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Measuring the Mandibular Ramus

Retrospective Radiographic Study

Highlights

Mercury Amalgam Dental Fillings

Oral Complications in Cancer Patients

Discovering Thoughts, Inventing Future

VOLUME 24 ISSUE 1 VERSION 1.0

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High Voltage Mercury Amalgam Dental Fillings, Medical Considerations

By Stephen Bourne MB, MRCGP

Abstract- Dental amalgam contains 50% mercury, copper, silver and tin. These metals bathed in acid saliva form a battery. Experience collaborating with a mercury-free dentist indicates that the metallic dental fillings most urgently needing replacement are those with the highest associated voltages (>100mVs).

Electrical currents caused by mercury amalgam dental fillings are liable to be associated with chronic illness, and replacing them with non-metallic, non-toxic dental material can be therapeutic.

An earthing mat (9) that removes static electricity from patients with high-voltage mercury amalgam dental fillings can cause symptomatic relief.

Two clinical cases are presented as evidence of the concept.

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An earthing mat (9) that removes static electricity from patients with high-voltage mercury amalgam dental fillings can cause symptomatic relief.

Two clinical cases are presented as evidence of the concept.

I. Introduction

The toxic properties of dental mercury are well-known(1, 2, 3), and dental mercury is banned in the Scandinavian countries (4). There are no published UK studies in this field.

Dental assistants must wear protective clothing when handling dental amalgam. After dentists have removed mercury amalgam dental fillings from their patients' mouths, they must dispose of them in sealed containers so that mercury vapour from the amalgam dental fillings cannot contaminate the ecosystem. The British Dental Association (BDA) has not explained why it considers dental mercury amalgam toxic when handled by dental technicians and when disposed of, but not harmful inside people's mouths.

The BDA advises that although dental mercury is toxic for pregnant women and children, it is not for adults. It has yet to explain how it has reached this conclusion.

The BDA's recommendation does not take into account environmental research (2,4), clinical research (1,4,5,6) and animal research (12),all of which indicate that dental mercury is toxic.

The BDA should consider dental research, which has become possible with the Jerome J431-X and the new J4045.0 mercury vapour analysers. This technology measures levels of oral mercury and has shown that heavy chewing (e.g. chewing gum) and drinking hot drinks cause significant release of mercury vapour from amalgam dental fillings into subjects' mouths. Dr Hesham El-Essawy, a London Harley Street dentist, has demonstrated this technology to the author. Such release of mercury vapour from amalgam dental fillings into subjects' mouths is inconsistent with the BDA's assertion that amalgam dental fillings are stable and not a source of mercury poisoning.

A meta-analysis of patients treated for dental mercury toxicity has shown that 89% of 1569 patients treated experienced 'that their symptoms had improved or were eliminated after the safe replacement of their mercury amalgam dental fillings (5).'

Mercury from dental amalgam fillings is a systemic toxin that can contribute to the pathogenesis of many chronic medical conditions, particularly anxiety, phobias, Parkinson's syndrome, multiple sclerosis, allergies, chronic fatigue syndrome, irritable bowel syndrome, arthritis and stroke (6).

II. Case Reports

a) Case 1

During 1981, a fifty-one-year-old patient with malignant hypertension and severe chronic migraine joined my NHS general practice. His symptoms had not responded to conventional medical treatment for hypertension from his previous GP, from me and subsequently from several private consultant physicians. He was eventually treated successfully by George Le with MRCP (deceased), who identified high-voltage mercury amalgam dental fillings as the cause of his migraine and hypertension. Dr Le with referred my patient to a mercury-free dentist who was a member of the British Society for Mercury-free Dentistry (7).

For replacement of his pathogenic high-voltage mercury amalgam dental fillings. The patient's migraine and hypertension cleared up immediately after the dentist had replaced his high-voltage metallic mercury amalgam dental fillings.

At the time, the patient was incapacitated by chronic poor health. Since replacing his high-voltage amalgam dental fillings, he led a full and active life.

Here is the patient's account.

"In 1981, I was aged fifty-one and seriously ill with malignant hypertension and migraine. Conventional medical treatment had not helped. My GP, Dr Bourne, eventually suggested that I consult Dr George Le with at his clinic on Upper Harley Street. Dr Le with compared my amalgam dental fillings to 'having a battery in my

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mouth'. He used a simple DC voltmeter to measure the voltages at my amalgam dental fillings.

As an electrical engineer, I did not find it surprising that Dr Le with identified my high-voltage amalgam dental fillings (> 1.5 Volts) as the causes of my migraine and high blood pressure.

The rest is history. Dr Le with referred me to a mercury-free dentist, who replaced my high-voltage amalgam dental fillings. The result was quick and astonishing: the migraines and malignant hypertension ceased straightaway, and there was also an improvement in my energy levels. Removing my high voltage amalgam dental fillings has been a life-enhancing procedure."

Here is the account of another patient with high-voltage amalgam dental fillings.

b) Case 2

"I first consulted Dr Bourne in August 2020 because I had been feeling abnormally tired for years. He identified two high-voltage mercury amalgam dental fillings as the cause of my tiredness. He advised me to consult a mercury-free dentist to have my 'silver' mercury amalgam dental fillings replaced.

I visited a mercury-free dentist in September; the fillings were replaced in November.

Since they were replaced, I have no longer felt abnormally tired and have been able to concentrate better at work. My tiredness cleared up immediately the silver fillings were changed. Dr Bourne explained that this was due to removing the mercury amalgam-associated electric currents in my mouth.

I used to have a sore throat every winter, which returned in September this year. My sore throat cleared immediately after my high voltage dental fillings were replaced."

III. Discussion

The two case histories correlate with an association between high-voltage mercury amalgam dental fillings and chronic poor health. Further clinical experience will indicate whether this association can be replicated in a cohort of suitable subjects.

While in NHS general practice, I noticed that some patients with chronic fatigue syndrome (CFS) who had not responded to conventional medical treatment had high-voltage' silver' dental amalgam fillings. Although one such patient made a remarkable recovery from CFS after a private dentist replaced his high-voltage mercury fillings, most NHS patients could not afford such private dental treatment, and my attempts to have their high-voltage fillings replaced within the NHS were unsuccessful.

During retirement from general practice, while specialising in integrative medicine, I found that several chronically ill patients who had not responded to conventional medical treatment had high-voltage metallic mercury amalgam dental fillings. Their symptoms improved immediately after their high-voltage mercury amalgam fillings were replaced.

Autopsy research on cadavers has shown that mercury from dental amalgam is deposited in body organs proportionately to the number of amalgam dental fillings and to the number of years that they have been in place (10). At autopsy, the highest mercury concentrations were found in the brain, thyroid gland and kidneys. Given this finding, it is improbable that replacing patients' mercury amalgam dental fillings would cause a sufficient reduction in systemic mercury poisoning to account for the immediate clinical improvements reported in the above two case histories. The immediate clinical improvements were associated with an immediate cessation of dental amalgam-generated electric currents.

Dental mercury molecules are liable to be deposited in the brain (10), becoming micro aerials that attract harmful electromagnetic radiation so that people with mercury amalgam dental fillings can feel abnormally tired when visiting electrically charged places such as airports and underground railways (11).

Mercury deposited in sheep kidneys has been shown to significantly impair their renal function (12). This finding is consistent with a higher incidence of dialysis-dependent renal failure patients in countries whose residents can afford only mercury amalgam dental fillings rather than more expensive, less toxic alternatives. (13).

Given these considerations, further clinical research is indicated to investigate the anticipated correlation between high-voltage mercury amalgam dental fillings and health deterioration. Such research would entail doctors routinely using voltmeters to measure the voltages associated with metallic dental fillings in chronically ill patients' mouths. When dental fillings with voltages above 100 mV are found in patients' mouths (14,15), they should be referred to dentists with post-graduate expertise in mercury-free dentistry (7) to have their pathogenic high-voltage mercury amalgam dental fillings safely replaced.

IV. Conclusion

Mercury amalgam dental fillings can cause pathogenic oral electric currents. They can also cause pathogenic mercury deposits in the body's vital organs and health deterioration (1, 2, 3, 4, 5, 6, 10, 11, 12, 13). Given these considerations, the use of mercury amalgam in dentistry should be discontinued.

