and neutral (16.2%) response. 35.2% of the participants indicated that the use of CMCR is a moderately time-consuming procedure. Almost participants (67.6%) agreed that CMCR reduces the need for local anesthesia during dental caries excavation(Graph-5) [Table 3].

No adverse effects were encountered by most of the respondents (96.5%). Only 3.5% reported that they have encountered adverse effects in patients, but none of them mentioned the type of effect. Majority of the participants (73.2%) agreed that CMCR is an effective alternative for the conventional drilling technique in the removal of caries dentin (Graph-6). Cariesolv was preferred by majority of the respondents (33.7%) followed by papacarie (25%), Brix 3000 (11.5%), Carie care (9.6%) and Cariedex (5.8%). Other alternative technique suggested by most of the participants are Atraumatic restorative treatment (13%) and Silver Diamine Fluoride (13%) followed by smart burs (10.5%), lasers (10.5%) and Air abrasion (5.4%). [Table 4].

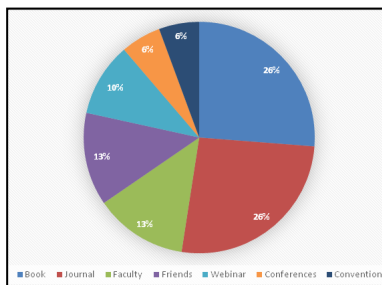
The analysis of awareness according to age, years of clinical experience and dental specialties is enumerated in table 5& graph 7. The initial use of CMCR either before Covid-19 or during Covid-19 according to age, years of clinical experience and dental specialties is enumerated in table 5.

No statistical difference was found when comparing awareness with age group (p=0.6) and clinical experience (p=0.6). Comparing the age groups, participants of 26-40 years (76.9%) initiated the clinical application of CMCR during Covid crisis which is

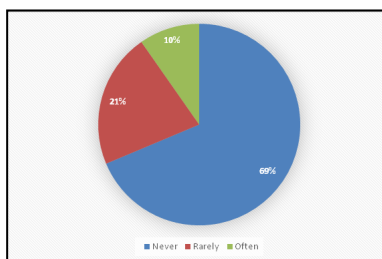
**Graph 1. Awareness of CMCR.**



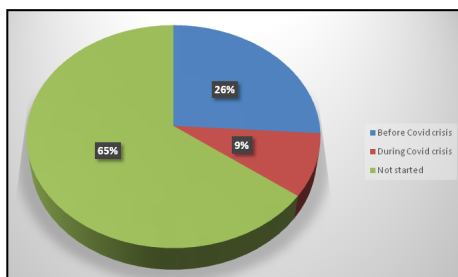
**Graph 2. Participant's source of knowledge about CMCR.**



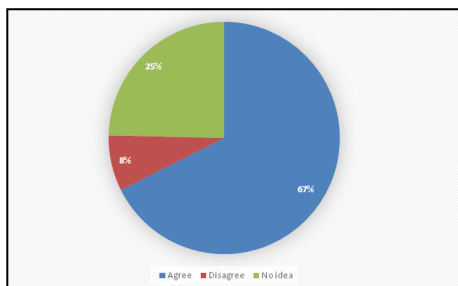
**Graph 3. Using CMCR in clinical practice.**



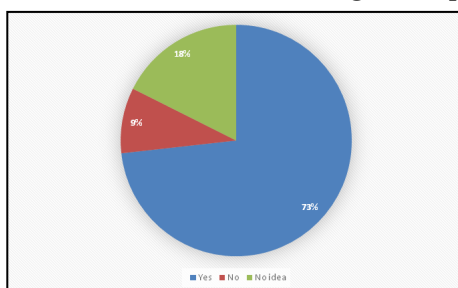
**Graph 4. Distribution of initial use of CMCR.**



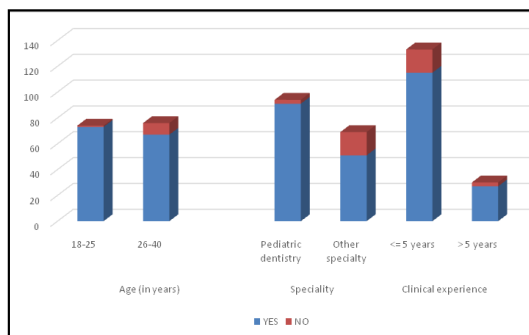
**Graph 5. CMCR reduces the need for Local anesthesia during caries excavation.**



**Graph 6. CMCR is a better alternative than traditional drilling technique in removing carious dentin.**



**Graph 7. Awareness of CMCR among age groups, specialties and clinical experience.**



statistically significant ( $p=0.004$ ). Significant difference was obtained between clinical experience and the initial use of CMCR ( $p=0.002$ ) with higher proportion of clinical use in participants with less clinical experience ( $\leq 5$  years). No statistical difference was found regarding the initial use of CMCR and among specialists ( $p=0.078$ ).

