

Effectiveness of the 5A's Approach Combined with CO Analysis in Tobacco Cessation: A Study of 500 Patients at A Dental College-Based Tobacco Cessation Centre

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Abstract- BACKGROUND

Tobacco use continues to pose a significant public health challenge in India, contributing substantially to preventable illness and premature death. Nicotine dependence is a chronic, relapsing condition that often benefits from structured, supportive interventions. The dental outpatient setting offers a valuable and timely opportunity to identify tobacco users and initiate early cessation support. Integrating compassionate behavioral counseling with objective feedback tools, such as carbon monoxide monitoring, may gently enhance patient awareness, strengthen motivation, and support sustained quit attempts. This approach holds promise for improving cessation outcomes while fostering a patient-centered culture of care.

AIM:

To evaluate the effectiveness of the 5A's approach combined with carbon monoxide analysis in tobacco cessation among patients attending a dental college-based tobacco cessation centre.

OBJECTIVE:

1. To assess the nicotine dependence level in tobacco users (smoked and smokeless form).
2. To assess the prevalence of oral diseases due to tobacco use and its stage.
3. To use the newly made chart of 5A's and assess the usefulness of the chart in tobacco cessation counseling.
4. To assess CO using a Smokerlyzer hand-held machine and correlate it with the smoking status.

MATERIALS AND METHODOLOGY:

A two-year institutional study was conducted among 500 patients attending the Department of Oral Medicine and Radiology. Individuals identified as tobacco users were enrolled and received structured cessation support based on the 5A's approach (Ask, Advise, Assess, Assist, Arrange). Nicotine dependence was evaluated using the Fagerström Test for Nicotine Dependence, and baseline exhaled carbon monoxide (CO) levels were measured with a Smokerlyzer device to provide objective feedback. Each participant underwent individualized behavioral counseling, received educational materials on the health

effects of tobacco use, and was guided in developing a structured quit plan tailored to readiness and dependence level. Follow-up assessments were conducted to monitor progress, reinforce motivation, and evaluate changes in tobacco use behavior and CO levels over time.

RESULTS:

The study population was predominantly middle-aged, with the highest proportion of participants in the 30–40 year age group (31.9%), followed by 40–50 years (25.3%) and 20–30 years (24.1%), while smaller proportions were observed in the 50–60 years (10%), 0–20 years (4.2%), and 60–70 years (3.2%) age groups, and very few participants belonged to the 70–80 year age group. Assessment of nicotine dependence using the Fagerström Test indicated that the majority of participants had minimal dependence (456; 91.2%), followed by moderate dependence (42; 8.4%), with only 2 participants (0.4%) showing high dependence. Among minimally dependent individuals, smoking was the most common form of tobacco use (298), followed by smokeless tobacco (186), while very few used both forms (2); among moderately dependent individuals, 8 were smokers and 5 used smokeless tobacco, and one highly dependent participant was a smoker. With regard to tobacco-related oral morbidities, Oral Submucous Fibrosis (OSMF) was the most frequently observed condition (211 cases), followed by leukoplakia (91) and periodontitis (62), while other conditions included smoker's palate (8), candidiasis (6), tobacco pouch keratosis (3), gingivitis (2), and other tobacco-associated lesions (117). In proportional distribution, OSMF accounted for 42.2% of cases, followed by leukoplakia (18.2%) and periodontitis (12.4%). Comparison of exhaled carbon monoxide (CO) levels before and after counselling showed a reduction in CO exposure, with the number of individuals with 0 ppm increasing from 120 before counselling to 213 after counselling, while higher CO levels decreased considerably. Similarly, comparison of nicotine dependence levels before and after counselling demonstrated improvement, as 121 participants became tobacco-free following counselling, minimal dependence decreased from 456 to 358, moderate dependence reduced from 42 to 21, and no participants remained in the highly dependent category, indicating the effectiveness of tobacco

cessation counselling in reducing nicotine dependence and tobacco exposure.

CONCLUSION:

The present study demonstrates that the 5A's counseling approach combined with carbon monoxide (CO) monitoring as an effective strategy for promoting tobacco cessation in a dental outpatient setting. The integration of structured behavioral counseling with objective feedback from CO analysis helped increase patient awareness, motivation, and engagement in quitting tobacco. A notable reduction in nicotine dependence levels and CO exposure, along with the increase in tobacco-free individuals after counseling, highlights the positive impact of this intervention. Therefore, incorporating the 5A's model with CO monitoring in dental clinics can serve as a practical and valuable approach for early intervention and effective tobacco cessation support.

I. INTRODUCTION

Tobacco use remains one of the leading preventable causes of morbidity and mortality worldwide and is strongly associated with a wide range of oral and systemic diseases. In India, the burden of tobacco consumption is particularly high due to the widespread use of both smoked and smokeless forms of tobacco, contributing to conditions such as oral potentially malignant disorders, oral cancer, periodontal disease, and other systemic complications. Nicotine dependence is a chronic and relapsing condition that often requires structured behavioural support to achieve successful cessation. Healthcare professionals, especially dental practitioners, are in a unique position to identify tobacco users during routine dental visits and provide timely interventions to encourage quitting.¹²

The 5A's approach—Ask, Advise, Assess, Assist, and Arrange—is a widely recommended evidence-based counselling strategy designed to help healthcare providers deliver brief but effective tobacco cessation interventions in clinical settings. This model emphasizes systematic identification of tobacco users, personalized advice to quit, evaluation of readiness to change, assistance in developing quit plans, and follow-up support to prevent relapse. Studies have