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    Abstract

    Eighteen cadavers from routine autopsy casework were subject to a study of tissue levels of total mercury in the brain, thyroid, and kidney samples by atomic absorption. On these same cadavers, all dental amalgam fillings, the most essential source of organic mercury exposure in the general population, according to the World Health Organization (WHO), were charted. Total mercury levels were significantly higher in subjects with a more significant number of occlusal amalgam surfaces (>12) compared with those with fewer occlusal amalgams (0-3) in all types of tissue (all $P \leq 0.04$). Mercury levels were significantly higher in brain tissues compared with thyroid and kidney tissues in subjects with more than 12 occlusal amalgam fillings (all $P \leq 0.01$) but not in subjects with three or fewer occlusal amalgams (all $P \geq 0.07$).
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    Abstract

    Within thirty days after placing twelve occlusal amalgam fillings in six adult sheep, there was a 50% kidney function impairment. After sixty days, there was 60%. impairment in renal function.
13. During a lecture at the Royal London Hospital about twenty-five years ago, Prof Blandy (professor of nephrology) pointed out that renal failure is statistically much higher in wealthy than poor, undeveloped countries. He subsequently agreed with me that this is likely to be due to the extensive

use of dental mercury in wealthy countries, and he agreed with my suggestion of research to measure the voltages associated with the amalgam fillings of teeth in renal failure patients and to compare them with those of age-matched controls. This suggested research was not allowed because it was unfunded.

14. Set an electrician's voltmeter to measure up to 2 volts (2000 millivolts). Place one probe gently on the inside of the patient's cheek (buccal mucosa) and the other gently on the 'silver' dental filling being investigated. Record the positions and voltages of all the teeth with voltages above 100 millivolts because the amalgam fillings in these teeth will be replaced first. Ideally, all the mercury amalgam dental fillings should eventually be replaced.
15. This recommendation is based on over forty years of clinical experience.

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Gender Determination by Measuring the Mandibular Ramus and Body of the Mandible: A Retrospective Radiographic Study

By Dr. Kirti Saharan, Dr. Shivaprasad S. & Dr. Ashok L.

Abstract- *Aims:* 1) To measure the height and width of the mandibular ramus and height of the body of the mandible on digital orthopantomograms. 2) To compare the measurements on the mandibular ramus & body of the mandible and use them in gender determination.

Setting and Design: Retrospective study on 120 retrieved digital orthopantomograms of individuals of Indian origin.

Materials and Methods: A study was conducted on 120 retrieved digital orthopantomograms which were categorized into three age groups of age between 21-50 years. 40 digital orthopantomograms were selected under each age group which included 20 male and 20 female radiographs. The Digital OPG images that were obtained using the PLANMECA PROLINE XC machine were measured using PLANMECA ROMEXIS 2.3.1.R software.

Keywords: *forensic odontology, gender determination, identification, mandibular ramus, digital orthopantomograms, height of the body of mandible.*

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Statistical analysis used: The measurements of the mandibular ramus and body were subjected to ROC curve analysis and Bland Altman analysis.

Results: The best parameter in determining gender were the Condylar Height followed by the Coronoid Height and the Projective Height of Ramus. The overall prediction accuracy for mandibular ramus parameters came out to be 80.5% and for the body of the mandible parameter it came out to be 76.7%.

Conclusion: Mandibular ramus has a better potential than the body of the mandible in terms of gender determination.

Keywords: forensic odontology, gender determination, identification, mandibular ramus, digital orthopantomograms, height of the body of mandible.

I. Introduction

Skeleton has always helped in genetic, anthropological, odontological and forensic investigation of living and dead individuals. Skull bones and pelvis are the most commonly used bones in gender and age determination.[1] The mandible is the most dimorphic and strongest bone of the skull and therefore, it is useful for gender and race determination in forensic and archaeological cases where intact skull is not found.[2] Sexual dimorphism in the mandible is noticed in its shape and size. Previous studies have shown that the difference between sexes are generally more significant in the mandibular ramus than the body because the relative development (size, strength, and angulation) of the muscles of mastication affects the gender expression of mandible as the masticatory forces exerted are different for men and women[3]

Panoramic radiography has been used as an important tool in forensic anthropology and studies have been conducted to make a biometric system for human identification. It is commonly used for obtaining a comprehensive overview of the maxillofacial complex and the image quality of the panoramic radiograph is increased by the digital panoramic radiography. The advantages of digital images are their broad anatomical coverage, low patient exposure, and less time required for image acquisition and the disadvantages are magnification, geometric distortion and positioning errors.[4,5]

Normally morphological and metric methods are used to estimate the gender of a mandible. The mandibles of males and females are differentiated by their size, chin shape, muscular markings, and gonial angle or flare. Determining sex using metric parameters like condylar breadth, coronoid breadth, gonial breadth, ramus breadth and height, height of the body of mandible, etc. are easy and more reliable compare to traditional non-metric methods.[6] Therefore, by combining the reliable metric parameters and digital radiography we can get a more accurate gender estimation.

II. Aims & Objectives

1. To compare the measurements on the mandibular ramus & body of the mandible and use them in gender determination among various age groups.
2. To measure the width & height of mandibular ramus and height of the body of mandible on digital orthopantomograms among various age groups.

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III. Materials and Methods

A retrospective study was conducted on 120 digital orthopantomograms of the Indian individuals, which were later divided into three age groups of age between 21-30 years, 31-40 years and 41-50 years respectively. 40 digital orthopantomograms were taken under each age group consisting of 20 males and 20 females. Ideal Orthopantomograms of the patients with full set of permanent teeth, minimal alveolar bone loss and without any artefacts were included in the study whereas radiographs with developmental disturbances of the skull, mandibular deformities, pathologies, fractures and distorted digital images were excluded from the study.

The Digital OPG images that was obtained using PLANMECA PROLINE XC machine were measured using PLANMECA ROMEXIS 2.3.1.R software. The following measurements were taken on the right side of OPG's digitally (Fig.1 & Fig.2):

1. *Maximum ramus breadth:* The distance between the most anterior point on the mandibular ramus and a line connecting the most posterior point on the condyle and the angle of jaw.
2. *Minimum ramus breadth:* Smallest anterior–posterior diameter of the ramus.
3. *Condylar height/maximum ramus height:* Height of the ramus of the mandible from the most superior point on the mandibular condyle to the tubercle, or most protruding portion of the inferior border of the ramus.
4. *Projective height of ramus:* Projective height of ramus between the highest point of the mandibular condyle and lower margin of the bone.
5. *Coronoid height:* Projective distance between coronion and lower wall of the bone.[7]
6. *Height of the body of mandible:* The distance from the inferior surface of the mandibular body to the height of the alveolar crest.

To eliminate the inter-observer variations and determination of reliability and reproducibility of the measurements, the images were evaluated by two qualified Oral Radiologist under standard conditions in a semi-dark room with ambient light & using magnifying lens icon.

IV. Statistical Analysis

Mean comparison between the age groups were done using Independent Student t-test. ANOVA test was used to compare the difference in the means of three groups for individual parameter for both the observers. ROC (Receiver operating characteristic) curve analysis was used to estimate the cut-off value for males and females, sensitivity and specificity for individual parameters among various age groups. This analysis has not been done in the literature before for similar kind of studies. Bland Altman analysis was used estimating agreement between observer 1 and observer 2.

V. Results

Statistical analysis showed that each variable was a significant predictor in classifying a given sample ($P < 0.001$). The mean values for all the measurements were higher for the males as compared to the females. (Table 1)

Table 1: Total Mean and Standard Deviation for All the Parameters among Males and Females (Observer 1 & 2)

Parameters	Sex	Sample Size	Ob 1			Ob 2		
			Mean (mm)	Std. Deviation (mm)	P-Value	Mean (mm)	Std. Deviation (mm)	P-Value
Maximum Ramus Breadth	M	60	37.2	2.79	0.027	37.9	2.68	0.131
	F	60	34.3	2.80	0.075	34.6	2.86	0.310
Minimum Ramus Breadth	M	60	29.0	2.14	0.810	28.0	2.12	0.883
	F	60	27.3	2.58	0.342	26.3	2.48	0.383
Condylar Height	M	60	62.9	4.11	0.293	62.8	4.10	0.343
	F	60	55.9	3.14	0.109	56.0	3.02	0.165
Projective Height of Ramus	M	60	60.7	4.17	0.171	60.8	4.10	0.310
	F	60	54.0	3.55	0.168	53.9	3.47	0.321
Coronoid Height	M	60	56.7	4.45	0.963	56.2	4.35	0.911
	F	60	50.2	2.88	0.756	49.8	2.87	0.546
Height of the Body of Mandible	M	60	28.9	2.40	0.635	28.8	2.50	0.776
	F	60	26.0	2.09	0.821	25.9	2.18	0.884

The Bland & Altman analysis for inter-observer agreement showed statistically significant evidence of agreement between both the observers.