**Discussion**

The first CMCR agent was developed in 1972 using the chemical N-monochloroglycine, commercially as GK-101. Later, to enhance the efficiency of GK-101, the glycine content was replaced with amino butyric acid and marketed with the name Caridex. Disadvantages of Caridex are high-cost, short shelf life, time consuming procedure and requirement of enormous amount of solution. A new CMCR agent, Carisolv gel was commercially introduced in two syringe system, composed of sodium hypochlorite

(0.95%) in one syringe and amino acids (lysine, leucine, glutamic acid), carboxymethyl cellulose, erythrocin in another syringe with certain advantages over Caridex easier to use and highly efficient as compared to Caridex. Drawbacks of Carisolv include short shelf life, extensive training and requirement of customized curettes which are expensive. Papacarie, a papaine based gel was introduced to overcome drawbacks of Caridex. It is a biocompatible gel with antibacterial properties that eliminates only the compromised dentine.[10, 11] Carie-Care, a CMCR agent was discovered in India with an additional benefit of having anti-inflammatory property.[12] Recently, Brix-3000, similar to Papacarie with improved properties was released into market with higher concentration of papaine (3000 U/mg in a concentration of 10%).[13]

Zemouri C et al., (2017)[14] mentioned that around 39 micro-organisms were found in dental setup, including potentially infective organisms such as Legionella pneumophila, the causative agent for pneumonia. Hence, the use of CMCR should be encouraged

Table 1. Socio-demographic characteristics of study participants.

Variables	Categories	Frequency	Percent
Age (in years)	18-25	85	52.1
	26-40	76	46.6
	41-55	2	1.2
Gender	Female	132	81
	Male	31	19
Years of clinical experience	< 5 years	133	81.6
	5-10 years	25	15.3
	10-15 years	3	1.8
	15-20 years	1	0.6
	> 20 years	1	0.6
Institution	Government	10	6.1
	Private/ aided	153	93.9
Specialty	BDS	38	23.3
	Endodontist	6	3.7
	Oral medicine	2	1.2
	Oral pathology	3	1.8
	Oral surgeon	4	2.5
	Orthodontist	6	3.7
	Pedodontist	94	57.7
	Periodontist	5	3.1
	PHD	2	1.2
	Prosthodontist	3	1.8

Table 2. Awareness and reasons for preferences of participants about CMCR.

Variables	Categories	Frequency	Percent
Awareness	No	21	12.9
	Yes	142	87.1
How did you know about CMCR*	Book	107	26.2
	Journal	107	26.2
	Webinar	42	10.3
	Faculty	53	13
	Friends	53	13
	Conferences	23	5.6
	Conventions	23	5.6
	Reasons for Preferring CMCR*	Easy to use	41
Good Patient co-operation	45	18.4	
In anxious patients	42	17.1	
Minimal invasive	94	38.4	
Time consuming	1	0.4	
None of the above	22	9	
Reasons for not Preferring CMCR	Expensive	43	24.4
	Inavailability in department	1	0.6
	Ineffective method	10	5.7
	Not having enough information	47	26.6
	Planning to start soon	1	0.6
	Time consuming	30	17.1
	None of the above	44	25

\* Dichotomy group tabulated at value 1.

**Table 3. Participant’s response with regard to usage, effectiveness, acceptance and feasibility of CMCR.**

Variables	Categories	Frequency	Percent
Have you ever used CMCR in clinical practice?	Depending on attitude of the patient	8	5.6
	Never	92	64.8
	Often	13	9.2
	Rarely	29	20.4
When did you start using CMCR?	Before Covid crisis	37	26.1
	During Covid crisis	13	9.2
	Not started	92	64.8
CMCR method can be used in both children as well as adult.	Yes	81	57
	No	6	4.2
	No idea	17	12
Do you think the use of CMCR is an effective method in caries excavation?	Yes	89	62.7
	No	4	2.8
	No idea	47	34.5
How will you rate patient acceptance when using CMCR?	Extremely good	17	12
	Good	52	36.6
	Neutral	23	16.2
	Not aware of the procedure	33	23.2
	None of the above	17	12
Based on time, how easy it is to work using CMCR?	Less time consuming	25	17.6
	Moderately time consuming	50	35.2
	More time consuming	19	13.4
	None of the above	9	6.3
	Not sure	39	27.5
CMCR reduces the need for Local anesthesia during caries excavation.	Agree	96	67.6
	Disagree	11	7.7
	No idea	35	24.6