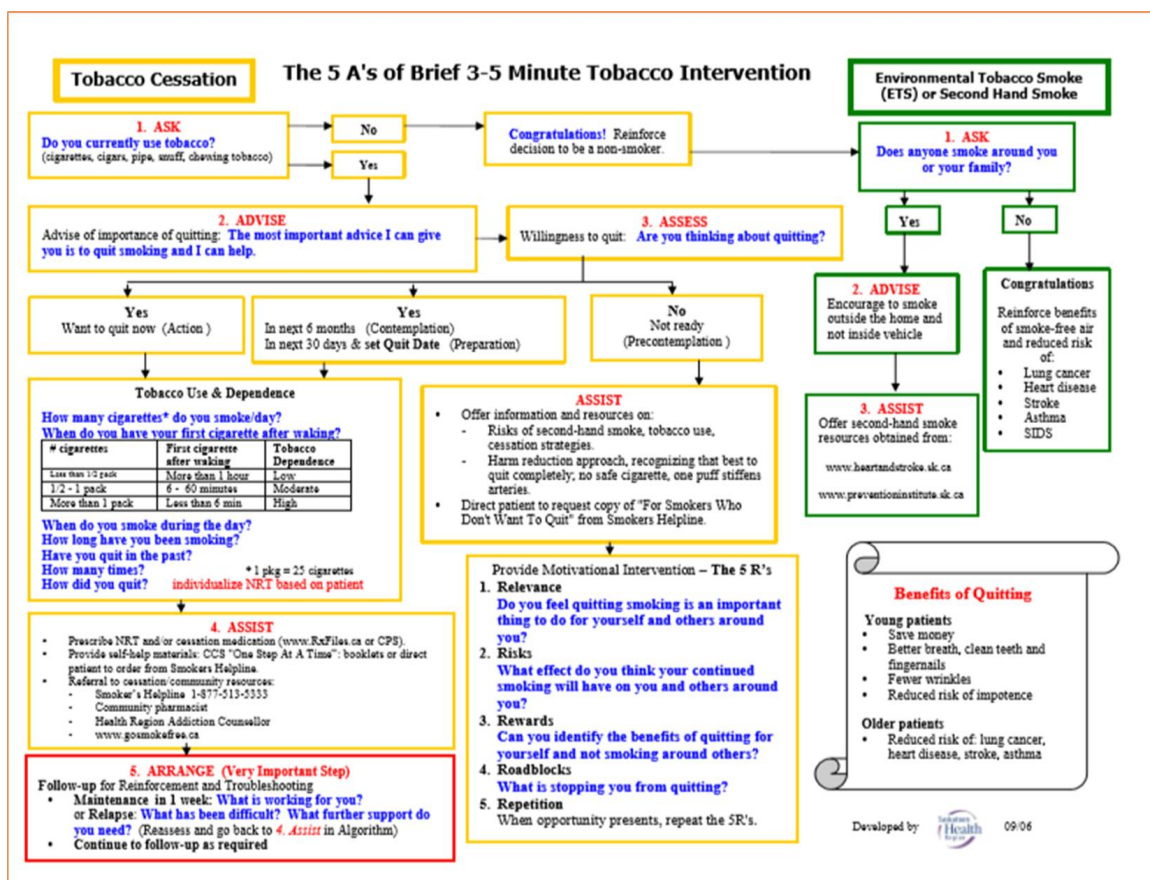
shown that brief counselling based on the 5A's framework can significantly improve quit attempts and long-term abstinence rates among tobacco users.³ In addition to behavioural counselling, the use of objective biomarkers such as exhaled carbon monoxide (CO) has gained importance in tobacco cessation programs. Measurement of CO levels using handheld devices like the Smokerlyzer provides immediate and visible feedback regarding recent tobacco smoke exposure. This real-time feedback can enhance patient awareness of the harmful effects of smoking, reinforce counselling messages, and motivate individuals to reduce or stop tobacco use. Evidence suggests that integrating CO monitoring with cessation counselling can improve patient engagement and strengthen motivation to quit.⁴⁵

Therefore, combining the structured 5A's counselling approach with CO analysis may provide a comprehensive strategy for tobacco cessation in clinical practice. The dental outpatient setting, where patients frequently present with tobacco-related oral conditions, offers an ideal opportunity for implementing such interventions and promoting early behavioural change.

II. MATERIALS AND METHODOLOGY

Outpatients reporting to the Department of Oral Medicine and Radiology at Al-Badar Rural Dental College and Hospital, Kalaburagi, were included in the study. The study was conducted over a period of two years and comprised 500 patients attending the department. Following a comprehensive oral examination, patients were asked about their tobacco use habits. Individuals identified as tobacco users were referred to the Tobacco Cessation Center, a fully equipped facility established in accordance with the Dental Council of India (DCI) guidelines, for further evaluation and tobacco cessation counseling.

- A Huge 10 X 8 ft chart specially made for the counseling and which is attracted to the attention of all the tobacco users towards it after entering the tobacco cessation center.



- Chart of 5 days quit plan in Urdu, Kannada, Hindi.
- Chart showing the De-addiction center address and phone numbers in the city.
- Weighing machine
- Laptop for showing videos
- 6 Files:
 - 1st file containing the Registration form
 - 2nd file containing proforma of study and consent of the patient
 - 3rd file containing Fagerstrom nicotine dependence score proforma
 - 4th file containing the 60 coloured charts for explaining the patient.
 - 5th file containing the leaflet and form to be given to the patient during 5 days quit plan and benefits of tobacco cessation.
 - 6th file containing the leaflets of Cold turkey method for the patient and list of alternative and

healthy products instead of tobacco to overcome the craving of tobacco and leaflet of benefits of quitting.

THE STUDY WAS DIVIDED INTO 10 PARTS:

1. Filling up the Tobacco cessation center registration form which is provided by National guidelines for Tobacco cessation.
2. Assessment of Nicotine dependence using the Fagerstrom test, which is a validated questionnaire for a smoked and smokeless form of tobacco use.
3. Diagnosis of oral disease.
4. Detail counseling of patients in sequence based on 5A's {Process of Cessation- Interventional strategies the 5 A's}.