According to ROC curve analysis the decreasing order of various parameters for the sensitivity for cut-off values in males and females was:

Projective Height of Ramus > Condylar Height > Minimum Ramus Breadth = Coronoid Height > Maximum Ramus Breadth > Height of the Body of Mandible.

The decreasing order of various parameters for the specificity for cut-off values in males and females was: Height of the Body of Mandible > Coronoid Height > Condylar Height > Projective Height of Ramus > Maximum Ramus Breadth > Minimum Ramus Breadth.

The decreasing order of various parameters on mandibular ramus and body according to prediction accuracy was: Condylar Height > Coronoid Height = Projective Height of Ramus > Height of the Body of Mandible > Maximum Ramus Breadth > Minimum Ramus Breadth.

The overall prediction accuracy for mandibular ramus parameters came out to be 80.5% whereas the overall prediction accuracy for mandibular body parameter came out to be 76.7%.

VI. Discussion

In the present study a total of six parameters were measured namely; maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus, coronoid height and height of the body of mandible which were similar to the study carried out by *Saini V et al.*[7] *(2011), Indira AP et al.*[4] *(2012), Samantha K et al.*[8] *(2016), Sairam V et al.*[9] *(2016), Jambunath U et al.*[10] *(2016), Kartheeki B et al.*[11] *(2017).*

1. Maximum ramus breadth

In the present study, the average cut-off point for Maximum Ramus Breadth in males and females of all the groups came out to be 34.9mm which was similar to that in the study conducted by *Sikka A et al.*[12] *(2016)* in which it was 35mm and lesser than the cut-off point taken in the study conducted by *Vinay G et al.*[13] *(2013)* in which it was 39.5mm.

In the present study, the accuracy of Maximum Ramus Breadth for males was 83.3% and for females was 66.7% which was greater than in the study conducted by *Vinay G et al.*[13] *(2013)* in which it was 72.08% for males and 63.64% for females. It was also greater than the male accuracy and lesser that the female accuracy in the study conducted by *Dong H et al.*[6] *(2015)* in which it was 69.8% and 76.6%. The combined accuracy for Maximum Ramus Breath was 75% which was greater than in the study done by *Saini V* [14] *(2013)* in which it was 65.3% and *Dong H et al.*[6] *(2015)* in which it was 73.4%.

2. Minimum ramus breadth

In the present study, the average cut-off point for Minimum Ramus Breadth in males and females of all the groups came out to be 27.1mm which was lesser than the cut-off point taken in the study conducted by *Saini V et al.*[7] *(2011) and Vinay G et al.*[13] *(2013)* in which it was 30.5mm.

In the present study, the accuracy of Minimum Ramus Breadth for males was 85% and for females was 55% which was greater than the male accuracy and lesser than the female accuracy noted in the study conducted by *Vinay G et al.*[13] *(2013)* in which it was 68.18% for males and 62.12% for females. The combined accuracy for Minimum Ramus Breath was 70% which was greater than in the study done by *Saini V* [14] *(2013)* in which it was 63.2%.

3. Condylar height

In the present study, the average cut-off point for Condylar Height in males and females of all the groups came out to be 57.7mm which was lesser than the cut-off point taken in the study conducted by *Datta A et al.*[15] *(2015)* in which it was 61.5mm and greater than the cut-off point taken in the study conducted by *Franklin D et al.*[16] *(2008)* in which it was 53.8mm. But it was similar to the cut-off value given by *Saini V et al.*[7] *(2011)* in which it was 57.6mm.

In the present study, the accuracy of Condylar Height for males was 93.3% and for females was 81.7% which was nearly similar to the accuracy noted in the study conducted by *Datta A et al.*[15] *(2015)* in which it was 96% for males and 84% for females. But our accuracy was greater than the accuracy noted in the study conducted by *Saini Vet al.*[7] *(2011)* in which it was 73.9% of males and 66.7% for females, *Dong H et al.*[6] *(2015)* in which it was 72.9% for males and 80.4% for females. The combined accuracy for Condylar Height was 87.5% which was greater than in the study done by *Franklin D et al.*[16] *(2008)* in which it was 73.8%, *Saini V et al.*[7] *(2011)* in which it was 72.4% and *Dong H et al.*[6] *(2015)* in which it was 76.8%.

4. Projective height of ramus

In the present study, the average cut-off point for Projective Height of Ramus in males and females of all the groups came out to be 55.6mm which was greater than the cut-off point taken in the study conducted by *Saini V et al.*[7] *(2011)* in which it was 50.7mmand also greater than the cut-off point taken in the study conducted by *Datta A et al.*[15] *(2015)* in which it was 50.1mm.

In the present study, the accuracy of Projective Height of Ramus for males was 95% and for females was 75% which was greater than the accuracy noted in the study conducted by *Saini V et al.*[7] *(2011)* in which it was 65.2% for males & 79.2% for females and also greater than the male accuracy in the study conducted by *Wankhede KP et al.*[17] *(2015)* in which it was 76.4% but lesser than the female accuracy which was 81.5%. The combined accuracy for Projective Height of Ramus was 85% which was greater than in the study done by *Saini V at al.*[7] *(2011)* in which it was 68.1% and *Wankhede KP et al.*[17] *(2015)* in which it was 78%.

5. Coronoid height

In the present study, the average cut-off point for Coronoid Height in males and females of all the groups came out to be 52.8mm which was lesser than the cut-off point taken in the study conducted by *Saini V et al.*[17] *(2011)* in which it was 58.3mmand also lesser than the cut-off point taken in the study conducted by *Datta A et al.*[25] *(2015)* in which it was 56.7mm. But our value is somewhat near to the value given in the study conducted by *Franklin D et al.* [16] *(2008)* in which it was 55.5mm

In the present study, the accuracy of Coronoid Height for males was 83.3% and for females was 86.7% which was greater than the accuracy noted in the study conducted by *Saini Vet al.*[7] *(2011)* in which it was 73.9% for males & 75% for females. But it was lesser than the male accuracy and greater than the female accuracy in the study conducted by *Datta A et al.*[15] *(2015)* in which it was 84% for both males and females. The combined accuracy for Coronoid Height was 85% which was greater than in the study done by *Franklin D et al.* [16]*(2008)* in which it was 73.3% and *Saini V et al.*[7] *(2011)* in which it was 74.1%.

6. Height of the body of mandible

In the present study, the average cut-off point for the Height of the Body of Mandible in males and females of all the groups came out to be 28.3mm which was greater than the cut-off point taken in the study conducted by *Sikka A et al.*[12] *(2016)* in which it was 23.0mmand almost close to the cut-off point taken in the study conducted by *Datta A et al.*[15] *(2015)* and *Wankhede KP et al.*[17] *(2015)* in which it was 25.7mm.

In the present study, the accuracy of the Height of the Body of Mandible for males was 63.3% and for females was 90%. It was lesser than the male accuracy and greater than the female accuracy noted in the study conducted by *Wankhede KP et al.*[17] *(2015) & Datta A et al.*[15] *(2015)* in which it was 70.9% & 88% for males & 51.9% & 76% for females. The combined accuracy for the Height of the Body of Mandible was 76.7% which was greater than in the study done by *Saini V* [14] *(2013), Wankhede KP et al.*[17] *(2015)* and *Sikka A et al.*[12] *(2016)* in which it was 67.4%, 64.6% and 69.2%.