**Table 4. Participant’s opinion on adverse effects and alternative preferences over CMCR.**

Variable	Categories	Frequency	Percent
Have you encountered any adverse effects in children or adults after using CMCR?	No	137	96.5
	Yes	5	3.5
Do you think CMCR is a better alternative than traditional drilling technique in removing carious dentin?	Yes	104	73.2
	No	13	9.2
	No idea	25	17.6
Which CMCR do you prefer?	Brix 3000	12	11.5
	Caridex	6	5.8
	Caricare	10	9.6
	Carisolv	35	33.7
	Papa carie	26	25
	None of the above	15	14.5
Other than CMCR, do you prefer any other caries removal technique as a better alternative to traditional drilling?	Yes	37	26.1
	No	104	73.2
	I don’t know	1	0.7
If yes, please mention the technique which you prefer.	Air abrasion	2	5.4
	ART	5	13.5
	Laser	4	10.8
	Silver Diamine Fluoride	5	13.5
	Smart burs	4	10.8
	No Response	16	43.2

**Table 5. Association of Awareness and use of CMCR between age groups, specialities and clinical experience.**

Factors		Awareness		P-Value	When did you start using CMCR			P-Value
		Yes	No		Before Covid crisis	During Covid crisis	Not started	
Age (in years)	18-25	73 (52.1%)	1 (57.1%)	0.669	13 (37.1%)	3 (23.1%)	57 (62.0%)	0.004*
	26-40	67 (47.9%)	9 (42.9%)		22 (62.9%)	10 (76.9%)	35 (38.0%)	
Speciality	Pediatric dentistry	91 (64.1%)	3 (14.3%)	<0.001*	29 (78.4%)	9 (69.2%)	53 (57.6%)	0.078
	Other specialty	51 (35.9%)	18 (85.7%)		8 (21.6%)	4 (30.8%)	39 (42.4%)	
Clinical experience	<= 5 years	115 (81.0%)	18 (85.7%)	0.602	23 (62.2%)	10 (76.9%)	82 (89.1%)	0.002*
	> 5 years	27 (19.0%)	3 (14.3%)		14 (37.8%)	3 (23.1%)	10 (10.9%)	

\* Statistically significant at P<0.05

to prevent the transmission of such nosocomial infections. The present study assessed the awareness of Chemo Mechanical Caries Removal agents among general dentists and various dental specialists.

Majority of dentists participated in this survey were female (81%). The rationale behind the potential impact of feminization in dental field may be due to the presence of a greater number of females in under graduate and post graduate courses in dentistry compared to their male counterparts. 52.1% and 46.6% of the participants belong to the age group 18-25 and 26-40. This suggests the desire of young dentists to participate in online surveys. Despite the fact that the questionnaire survey was directed to all the general dentists and dental specialists, 57.7% of the contributors were Pedodontists. Most of the contributors (87.1%) were aware of CMCR. A high proportion of awareness was found in pediatric dentists (64.1%) which is statistically significant (p<0.001). This can be justified by the importance provided during training and specialization in the pediatric dental field. The advantages of CMCR are it helps in eliminating the necessity for injection and the drilling noise during conventional caries removal, thereby reducing anxiety and reinforcing positive behaviour in children towards dental treatment. Therefore, it is a favourable method which can be employed in children. Differences in the age and clinical experience of the participants did not appear to influence the awareness. In general, they perceived knowledge from books and journals. Yet, 26.1% of the contributors indicated that they do not have adequate knowledge to clinically utilize CMCR. Scrabec J et al (1989)[15], reported the non-inclusion of dental curriculum over CMCR products in USA and Canada resulting in lack of knowledge among dental postgraduates. With the advancement in technology and increased number of research work conducted worldwide, the awareness about the minimal invasive CMCR agents has increased. Studies conducted by Serdar Bagler et al, (2018) [16] and Bijle MNA et al (2013) [17] substantiated the participants willingness to acquire knowledge through seminars or CDE programs. Expensiveness (25.3%) is one of the reasons for rejecting CMCR in dental clinics. In a developing country like India, the high cost of CMCR makes it unaffordable to many.

Only 9.2% of the dentists had established CMCR application during Covid-19 period. This can be explained by the non-aerosol producing nature of CMCR. 57% of the participants indicated that CMCR can be utilized in both children as well as in adults. Although only few studies [18-20] have been conducted in permanent teeth, no controversial results were provided regarding

the use of CMCR in permanent teeth. 67.6% of the responders indicated that CMCR reduces the necessity of local anesthesia.

In the present study, the participants who had never used CMCR in their clinical practice also stated that CMCR is an effective alternative to the traditional drilling technique. The participants might have judged the efficiency of CMCR based on their knowledge obtained through journals, books or faculty and friends.

### Conclusion

The importance of insisting on use of CMCR is that it is an excellent valuable alternative to the high-speed handpiece in excavating the dentinal caries as well as minimal invasive procedure and non-aerosol generating method. CMCR holds a promising solution in this era of Covid-19 pandemic as the risk for the transmission of respiratory infections is lesser. Within the limitations of this questionnaire survey, we could conclude that, extensive research should be conducted to develop an highly efficient and inexpensive CMCR agent with rapid action on infected dentin that is easy to perform, with lesser or no potential adverse effects on oral soft tissues and sound tooth structure.

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