SEQUENCE OF TOBACCO COUNSELLING	
1. ASK	
a. Case history	• Self help interventions for Tobacco cessation
b. Nicotine dependence level	➤ Audiotapes
c. Nicotine content and chemical composition	➤ Videotapes
d. Mechanism of action of nicotine	➤ Leaflet
e. Viscious cycle of smoking	➤ Manuals
f. Nicotine craving cycle	➤ CD
g. Ill effects of tobacco	➤ Internet
2. ADVICE TO QUIT	➤ Website
a. Benefits of quitting	➤ TV
3. ASSESING THE READINESS TO CHANGE	➤ Newspaper
a. Prochaska model	➤ Telephone help lines
4. ASSIST	➤ Quit and win competition
➤ Not ready to quit	➤ Challenge
a. 5 R Chart	• Minimal clinical intervention
b. Encourage ,motivate and tell benefits of quitting	• Intensive clinical intervention
➤ If ready then	➤ Individual counselling
a. START Chart	➤ Supportive group session
b. 5 Day plan	• Aversion therapy
c. Withdrawal symptoms	➤ Rapid smoking
d. Tips of quitting smoking	➤ Focused smoking
e. Behavioural therapy	➤ Smoke holding
• 4D	➤ Convert sensitization
• 3R	➤ Excessive smoking
f. Carbon monoxide poisoning	➤ Symbolic aversion
• Breath analyzer	➤ Paced smoking
• Levels of carbon monoxide	➤ Electric shocks
• Details of carbon monoxide	➤ Self paced smoking
g. Cessation method	➤ Bitter pills
• Non pharmacological cessation	h. Other forms of therapy
➤ Tapering	• Acupuncture
➤ Cold turkey	• Hypnosis
• Pharmacological Methods	• Yoga and meditation
➤ Nicotine patch	
➤ Nicotine gum	5. ARRANGE
➤ Nicotine inhaler	a. Follow up
➤ Bupropion	b. Relapse
➤ Varenicline	c. Relapse prevention
	d. Deaddiction Centres

Many questionnaires have been developed which act as a surrogate marker of nicotine dependence. One such questionnaire is the Fagerström Test for Nicotine Dependence (FTND) and Modified Fagerstrom Test for Nicotine Dependence (FTND-ST).

The questionnaire was used on smokers and smokeless tobacco users in different parts of the world and its reliability is confirmed in a different population.

FAGERSTORM NICOTINE DEPENDENCE
SCALE – SMOKING

Sr. NO	Question	Answer	Points
1.	How soon after you wake up do you smoke your first cigarette?	Within 5 minutes 5 to 30 minutes 31 to 60 minutes After 60 minutes	(3 points) (2 points) (1 points) 1. points)
2.	Do you find difficult not to smoke in places where you shouldn't, such as in church or school, in a movie, at library, on a bus, in court or in a hospital?	Yes No	(1 point) (0 point)
3.	Which cigarette would you most hate to give up; which cigarette do you treasure the most?	The first one in the morning Any other one	(1 point) (0 point)
4.	How many cigarette do you smoke each day?	10 or fewer 11 to 20 21 to 30 31 or more	(0 points) (1 points) (2 points) (3 points)
5.	Do you smoke more during the first few hours after waking up than during the rest of the day?	Yes No	(1 point) (0 points)
6.	Do you still smoke if you are so sick that you are in bed most of the day, or if you have a cold or the flu and have trouble breathing?	Yes No	(1 point) (0 points)

A standard questionnaire of Fagerstrom Test for Nicotine Dependence (FTND Revised Version) for smoking was given by Heatherton et al. (1991) and smokeless form of tobacco given by Ebbert et al. (2006) were administered to each subject.

MODIFIED FAGERSTORM NICOTINE
DEPENDENCE SCALE-SMOKELESS TOBACCO
Fagerstrom Test for Nicotine Dependence - Smokeless
Tobacco (FTND- ST)

No.	Questions	Answers	Points
1.	How soon after you wake up to do you place your first dip?	Within 5 min 6-30 min 31-60 min After 60 min	3 2 1 0
2.	How often do you intentionally swallow tobacco juice?	Always Sometimes Never	2 1 0
3.	Which chew would you hate to give up most?	First one in the morning Any other	1 0
4.	How many cans/ pouches per week do you use?	More than 3 2-3 1	2 1 0
5.	Do you chew more frequently during the first hours after awakening than during rest of the day?	Yes No	1 0
6.	Do you chew if you are so ill that you are in bed most of the day?	Yes No	1 0

Source: Ebbert JO, Patten CA, Schroeder DR. The Fagerstrom Test For Nicotine Dependence Smokeless Tobacco (FTND-ST). Addictive Behaviours 31(9), 2006, 1716-1721. doi:10.1016/i.addbeh.2005.12.015

5. Providing leaflets for the benefits of tobacco cessation.
6. Providing a chart of 5 days quit plan with instructions and how to follow it.
7. Providing leaflets of the Cold turkey method and making them aware of the use of healthy and alternative products instead of tobacco.
8. Showing videos of awareness of the hazardous effects of tobacco and the benefits of tobacco cessation.

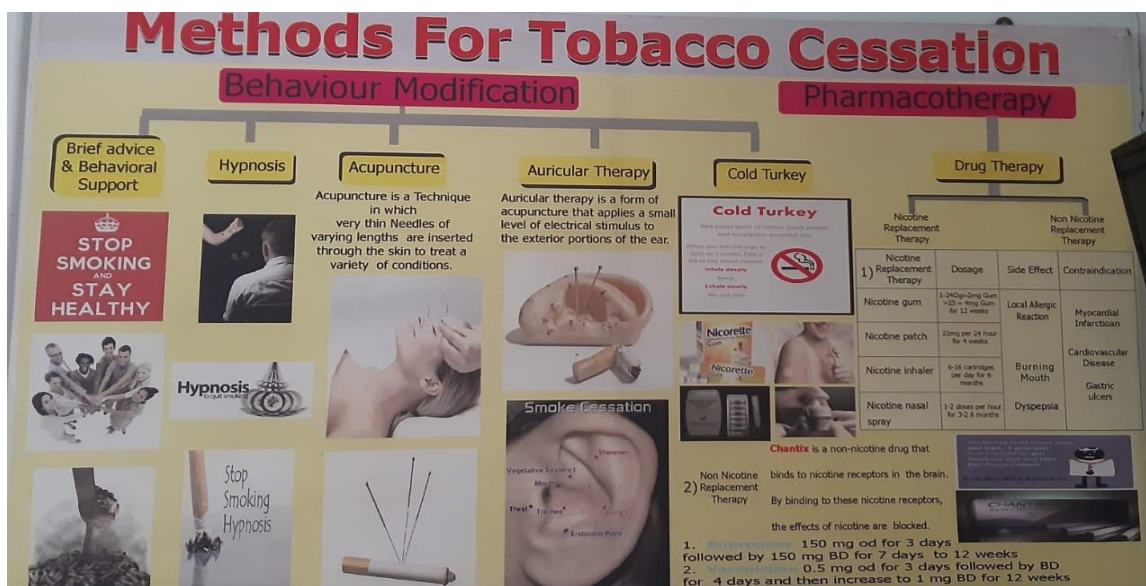
9. Recall for Follow-up.
10. Assessment of nicotine dependence using the Fagerstrom test, which is a validated questionnaire for a smoked and smokeless form of tobacco which will be used again during follow-up.