In the present study, the highest sexual dimorphism was seen with Condylar Height followed by Projective Height of Ramus and Coronoid Height which was similar to the study conducted by *Indira AP et al.*[4] *(2012) & Kartheeki B et al.*[11] *(2017)* in which all variables showed strong sexual dimorphism with the mandibular ramus in terms of condylar height, coronoid height followed by projective height of ramus. In the present study least sexual dimorphism was noticed with theMinimum Ramus Breadth similar to the study conducted by *Saini V et al.*[7] *(2011) and Samantha K et al.*[8] *(2016).*

In the present study, the overall prediction accuracy for Mandibular Ramus parameters in males was 88% and in females was 73% with a combined accuracy of 80.5% which was almost similar to the study conducted by *Saini V et al.*[7] *(2011)* the overall prediction rate using five variables was 80.2% and also similar to the study conducted by *Kartheeki B et al.*[11] *(2017)* where overall prediction rate using all the five variables was 80.4%.

The overall prediction accuracy for the Height of the Body of Mandible in males was 63.3% and in females was 90% with a combined accuracy of 76.7%. This proved that the Mandibular Ramus parameters are more significant than the Height of the Body of Mandible measurement parameter in determining gender on the digital orthopantomograms.

Limitations of the present study are the inability to reliably estimate gender in the sub-adult range, edentulous patients, and severely deformed mandibular ramus.

VII. Conclusion

In conclusion, the ramus of the mandible has a better potential than the body of the mandible in determination of sex. However, larger sample size and more diverse population would enhance the reliability of this parameter.

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Table 2: Cut-Off Value for Males, Sensitivity and Specificity for Maximum Ramus Breadth in Various Age Groups (Observer 1 & 2)

Age Groups (years)	Ob 1			Ob 2		
	Cut off value (mm)	Sensitivity	Specificity	Cut off value (mm)	Sensitivity	Specificity
Group I (21-30)	> 34.5	70%	75%	> 36.5	70%	90%
Group II (31-40)	> 36.9	75%	85%	> 37	90%	70%
Group III (41-50)	> 33.4	100%	40%	> 36.9	55%	90%

Table 3: Cut-Off Value for Males, Sensitivity and Specificity for Minimum Ramus Breadth in Various Age Groups (Observer 1 & 2)

Age Groups (years)	Ob 1			Ob 2		
	Cut off value (mm)	Sensitivity	Specificity	Cut off value (mm)	Sensitivity	Specificity
Group I (21-30)	> 27.5	80%	75%	> 26.2	85%	65%
Group II (31-40)	> 26	100%	25%	> 28.5	45%	90%
Group III (41-50)	> 27.9	70%	65%	> 26.8	70%	65%

Table 4: Cut-Off Value for Males, Sensitivity and Specificity for Condylar Height on Right Side in Various Age Groups (Observer 1 & 2)

Age Groups (years)	Ob 1			Ob 2		
	Cut off value (mm)	Sensitivity	Specificity	Cut off value (mm)	Sensitivity	Specificity
Group I (21-30)	> 56.4	95%	80%	> 59.2	85%	95%
Group II (31-40)	> 60.1	85%	90%	> 60	80%	95%
Group III (41-50)	> 56.6	100%	75%	> 56.7	95%	80%

Table 5: Cut-Off Value for Males, Sensitivity and Specificity for Projective Height of Ramus on Right Side in Various Age Groups (Observer 1 & 2)

Age Groups (years)	Ob 1			Ob 2		
	Cut off value (mm)	Sensitivity	Specificity	Cut off value (mm)	Sensitivity	Specificity
Group I (21-30)	> 55.6	95%	80%	> 55.6	95%	80%
Group II (31-40)	> 57.3	90%	80%	> 58.8	75%	90%
Group III (41-50)	> 53.8	100%	65%	> 53.7	100%	70%

Table 6: Cut-Off Value for Males, Sensitivity and Specificity for Coronoid Height on Right Side in Various Age Groups (Observer 1 & 2)

Age Groups (years)	Ob 1			Ob 2		
	Cut off value (mm)	Sensitivity	Specificity	Cut off value (mm)	Sensitivity	Specificity
Group I (21-30)	> 51	100%	75%	> 51.5	100%	75%
Group II (31-40)	> 53	80%	85%	> 53	85%	85%
Group III (41-50)	> 54.3	70%	100%	> 52.5	80%	90%

Table 7: Cut-Off Value for Males, Sensitivity and Specificity for Height of the Body of Mandible on Right Side in Various Age Groups (Observer 1 & 2)

Age Groups (years)	Ob 1			Ob 2		
	Cut off value (mm)	Sensitivity	Specificity	Cut off value (mm)	Sensitivity	Specificity
Group I (21-30)	> 28.7	50%	100%	> 25.8	90%	55%
Group II (31-40)	> 28.2	65%	90%	> 25.9	90%	55%
Group III (41-50)	> 27.9	75%	80%	> 28.3	65%	90%

Table 8: Bland & Altman Analysis for Inter-Observer Agreement for Maximum Ramus Breadth among Various Age Groups

Age Groups (years)	Sample Size	Arithmetic Mean (mm)	95% Confidence Interval (mm)	Lower limit (mm)	95% Confidence Interval (mm)	Upper Limit (mm)	95% Confidence Inetrval (mm)	p-value
Group I (21-30)	40	-1.03	-1.37 to -0.69	-3.11	-3.70 to -2.53	1.05	0.47 to 1.64	< 0.0001
Group II (31-40)	40	-0.32	-0.72 to 0.09	-2.79	-3.48 to -2.09	2.16	1.46 to 2.85	0.122
Group III (41-50)	40	-0.07	-0.49 to 0.35	-2.63	-3.35 to -1.91	2.49	1.77 to 3.20	0.727

Table 9: Bland & Altman Analysis for Inter-Observer Agreement for Minimum Ramus Breadth among Various Age Groups

Age Groups (years)	Sample Size	Arithmetic Mean (mm)	95% Confidence Interval (mm)	Lower limit (mm)	95% Confidence Interval (mm)	Upper Limit (mm)	95% Confidence Interval (mm)	p-value
Group I (21-30)	40	0.94	0.73 to 1.14	-0.32	-0.67 to 0.04	2.19	1.83 to 2.54	< 0.0001
Group II (31-40)	40	0.91	0.76 to 1.07	-0.04	-0.31 to 0.23	1.87	1.60 to 2.14	< 0.0001
Group III (41-50)	40	1.06	0.87 to 1.25	-0.12	-0.45 to 0.21	2.24	1.91 to 2.57	< 0.0001

Table 10: Bland & Altman Analysis for Inter-Observer Agreement for Condylar Height among Various Age Groups

Age Groups (years)	Sample Size	Arithmetic Mean (mm)	95% Confidence Interval (mm)	Lower limit (mm)	95% Confidence Interval (mm)	Upper Limit (mm)	95% Confidence Interval (mm)	p-value
Group I (21-30)	40	-0.22	-0.66 to 0.22	-2.93	-3.69 to -2.16	2.49	1.73 to 3.25	0.326
Group II (31-40)	40	0.15	-0.20 to 0.49	-1.98	-2.58 to -1.38	2.28	1.68 to 2.87	0.396
Group III (41-50)	40	0.06	-0.36 to 0.47	-2.49	-3.20 to -1.77	2.61	1.89 to 3.32	0.781

Table 11: Bland & Altman Analysis for Inter-Observer Agreement for Projective Height of Ramus among Various Age Groups

Age Groups (years)	Sample Size	Arithmetic Mean (Mm)	95% Confidence Interval (Mm)	Lower Limit (Mm)	95% Confidence Interval (Mm)	Upper Limit (Mm)	95% Confidence Interval (Mm)	p-Value
Group I (21-30)	40	-0.23	-0.56 To 0.10	-2.24	-2.80 To -1.67	1.78	1.22 To 2.35	0.168
Group II (31-40)	40	0.30	0.10 To 0.49	-0.89	-1.23 To -0.56	1.48	1.15 To 1.82	0.004
Group III (41-50)	40	-0.12	-0.54 To 0.31	-2.72	-3.45 To -1.99	2.49	1.76 To 3.22	0.587

Table 12: Bland & Altman Analysis for Inter-Observer Agreement for Coronoid Height among Various Age Groups

Age Groups (years)	Sample Size	Arithmetic Mean (mm)	95% Confidence Interval (mm)	Lower limit (mm)	95% Confidence Interval (mm)	Upper Limit (mm)	95% Confidence Interval (mm)	p-value
Group I (21-30)	40	-0.01	-0.28 to 0.27	-1.72	-2.20 to -1.24	1.71	1.23 to 2.19	0.971
Group II (31-40)	40	0.61	0.33 to 0.90	-1.14	-1.63 to -0.65	2.36	1.87 to 2.85	0.0001
Group III (41-50)	40	0.65	0.37 to 0.92	-1.03	-1.50 to -0.56	2.32	1.85 to 2.79	< 0.0001

Table 13: Bland & Altman Analysis for Inter-Observer Agreement for Height of the Body of Mandible among Various Age Groups

Age Groups (years)	Sample Size	Arithmetic Mean (mm)	95% Confidence Interval (mm)	Lower limit (mm)	95% Confidence Interval (mm)	Upper Limit (mm)	95% Confidence Interval (mm)	p-value
Group I (21-30)	40	-0.01	-0.12 to 0.09	-0.66	-0.84 to -0.48	0.63	0.45 to 0.82	0.812
Group II (31-40)	40	0.18	-0.02 to 0.38	-1.02	-1.36 to -0.68	1.38	1.04 to 1.72	0.071
Group III (41-50)	40	0.13	-0.00 to 0.27	-0.68	-0.91 to -0.45	0.95	0.72 to 1.18	0.051

Table 14: Prediction Accuracy for Various Parameters on Mandibular Ramus and Body Among Males and Females of Various Age Groups (Observer 1 & 2)

S.No.	PARAMETERS	Ob 1			Ob 2		
		Males	Females	Total	Males	Females	Total
1.	Maximum Ramus Breadth	83.3%	66.7%	75%	73.3%	83.3%	78.3%
2.	Minimum Ramus Breadth	85%	55%	70%	68.3%	75%	71.7%
3.	Condylar Height	93.3%	81.7%	87.5%	90%	90%	90%
4.	Projective Height of Ramus	95%	75%	85%	90%	81.7%	85.8%
5.	Coronoid Height	83.3%	86.7%	85%	88.3%	83.3%	85.8%
6.	Height of the Body of Mandible	63.3%	90%	76.7%	81.7%	68.3%	75%

Table 15: Comparison of Prediction Accuracy for Various Parameters on Mandibular Ramus and Body of the Mandible among Males and Females of Various Age Groups (Observer 1 & 2)

S.No.	PARAMETERS	Ob 1			Ob 2		
		Males	Females	Total	Males	Females	Total
1.	Mandibular Ramus	88%	73%	80.5%	82%	82.7%	82.3%
2.	Body of the Mandible	63.3%	90%	76.7%	81.7%	68.3%	75%

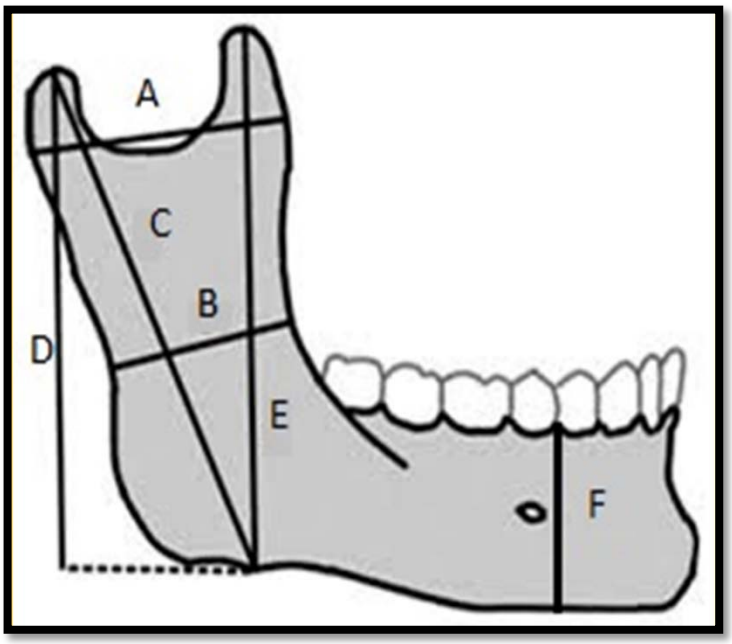

Fig. 1: Image showing measurement from the reference lines drawn from the anatomic landmarks of the mandible. (Diagram showing mandibular ramus measurements adapted from Saini et al. (17))

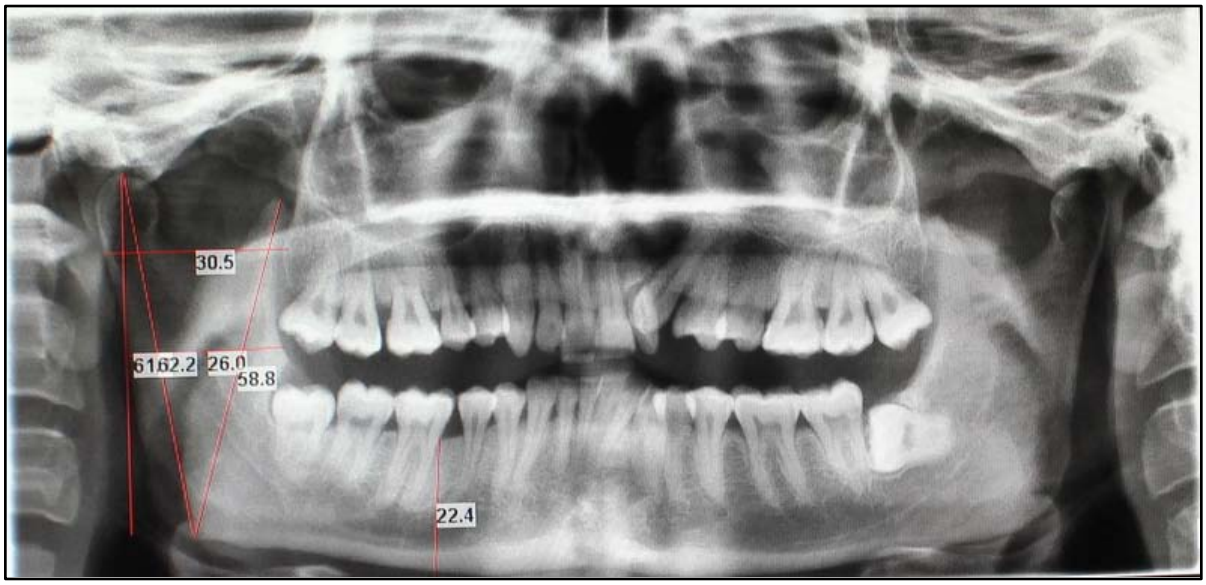

Fig. 2: OPG image showing measurements taken on the right side of the mandible.

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Oral Complications in Cancer Patients: The Role of Chemotherapy and Radiotherapy

By Bárbara Maria de Souza Moreira Machado, Paula Cardoso Mascarenhas Xavier, Mariane Carolina Faria Barbosa, Leandro Araújo Fernandes, Daniela Coelho de Lima & Eduardo José Pereira Oliveira

Abstract- *Objective:* To evaluate the association between chemotherapy and radiotherapy with occurrence of oral complications in cancer patients.

Methods: This cross-sectional study included 399 adults in cancer treatment in a High Complexity Oncology Care Unit (HCOCU) in Minas Gerais, Brazil. Participants adults (> 18 years) were included in the study who undergoing treatment or are being monitored after treatment, at the Oncological Center of the Casa de Caridade Nossa Senhora do Perpétuo Socorro between 2017 and 2019. Outcomes were assessed through a questionnarie about self-reported oral complications, such as xerostomia, halitosis, taste changes, dietary modifications, trismus, mucositis, and the presence of infection/inflammation.

Keywords: *chemotherapy, radiotherapy, oncology hospital services, oral health, questionnaires and surveys.*

GJMR-J Classification: *NLMC Code: QZ 241-260*

Oral Complications in Cancer Patients: The Role of Chemotherapy and Radiotherapy

Bárbara Maria de Souza Moreira Machado [α], Paula Cardoso Mascarenhas Xavier [σ], Mariane Carolina Faria Barbosa [ρ], Leandro Araújo Fernandes [ω], Daniela Coelho de Lima [¥] & Eduardo José Pereira Oliveira [§]

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Results: The most common treatment was the combination of chemotherapy and radiotherapy (36.34%), while radiotherapy alone was the least common (13.78%). Among the oral changes after cancer treatment, the most prevalent were xerostomia (60.15%) and dietary changes (57.64%). Chemotherapy was associated with taste changes (OR: 2.44; 95% CI: 1.22-4.90). Chemotherapy and radiotherapy togheter were associated with greater odds of taste changes (OR: 3.86; 95% CI: 1.92-7.75) and mucositis (OR: 2.51; 95% CI: 1.06-5,94).