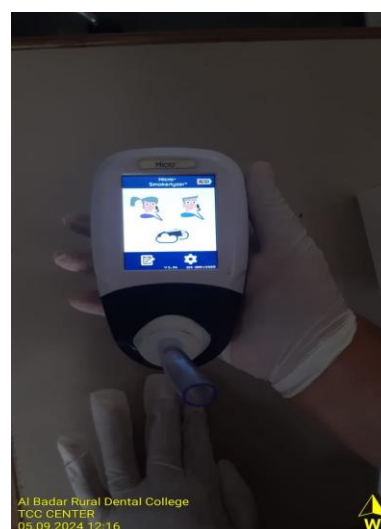
- Data was collected by face- to- face interview method by having questions about socio-demographic details and tobacco use.
- Nicotine dependence was assessed using the Fagerstrom test, a validated questionnaire for nicotine dependence. This was a questionnaire-based prospective cross-sectional survey.
- The patients were told about the nicotine dependence score and their diagnosis for the oral condition which is due to tobacco use.
- Patients were told about the importance of tobacco cessation centers and the tobacco cessation program.
- The counseling was done by explaining the chart which contents of 5 A's and the counseling in the

proper sequence by stepwise and point wise.

- The 10 colored charts was explained in detail through local and simple language.
- The harmful contents of cigarette, a vicious cycle of smoking, benefits of quitting, Ill-effects of tobacco on general and oral health, mechanism of action of nicotine, withdrawal symptoms, 5 days quit plan were used ,5 R chart was utilized if the patient was not ready to quit.
- If ready then START chart, tips of quitting smoking, 4D and 3R behavioral therapy, cessation methods, self-help interventions, individual and group counseling, other forms of therapy like yoga, acupuncture, meditation, hypnosis, follow-up, etc.



- As a result, the counselor understood the withdrawal symptoms and the difficulties the patient faced in overcoming tobacco use. Then the patient was also given leaflets of the Cold turkey method.
- In this method, the patient was asked to take 4 to 5 black pepper and make a powder of it and mix 3 to 4 drops of lemon juice and eucalyptus oil into it and will be told to store it in a small box and advised to smell whenever they had a craving of tobacco.
- The patients were also given a list of alternative and healthy products instead of tobacco to use for the craving of tobacco and they were asked to use almonds, cashew nuts, dates, amla candy, chocolate, a banana or apple or carrot or fennel seeds whenever they have a severe desire or craving of tobacco so that whenever they will be using these products instead of tobacco they will be benefitted according to the health-wise.
- The carbon monoxide smokerlyser was used to the tobacco patients.
- By using the smokerlyser the patient was asked to inhale the breath for 15 sec and after completion of the 15 sec patient was asked to exhale the breath slowly so that the co level was analysed on the smokerlyser in ppm.



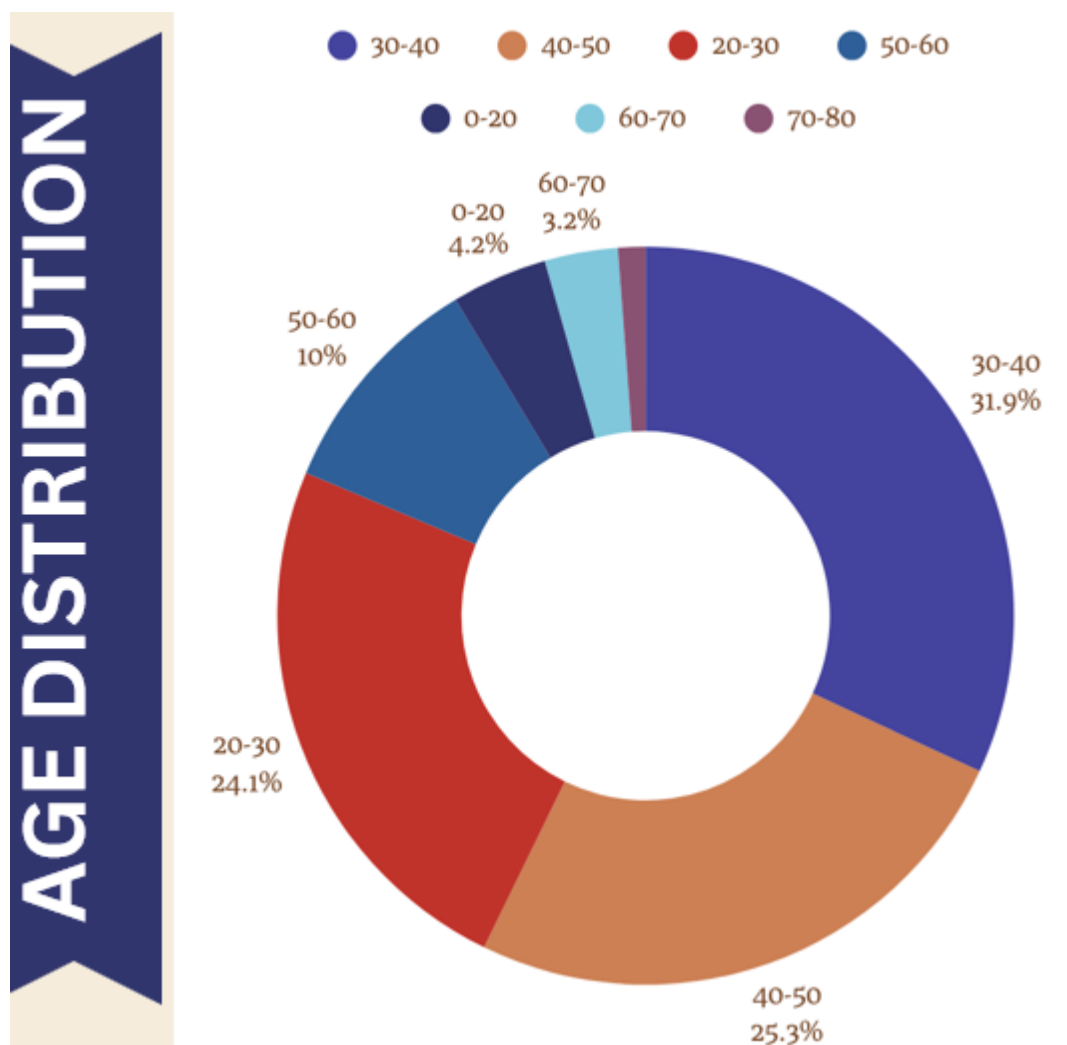
STATISTICAL ANALYSIS:

Statistical data was analyzed by IBM SPSS 25.0 version software. Collected data was spread on excel sheet and prepared master chart. Through the master chart tables and graphs were constructed. If P-value was less than 0.05 considered as significant.

RESULTS:

AGE DISTRIBUTION:

The study population was predominantly middle-aged. The highest proportion of participants belonged to the 30–40 year age group (31.9%), followed by 40–50 years (25.3%) and 20–30 years (24.1%). Older age groups were less represented, with 50–60 years accounting for 10% of participants, 0–20 years for 4.2%, and 60–70 years for 3.2%, while individuals aged 70–80 years constituted only a very small fraction of the sample. (GRAPH 1)

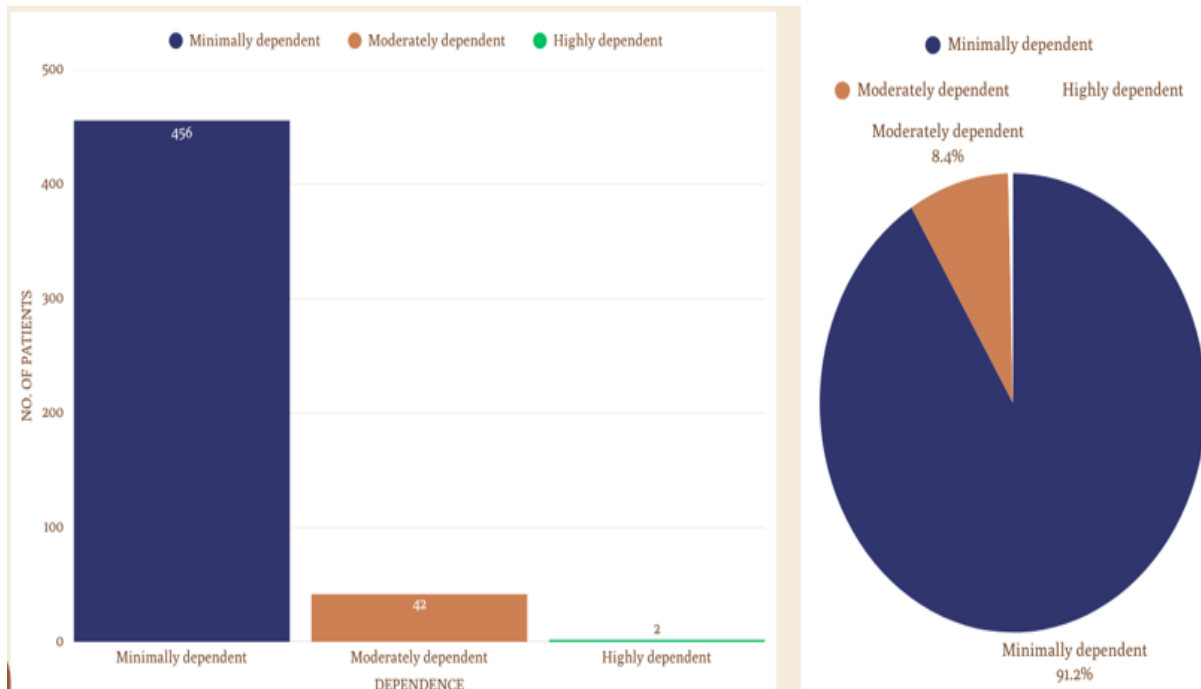


GRAPH 1 : AGE DISTRIBUTION

NICOTINE DEPENDENCE LEVELS:

Assessment using the Fagerström Test for Nicotine Dependence showed that the majority of participants were minimally dependent (456 patients; 91.2%). A

smaller proportion demonstrated moderate dependence (42 patients; 8.4%), while only a negligible number were highly dependent (2 patients; 0.4%), indicating that most tobacco users in the study exhibited low levels of physiological dependence. (GRAPH 2)

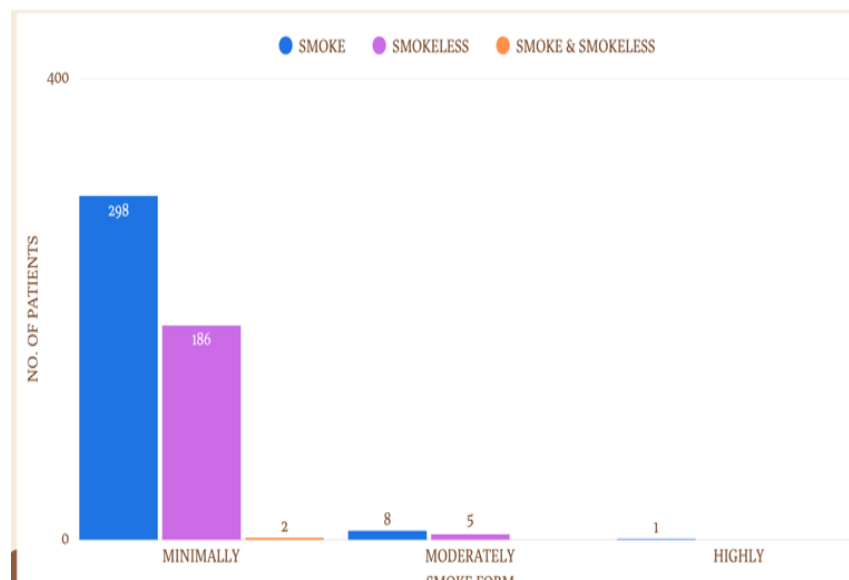


GRAPH 2: NICOTINE DEPENDENCE LEVELS

FORM OF TOBACCO USE BY DEPENDENCE LEVEL:

Among minimally dependent individuals, smoking was the most common form of tobacco use (298 patients), followed by smokeless tobacco use (186 patients), with a very small number using both forms

(2 patients). Among moderately dependent individuals, 8 patients used smoked tobacco and 5 used smokeless forms. Only one highly dependent participant reported tobacco use, and this individual was a smoker (GRAPH 3)



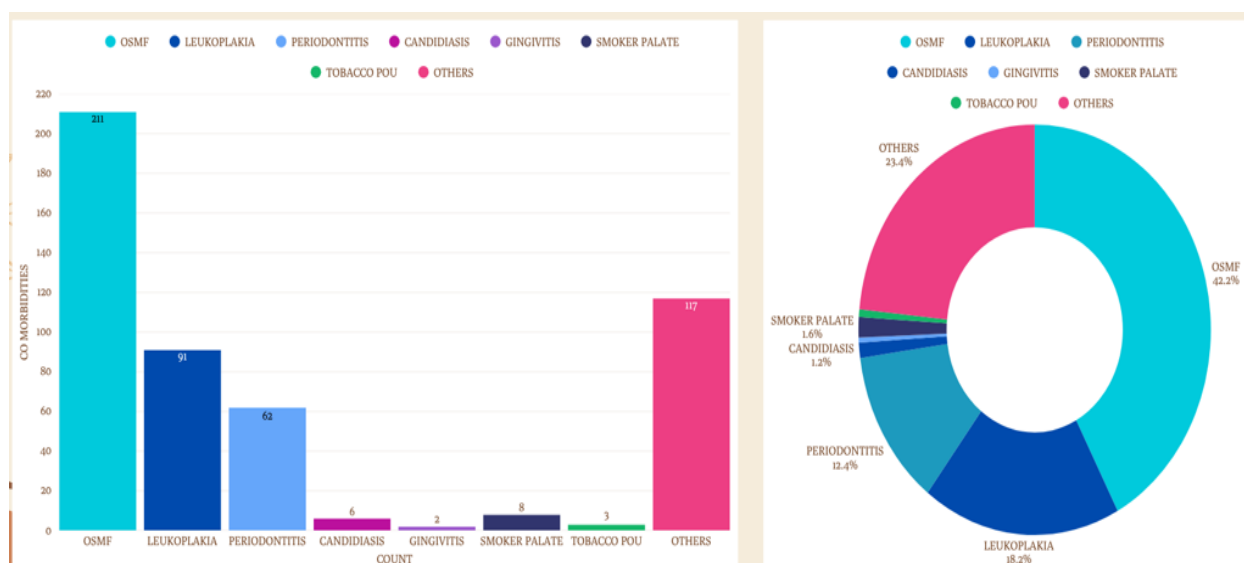
GRAPH 3: FORM OF TOBACCO USE BY DEPENDENCE LEVEL

TOBACCO-RELATED ORAL MORBIDITIES (FREQUENCY):

Oral Submucous Fibrosis (OSMF) was the most frequently observed condition, affecting 211 patients. This was followed by leukoplakia (91 cases) and periodontitis (62 cases). Other findings included candidiasis (6 cases), smoker's palate (8 cases), tobacco pouch keratosis (3 cases), and gingivitis (2 cases). A substantial number of patients (117 cases) presented with other tobacco-associated oral conditions.(GRAPH 4)

TOBACCO-RELATED ORAL MORBIDITIES (PROPORTION):

In proportional distribution, OSMF accounted for the largest share of oral lesions (42.2%), followed by leukoplakia (18.2%) and periodontitis (12.4%). Other conditions collectively constituted 23.4% of cases. Less frequent findings included smoker's palate (1.6%), candidiasis (1.2%), tobacco pouch keratosis (approximately 0.6%), and gingivitis (approximately 0.4%), indicating a predominance of potentially malignant disorders among tobacco users.(GRAPH 5)

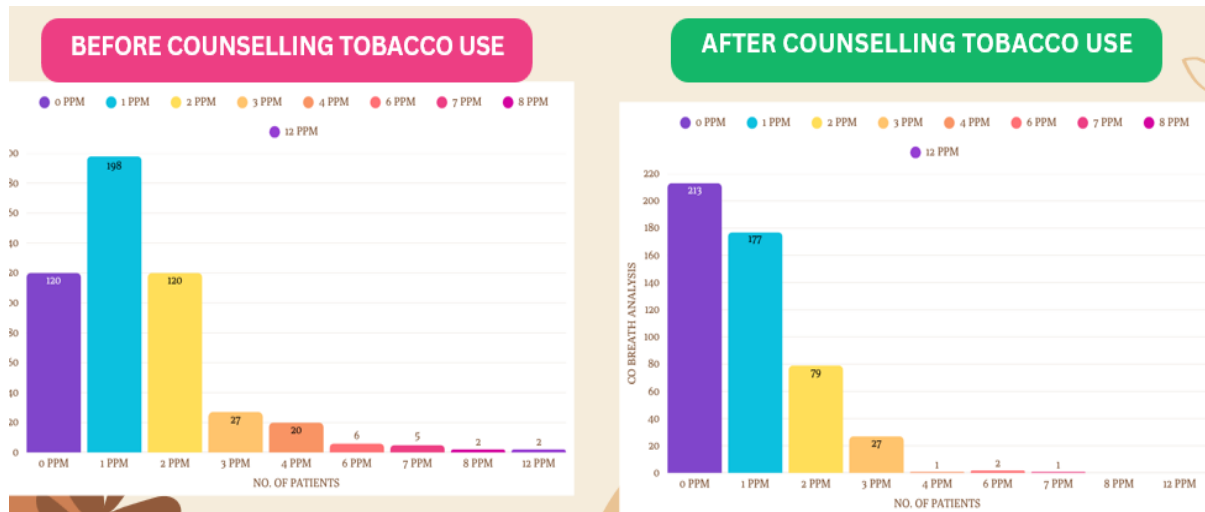


GRAPH 4 & GRAPH 5: TOBACCO-RELATED ORAL MORBIDITIES (FREQUENCY) & TOBACCO-RELATED ORAL MORBIDITIES (PROPORTION)