Conclusions: Patients undergoing chemotherapy alone or in combination with radiotherapy treatments were more prone to oral complications. This underscores the significance of dental care in promoting the well-being and quality of life for these patients.

Keywords: chemotherapy, radiotherapy, oncology hospital services, oral health, questionnaires and surveys.

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I. Introduction

Dental care is pivotal to the health of cancer patients. Both the disease itself and the therapeutic approaches used for treatment can give rise to oral complications[1].

Considered the second leading cause of death in the world, cancer poses significant public health challenges due to its multifaceted nature and its epidemiological, social, and economic impacts. GLOBOCAN's 2020 estimates showed approximately 19 million new cancer cases worldwide, resulting in around 10 million deaths. In such a scenario, malignant tumors of the lung, breast, prostate, skin, and oral cavity, as well as hematological and lymphatic tumors, were identified as the most prevalent cancer types[2]. In the Brazilian context, cancer is also considered an important public health problem. During the 2020-2022 triennium, an estimated 625,000 new cancer cases were expected annually[3,4].

Surgery, radiotherapy, chemotherapy, bone marrow transplantation, and targeted molecular therapy are commonly used, either in isolation or in combination, to treat cancer[5]. Advances in cancer treatments have contributed positively to the increase in survival and quality of life of these patients. Although there is no consensus on the best therapeutic approach for the treatment of cancer, it is notable that around 70% of patients undergo chemotherapy as their primary treatment[6]. However, chemotherapy's broad-spectrum toxicity affects not only neoplastic cells, but also healthy tissues, leading to oral complications and exacerbating pre-existing complications[7]. Furthermore, radiotherapy, is have reaching a utilization rate of 52% in the external irradiation modality, contributing to an increase in the patient's survival rate[8].

Therefore, the clinical manifestations of cancer and the effects of oncological therapies on the patient's oral health warrant attention. In addition to oral and dental complications that include mucositis, infections, pain, salivary gland dysfunction, taste changes, dysphagia, trismus, and necrosis of soft and hard tissues[9,10,11], patients can experience pronounced speech and swallowing impairments, aesthetic changes, sensory deficits, and chronic pain[12]. Such issues can substantially affect patient quality of life and

survival. It is estimated that approximately 40% of patients who receive radiotherapy and chemotherapy develop oral complications resulting from direct or indirect stomatotoxicity[6]. Even though radiotherapy, especially for head and neck cancers, which is a primary cause of oral complications, surgical procedures and chemotherapy can also induce or exacerbate dental and periodontal issues[13].

Considering the toxicities arising from cancer therapeutic approaches for the soft and hard tissues of the oral region, oncological treatment may even be halted, resulting in harmful events, such as increased morbidity and decreased survival[14]. In this context, dental assessments, and adequate management of cancer patients throughout the treatment phases of the disease are crucial for a holistic and multidisciplinary approach to patient care[15,16,17] to eliminate or reduce the risk of such complications. Therefore, attention and knowledge regarding the prevention, diagnosis, and management of oral complications from oncological therapies are essential so that all health professionals, including dentists, can contribute to mitigating the impact of these complications on the patient's life[18,19] and, thereby, enhancing their quality of life, reducing adverse effects and local complications of oncological treatment, and promoting more prolonged survival.

Given these considerations and the complications the cancer itself and the for treatment can give rise to oral health, the aim of this study was to assess the association between oncological treatment types and the onset of oral complications in patients treated in a High Complexity Oncology Care Unit (HCOCU) in southern of the Minas Gerais state, Brazil.

II. Material and Methods

a) *Ethical considerations*

This study was submitted for evaluation by the Human Research Ethics Committee of the Federal University of Alfenas (UNIFAL-MG), being approved under opinion no. 2,487,546. Voluntary participation was consented to by signing the Informed Consent Form (ICF). The procedures used in this study adhere to the tenets of the Declaration of Helsinki and the Resolution 466, December 2012, of the Brazilian National Health Council, respecting the principles of the beneficence, non-maleficence, autonomy, confidentiality and justice.

b) *Study design, setting, and participants*

A cross-sectional study was conducted on a sample of patients assisted by the *Associação dos Voluntários Vida Viva de Alfenas*. The approached patients received treatment at the HCOCU of *Santa Casa de Caridade Nossa Senhora do Perpétuo Socorro* in Alfenas, MG, Brazil. This oncology center offers public treatments including chemotherapy, immunotherapy, hormone therapy, radiotherapy, and surgery, serving regions in southern Minas Gerais, Brazil. This region covers 24 municipalities, being the reference for cancer treatment for a population of 437,005 inhabitants[20]. The Casa do Café of the Associação dos Voluntários Vida Viva was selected for this study because is the reference for the oncological patients attended in the southern region of Minas Gerais.

The minimum sample size was determined using the average DMFT (decayed, missing, and filled teeth) for the adult and elderly population[21]. This index is widely used as to produce a snapshot of the oral health conditions of the population as to parameterize sample size once caries and tooth loss are conditions with high dissemination and well described in many populations.[21] To this end, the equation proposed by Silva[22] was used:

$$n = \frac{Z^2.\ S^2.\text{deff} / \text{TNR}}{(\bar{X}.\varepsilon)^2}$$

where n refers to the final sample size; Z to the limit value of the rejection area, considering a certain level of significance (1.96 corresponding to 95% confidence); S^(2) to the DMFT[21] variance; deff (design effect – design effect) = 3; TNR at non-response rate = estimated percentage of loss of sample elements - 20%; $\bar{X}$: average DMFT[21]; ε represents acceptable margin of error – 10%. The reference were the DMFT indexes for the population of adults living in cities in the countryside of Southeastern Brazil: mean (16.64) and standard deviation (8.04), obtained from the last national oral health survey – SB Brasil 2010[21]. A confidence level of 95% was established. This led to an estimated sample size of 309 subjects. The sampling process was random, being interviewed those who agreed to participate in the study were listed until the minimum sample size was reached, covering 399 cancer patients attending the *Casa do Café* of the *Associação dos Voluntários Vida Viva de Alfenas*. The inclusion criteria were: accepting participation in the study and expressing consent in the Informed Consent Form; attending the study's location - *Casa do Café* of the *Associação dos Voluntários Vida Viva de Alfenas*; undergoing treatment at the Oncological Center of the *Casa de Caridade Nossa Senhora do Perpétuo Socorro* during the period the study, between 2017 and 2019; being over 18 years old; having any cancer (not specific) or are being monitored after treatment for a neoplasm; and being able to communicate with the researcher.

c) *Variables*

Outcomes were self-reported oral complications, including xerostomia, halitosis, taste changes, dietary changes, trismus, mucositis, and presence of infection/inflammation.

The primary exposure was the type of oncological treatment adopted, classified as chemotherapy; radiotherapy; chemotherapy and

radiotherapy; and others (surgical and/or drug treatment).

Covariates included socioeconomic factors health habits, general health, and oral health conditions. Socioeconomic factors included age; gender; education level (≤8 years of study/> 8 years of study). Health habits included current smoking and current drinking. General health conditions included multimorbidity (0-1 conditions/≥2 conditions); polypharmacy (<4 medications/≥4 medications); tumor location (other sites/head and neck); time of treatment (≤1 year/>1 year); previous cancer (yes/no). Oral health conditions included number of teeth (0 to 9 teeth; 10 to 19 teeth; 20 or more teeth); prosthesis use; dental caries; gum bleeding; periodontal pockets; self-assessment of poor/very poor oral health (yes/no); oral health guidance received during oncology treatment (yes/no).