COMPARISON OF CO LEVELS BEFORE AND AFTER COUNSELING

The comparison of exhaled carbon monoxide (CO) levels before and after tobacco cessation counselling demonstrated a noticeable reduction in CO exposure among the study participants. Before counselling, the majority of patients exhibited measurable CO levels, with the highest proportion observed at 1 ppm (198 patients), followed by 0 ppm (120 patients) and 2 ppm (120 patients). Smaller numbers of patients showed higher CO levels, including 3 ppm (27 patients), 4 ppm (20 patients), 6 ppm (6 patients), 7 ppm (5 patients), 8 ppm (2 patients) and 12 ppm (2 patients).

After counselling, a clear shift toward lower CO levels was observed. The number of individuals with 0 ppm increased substantially to 213 patients, indicating improvement in smoking exposure status. Patients with 1 ppm decreased to 177, and those with 2 ppm reduced to 79. The number of individuals with higher CO levels also declined, with 3 ppm recorded in 27 patients, 6 ppm in 2 patients, and only 1 patient showing 7 ppm, while 8 ppm and 12 ppm levels were no longer observed. This reduction in higher CO values suggests that tobacco cessation counselling had a positive impact in lowering recent tobacco smoke exposure among participants. (GRAPH 6)

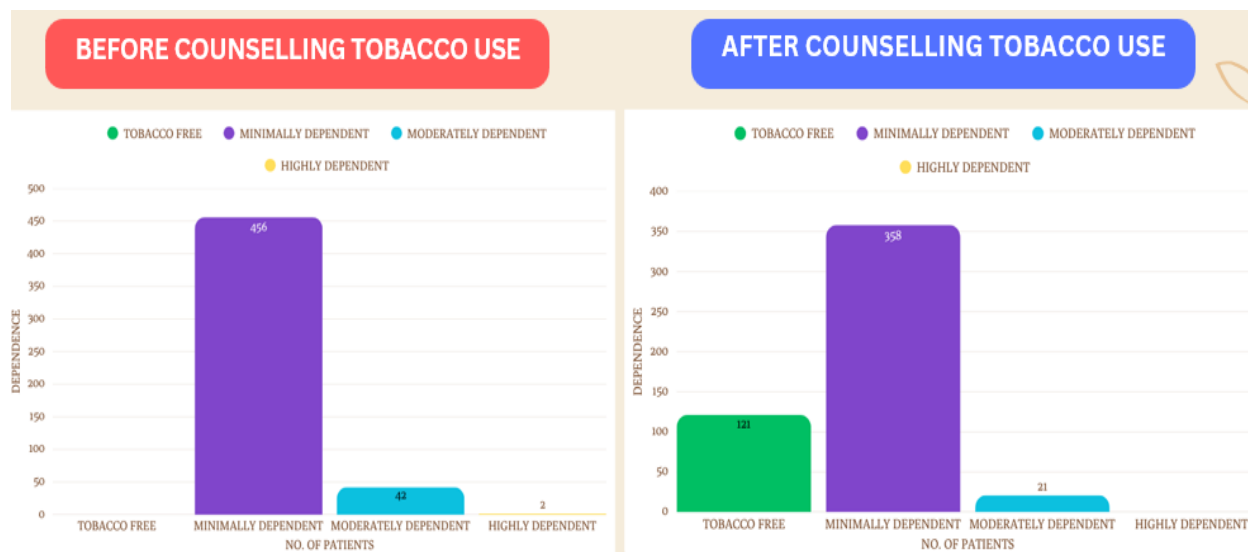


GRAPH 6: COMPARISON OF CO LEVELS BEFORE AND AFTER COUNSELLING

COMPARISON OF NICOTINE DEPENDENCE BEFORE AND AFTER COUNSELING

The comparison of nicotine dependence levels before and after counselling showed a significant improvement in tobacco cessation outcomes. Prior to counselling, the majority of participants were categorized as minimally dependent (456 patients) according to the nicotine dependence assessment. A smaller proportion demonstrated moderate dependence (42 patients), while high dependence was observed in only 2 patients. None of the participants were classified as tobacco-free before counselling.

Following counselling, a considerable behavioural change was observed. 121 participants became tobacco-free, indicating successful cessation after intervention. Although minimally dependent individuals decreased to 358 patients, this category still represented the largest group. The number of moderately dependent individuals reduced to 21 patients, and no participants remained in the highly dependent category. These findings highlight the effectiveness of counselling in reducing nicotine dependence and increasing the proportion of tobacco-free individuals in the study population.(GRAPH 7)



GRAPH 7: COMPARISON OF NICOTINE DEPENDENCE BEFORE AND AFTER COUNSELING

III. DISCUSSION

Tobacco use continues to be a major risk factor for several oral and systemic diseases and remains a significant public health concern, particularly in developing countries like India. The present study evaluated the effectiveness of the 5A's counselling approach combined with carbon monoxide (CO) monitoring in tobacco cessation among patients attending a dental outpatient department.

In the present study, the majority of participants belonged to the 30–40 year age group, followed by the 40–50 and 20–30 year groups, indicating that tobacco use was more prevalent among the middle-aged population. Similar findings were reported by Naik N⁶ and colleagues, who observed a higher prevalence of tobacco use and oral mucosal lesions among individuals in the third and fourth decades of life. Middle-aged individuals are often more exposed to long-term tobacco habits, which may explain the higher representation in this group.

Assessment of nicotine dependence using the Fagerström Test for Nicotine Dependence revealed that the majority of participants had minimal dependence, while only a small proportion showed moderate or high dependence. Comparable findings were reported by Karl-Olov Fagerström⁷ who noted that many tobacco users demonstrate low to moderate levels of dependence despite prolonged exposure. Similarly, studies by Neal L. Benowitz⁵ have emphasized that nicotine dependence varies widely among individuals and may be influenced by behavioural, psychological, and social factors.

The present study also demonstrated that smoking was the most common form of tobacco use, followed by smokeless tobacco. This observation is consistent with findings reported by Saman Warnakulasuriya² who highlighted that both smoked and smokeless tobacco contribute significantly to oral health problems in South Asian populations.

Among tobacco-related oral morbidities, oral submucous fibrosis (OSMF) was the most frequently observed lesion, followed by leukoplakia and periodontitis. These findings are consistent with studies by Saman Warnakulasuriya² who reported a

strong association between smokeless tobacco use and the development of oral potentially malignant disorders such as OSMF and leukoplakia. Similar observations were also reported by Naik N⁶ and colleagues, who found OSMF to be one of the most common lesions among tobacco users in India.

The comparison of exhaled CO levels before and after counselling in the present study showed a clear reduction following tobacco cessation counselling. The number of participants with 0 ppm CO levels increased significantly after counselling, while higher CO levels declined. This finding supports the observations of Martin J. Jarvis⁴ who demonstrated that exhaled carbon monoxide is a reliable biomarker for recent smoking exposure and can be effectively used to monitor smoking status and motivate cessation.

Similarly, the comparison of nicotine dependence levels before and after counselling showed a substantial improvement, with 121 participants becoming tobacco-free after intervention. The number of moderately dependent individuals decreased and no participants remained in the highly dependent category. These findings are in agreement with the clinical practice guidelines developed by Michael C. Fiore³ which emphasize that structured behavioural counselling using the 5A's model significantly increases quit attempts and successful cessation rates. The integration of CO monitoring with behavioural counselling provides immediate and visible feedback to patients, which may enhance motivation and reinforce cessation efforts. This concept has also been supported by studies conducted by Neal L. Benowitz⁵ who highlighted that objective biomarkers such as CO measurement can strengthen patient engagement and improve tobacco cessation outcomes. Overall, the findings of the present study suggest that the dental outpatient department serves as an effective platform for tobacco cessation interventions. Dentists frequently encounter patients with tobacco-related oral conditions, providing an opportunity for early detection, patient education, and behavioural counselling.

Thus, the 5A's counselling approach combined with CO monitoring appears to be a practical and effective strategy for reducing nicotine dependence and

encouraging tobacco cessation among patients attending dental healthcare settings.

IV. CONCLUSION

The present study demonstrates that the 5A's counseling approach combined with carbon monoxide (CO) monitoring is an effective strategy for promoting tobacco cessation in a dental outpatient setting. The integration of structured behavioral counseling with objective feedback from CO analysis helped increase patient awareness, motivation, and engagement in quitting tobacco. A notable reduction in nicotine dependence levels and CO exposure, along with the increase in tobacco-free individuals after counseling, highlights the positive impact of this intervention. Therefore, incorporating the 5A's model with CO monitoring in dental clinics can serve as a practical and valuable approach for early intervention and effective tobacco cessation support.

V. CLINICAL SIGNIFICANCE

The integration of the 5A's counseling approach with carbon monoxide (CO) analysis provides a practical and effective strategy for tobacco cessation in clinical settings. Real-time Coach with carbon monoxide (CO) analysis provides a practical and effective strategy for tobacco cessation in clinical settings. Real-time CO monitoring offers objective and immediate feedback to patients, helping them understand the harmful effects of tobacco use and reinforcing the importance of quitting. This measurable evidence enhances patient motivation, improves engagement in cessation programs, and supports sustained behavioral change. Therefore, incorporating CO analysis along with structured counseling in routine dental practice can strengthen tobacco cessation efforts, promote early intervention, and contribute to improved oral and overall health outcomes.

VI. CURRENT & FUTURE PERSPECTIVES

Tobacco cessation programs in dental settings are increasingly recognized as an important component of comprehensive patient care. At present, structured counselling approaches such as the 5A's model, combined with objective tools like carbon monoxide (CO) monitoring, are being incorporated into clinical

practice to enhance patient motivation and improve cessation outcomes. The use of simple, non-invasive devices such as the Smokerlyzer allows clinicians to provide immediate feedback regarding tobacco exposure, making counselling more interactive and effective. Dental professionals play a crucial role in identifying tobacco users, detecting early oral lesions, and initiating timely cessation interventions during routine clinical visits.

In the future, tobacco cessation strategies are expected to become more integrated with digital health technologies, mobile applications, and tele-counselling platforms, which can support continuous patient monitoring and follow-up. The development of more advanced biomarkers and portable diagnostic tools may further improve the accuracy of tobacco exposure assessment and patient motivation. Additionally, incorporating tobacco cessation training into dental education and strengthening multidisciplinary collaboration among healthcare professionals will help expand the reach of cessation services. Such advancements will enhance personalized interventions and contribute significantly to reducing the burden of tobacco-related diseases.

REFERENCES

- [1] World Health Organization. WHO report on the global tobacco epidemic. Geneva: World Health Organization; 2023.
- [2] Warnakulasuriya S. Tobacco, oral health and treatment of dependence. *Oral Dis.* 2002;8(Suppl 2):34–37.
- [3] Fiore MC, Jaén CR, Baker TB, Bailey WC, Benowitz NL, Curry SJ, et al. Treating tobacco use and dependence: 2008 update. Clinical practice guideline. Rockville (MD): U.S. Department of Health and Human Services, Public Health Service; 2008.
- [4] Jarvis MJ, Russell MAH, Saloojee Y. Expired air carbon monoxide: A simple breath test for tobacco smoke intake. *Br Med J.* 1980;281(6238):484–485.
- [5] Benowitz NL. Carbon monoxide toxicity and tissue hypoxia in cigarette smokers. *N Engl J Med.* 1988;319(14):905–907.

- [6] Naik N, Gaunkar R, Kamat A, et al. Oral mucosal lesions' propensity as an outcome eventuated by exhaled carbon monoxide (CO) levels and nicotine dependency. Asian Pac J Cancer Prev. 2021;22(9):2781–2788.
- [7] Fagerström KO, Heatherton TF, Kozlowski LT. Nicotine addiction and its assessment. Ear Nose Throat J. 1990;69(11):763–765.