The blocks "socioeconomic factors", "general health", "health habits", "oral changes" and the variables "self-assessment of poor oral health" and "oral health guidance" from the "oral health" block were collected exclusively through interviews and recorded in a questionnaire. The other variables in this block were assessed through intraoral physical examination. This examination was carried out under natural light, using a mouth mirror, gauze, and a ballpoint-type periodontal probe, following the criteria recommended by the World Health Organization (WHO)[23,24] by two duly trained examiners (B.M.S.M.M., and M.C.F.B.), and calibrated in a previous pilot study conducted with 20 patients at the same institution as the main study. Pilot study participants were not included in the main study. The inter-examiner agreement coefficient (Kappa) was 0.89, expressing good agreement[23,24].

d) Data analysis

The descriptive analysis was carried out with estimates of measures of central tendency and its dispersion (for age) as well as absolute and relative frequencies, according to the type of oncological treatment. Associations between treatment types and other variables were determined using the chi-square test with Rao-Scott correction (Table 1).

For significant oral changes predicted by oncological treatment type ($p<0.05$) in Table 1, both crude and adjusted analyses were carried out using Logistic Regression models. Results were expressed using odds ratios (OR) and their respective 95% confidence intervals for detailing the risk of each of the oral changes, according to the oncological treatment type (chemotherapy; radiotherapy; chemotherapy and radiotherapy; others). The reference category was the "others" group. To define the variables listed as adjustment measures for the association between the oncological treatment type and oral changes, crude analyses of the association between the independent variables and the outcomes (oral changes) were conducted, and those independent variables whose association showed $p<0.05$ in the crude analysis were inserted as adjustment measures (Table 2). It is important to highlight that only relevant conditions were considered in this study, according the literature.

The results were generated using the Stata 14.0 program (Stata Corp LLP, College Station, TX). For all procedures, a significance threshold of 5% ($p<0.05$) was adopted.

III. Results

399 of the 1200 patients undergoing cancer treatment in the HCOCU in Alfenas, MG, Brazil between 2017 and 2019 were interviewed, exceeding the minimum required sample of 309 participants. In this way, it is possible to state that the sample was statistically representative of the study population. Table 1 describes the socioeconomic factors, health habits, general health, and oral health conditions, and oral changes following cancer treatment for the study participants. The average age of those interviewed at *Casa do Café* was 58.8 (±13.8) years. The sample included a majority of women (58.15%), people with low education levels (76.88% studied up to primary school), and low income (63.91% receive less than one monthly minimum wage). Health habits revealed 16.29% smokers and 13.03% reported regular alcohol consumption. The general health status of a quarter of patients undergoing cancer treatment is also affected by a set of other diseases (21.55% have two or more chronic conditions alongside cancer), with 22.50% of this population on at least four medications daily in the last three months. Head and neck tumors constituted 8.54% of cases, and most participants have been undergoing treatment for more than a year (61.79%).

Regarding oral health conditions, around half of the participants (49.62%) had severe tooth loss (between zero and nine remaining teeth), and 59.90% used prostheses. About one third of participants (31.83%) had active caries and the most prevalent periodontal condition was gingival bleeding with 84.71%. only 10.78% of the respondents rated their oral health as poor or very poor and only 13.03% received guidance about their oral health during cancer treatment. Regarding the oncological treatment type, the combination of chemotherapy and radiotherapy was most common (36.34%). Among the oral changes after cancer treatment, the most prevalent were xerostomia (60.15%) and dietary changes (57.64%). Oncological treatment types were associated with the occurrence of taste changes ($p<0.001$), dietary changes ($p=0.001$), and the occurrence of mucositis ($p=0.002$). Patients who underwent chemotherapy or chemotherapy associated with radiotherapy had more oral changes (taste changes, dietary changes, and mucositis).

Table 1: Characterization of the sample of cancer patients, according to the type of treatment received. Alfenas, MG, 2019.
(continues)

	Total		Type of cancer treatment				
			Others	Chemo	Radio	Chemo/Radio	p-value
	n	%	%	%	%	%	
Total	**399**	**100**	**17.29**	**32.58**	**13.78**	**36.34**	
Socioeconomic conditions							
Sex							
Man	167	41.85	18.56	36.53	16.77	28.14	**0.032**
Woman	232	58.15	16.38	29.74	11.64	42.24	
Education level							
≤8 years of study	306	76.88	18.63	31.37	15.03	34.97	0.194
>8 years of study	92	23.12	11.96	36.96	9.78	41.30	
Income							
≤1 minimum wage	193	63.91	15.54	29.53	14.51	40.41	0.316
>1 minimum wage	109	36.09	14.68	39.45	10.09	35.78	
Health habits							
Current Smoking							
No	334	83.71	17.07	32.04	14.07	36.83	0.918
Yes	65	16.29	18.46	35.38	12.31	33.85	
Current alcohol							
No	347	86.97	17.58	32.85	13.54	36.02	0.946
Yes	52	13.03	15.38	30.77	15.38	38.46	
General Health							
Multimorbity							
0-1 conditions	313	78.45	14.70	34.19	14.38	36.74	0.065
≥2 conditions	86	21.55	26.74	26.74	11.63	34.88	
Polipharmacy							
<4 medications	279	77.50	16.49	32.26	13.26	37.99	0.264
≥4 medications	81	22.50	23.46	34.57	14.81	27.16	
Tumor location							
Others sites	364	91.46	16.71	34.25	13.70	35.34	0.157
Head/neck	34	8.54	21.21	15.15	15.15	48.48	
Time in treatment							
≤1 year	149	38.21	22.82	40.27	11.41	25.50	**<0.001**
>1 year	241	61.79	13.28	27.80	14.94	43.98	
Previous câncer							
No	313	78.45	18.21	31.31	13.42	37.06	0.620
Yes	86	21.55	13.95	37.21	15.12	33.72	
Oral Health							
Number of teeth							
0 - 9 teeth	198	49.62	17.17	31.31	17.17	34.34	
10 a-19 teeth	51	12.78	25.49	29.41	15.69	29.41	0.136
20 or more teeth	150	37.59	14.67	35.33	8.67	41.33	
Use of prosthesis							
No	160	40.10	14.37	35.00	10.00	40.63	0.116
Yes	239	59.90	19.25	30.96	16.32	33.47	
Dental Caries							
No	272	68.19	17.28	33.46	13.60	35.66	0.954
Yes	127	31.83	17.32	30.71	14.17	37.80	
Gum bleeding							
No	338	84.71	17.46	32.54	14.79	35.21	0.485
Yes	61	15.29	16.39	32.79	8.20	42.62	
Periodontal pocket							
No	330	82.71	17.58	30.61	13.94	37.88	0.302
Yes	69	17.29	15.94	42.03	13.04	28.99	
Poor oral health							
No	356	89.22	16.57	32.02	14.04	37.36	0.491
Yes	43	10.78	23.26	37.21	11.63	27.91	

Table 1: Characterization of the sample of cancer patients, according to the type of treatment received. Alfenas, MG, 2019.

	Total		Types of cancer treatment				
			Others	Chemo	Radio	Chemo/Radio	p-value
	n	%	%	%	%	%	
Orientation in Oral Health							
No	347	86.97	18.73	32.85	14.99	33.43	**0.0**
Yes	52	13.03	7.69	30.77	5.77	55.77	**07**
Oral changes							
Xerostomia							
No	159	39.85	18.87	29.56	14.47	37.11	0.7
Yes	240	60.15	16.25	34.58	13.33	35.83	41
Halitosis							
No	291	72.93	17.87	34.02	15.12	32.99	0.1
Yes	108	27.07	15.74	28.70	10.19	45.37	33
Change in taste							
No	208	52.13	23.56	32.69	15.38	28.37	**<0.**
Yes	191	47.87	10.47	32.46	12.04	45.03	**001**
Dietary changes							
No	169	42.36	23.08	24.85	18.34	33.73	**0.0**
Yes	230	57.64	13.04	38.26	10.43	38.26	**01**
Lockjaw							
No	332	83.21	17.47	33.43	13.55	35.54	0.8
Yes	67	16.79	16.42	28.36	14.93	40.30	26
Mucositis							
No	262	65.83	20.23	32.06	16.79	30.92	**0.0**
Yes	136	34.17	11.76	33.82	8.09	46.32	**02**
Inflammation/infection							
No	300	75.19	18.33	30.67	15.67	35.33	0.1
Yes	99	24.81	14.14	38.38	8.08	39.39	35

Table 2 displays the crude and adjusted Logistic Regression models for oral changes and oncological treatment types. Radiotherapy alone didn't show any associations, whereas chemotherapy was associated to an increased likelihood of taste changes (OR: 2.44; 95% CI: 1.22-4.90). Chemotherapy and radiotherapy together were associated with more odds of taste changes (OR: 3.86; 95% CI: 1.92-7.75) and mucositis (OR: 2.51; 95% CI: 1.06-5. 94), independently of socioeconomic factors, health habits, general health, and oral health conditions.

Table 2: Crude and adjusted analyzes of the associations between type of cancer treatment and oral changes among cancer patients. Alfenas, MG, 2019.

	Chemotherapy		Radiotherapy		Chemo/Radio	
	OR (CI95%)	p	OR (CI95%)	p	OR (CI95%)	p
Change in taste						
An. Crude	2,23 (1,20-4,17)	**0,012**	1,76 (0,83- 3,71)	0,137	3,57 (1,93-6,62)	**<0,001**
An. Adjusted[1]	2,44 (1,22-4,90)	**0,011**	2,07 (0,91-4,73)	0,084	3,86 (1,92-7,75)	**<0,001**
Dietary changes						
An. Crude	2,72 (1,49-4,97)	**0,001**	1,01 (0,49-2,06)	0,986	2,01 (1,12-3,60)	**0,019**
An. Adjusted[2]	2,08 (0,90-4,78)	0,084	0,71 (0,25-2,00)	0,515	2,18 (0,95-5,00)	0,066
MUCOSITIS						
An. Crude	1,81 (0,93-3,53)	0,079	0,83 (0,35-1,97)	0,669	2,58 (0,17-0,53)	**<0,001**
An. Adjusted[3]	1,96 (0,80-4,81)	0,140	0,74 (0,23-2,38)	0,614	2,51 (1,06-5,94)	**0,036**

OR: odds ratio; CI95%: 95% confidence interval.

[1]Model adjusted for: age, sex, polypharmacy, tumor site, number of teeth, use of prosthesis, self-assessment of oral health, oral health guidance received in Oncology;

[2]Model adjusted for: age, education, income, alcohol, polypharmacy, tumor location, treatment time, scholarship, oral health self-assessment, oral health guidance received in Oncology;

[3]Model adjusted for: age, sex, education, income, alcohol, tumor location, number of teeth, oral health guidance received in Oncology.

IV. Discussion

This study contributes to understanding the association between different cancer treatment types and oral complications. Their findings indicate that the most prevalent oral changes after cancer treatment are xerostomia and dietary changes. Furthermore, chemotherapy is associated with more odds of taste changes, whereas the combination of chemotherapy and radiotherapy is associated with taste changes and mucositis. These findings can contribute to a better approaching of the cancer patients as oncological scenario as in oral health management.

Among the oral complications after cancer treatment, the study showed that xerostomia (60.15%) and dietary changes (57.64%) were the most prevalent. Such data aligns with existing literature on the topic. In previous studies, Floriano et al.[25] showed that xerostomia (71.9%), mucositis (67.7%), and candidiasis (32.3%) were the most common oral lesions after cancer treatment. Freire et al.[26] highlighted xerostomia (53.8%) as the most common oral manifestation, followed by purpura (15.4%), gingival bleeding (7.7%), periodontitis (7, 7%), thrombocytopenia (7.7%) and granulocytopenia (7.7%). Araújo et al.[27] identified in their study that xerostomia (21.0%) and mucositis (12.3%) were the most common manifestations during cancer treatment. However, the researchers observed that, in participants who had completed treatment between 2-5 years prior, the prevalence of xerostomia and mucositis was similar. In patients who had completed treatment more than five years earlier, only xerostomia was identified (8.8%), and no other oral manifestations which suggests that some oral manifestations of cancer treatment can attenuate along time. However, it must not be ignored the permanent oral problems resulted. Amaral et al.[28] also observed that the most identified oral complications were xerostomia (60.3%), mucositis (39.7%), and burning mouth syndrome (27.9%). Faza and Brun[29] observed that the most common complications were xerostomia, taste changes, and aphthous lesions. Considering xerostomia as the most prominent oral disorder, as in this study, Paiva and Biase[30] point out that it remains at a high incidence even after treatment has ended, as, in addition to the transitory decrease in saliva production, some therapeutic agents are capable of causing irreversible damage to glandular acini leading to lasting severe salivary dysfunction. Floriano et al.[25] warn that such conditions may be due to the lack of dental treatment both before oncological therapy, as well as during and after treatment, highlighting the importance of dental treatment or follow-up. Thus, Araújo et al.[27] reinforce the participation of the dentist during and after antineoplastic treatment. For Faza and Brun[29], the role of dental professionals in the multidisciplinary cancer treatment team is evident, both in the initial phases during the course of therapy and after the end of treatment, to guarantee a better quality of life. This is a special issue when considering that many of these oral complications can be prevented or even better managed in order to reduce losses in oral health, general health and quality of life of these patients.

This study showed that radiotherapy was not associated with any oral changes while chemotherapy resulted in greater odds of taste changes. However, chemotherapy and radiotherapy together were associated with greater odds of taste changes and mucositis. This result is consistent with the findings of Araújo et al.[27], who noted a greater occurrence of oral manifestations when the patient underwent chemotherapy associated with radiotherapy when compared to individuals who underwent only one of these therapies. It must be considered that chemotherapy is the most widely adopted treatment for cancer, and this may contribute to its association with oral complications[28,29]. Despite radiotherapy not being directly associated with any of the oral changes observed in this study, the literature points out that radiotherapy causes disturbances in the integrity and function of the patient's oral cavity, leading to the development of oral complications. Gaetti-Jardim Júnior[31], in a study carried out with patients undergoing head and neck radiotherapy, observed the presence of xerostomia, mucositis, and other side effects. Patients irradiated shortly after the start of radiotherapy develop severe mucositis, dermatitis, dysgeusia, xerostomia, and, to a lesser extent, candidiasis. After completion of radiotherapy, 68% of patients had grade III or IV mucositis. It was also found that the development of mucositis makes oral hygiene difficult, exacerbating inflammation in periodontal tissues. At the end of the study, the researchers concluded that the primary cause of radiotherapy abandonment as well as the severity of the sequelae depends on the oral conditions of the patients before starting treatment and the lack of dental treatment prior to oncological treatment. Braam et al.[32] agree that radiotherapy, whether applied alone or in conjunction with chemotherapy or surgery, can induce significant immediate and long-term side effects to the oral cavity. These effects range from xerostomia and challenges with chewing and swallowing to impaired taste and a heightened risk of tooth decay or oral candidiasis. Based on this assumption, the researchers carried out a study to describe long-term changes in quality of life and its correlation with parotid salivary output in patients with head and neck cancer who underwent radiotherapy. Upon concluding their study, the researchers observed an improvement in the quality-of-life score related to xerostomia post-radiotherapy. In short, radiotherapy has been identified as a frequent cause of xerostomia, affecting 70% to 100% of patients treated with this therapeutic modality, worsening xerostomia and mucositis, as well as the occurrence of

radiation-induced cavities[29], causing devastating effects on the oral cavity. Such effects often complicate the continuation of radiotherapy procedures[31,32,33,34], as well as negatively influence the quality of life of cancer patients[31,35,36,37,38]. Nonetheless, the magnitude of such complications depends on a series of factors related to the treatment, the tumor, and the patient[30]. This may partially explain the lack of association between radiotherapy and oral changes in this study, especially given that only 13% of our sample was subjected exclusively to radiotherapy.

Chemotherapy frequently emerges as the primary treatment option, either as a standalone or in combination with radiotherapy and other treatments[3,8]. The choice of treatment method depends on factors such as the nature, extent, and location of the tumor and the patient's health conditions. As therapies that can be performed alone or in combination with other modalities, as observed in this study, chemotherapy and radiotherapy can damage the patient's oral cavity during and after treatment. This accentuates the pivotal role of dental professionals in conducting pre-treatment evaluations and overseeing care throughout and after the cancer treatment. Therefore, it is expected that the combination of chemotherapy and radiotherapy can in fact amplify potential adverse outcomes, precipitating the onset of oral complications.

It should be noted that the present study has limitations, such as the cross-sectional design, which did not allow inference regarding the sequence of events investigated. Therefore, it was not possible to determine precisely which occurred first: the oncological treatment or the oral problems. However, it is useful to clinical purposes to identify and describe such correlations in order to prevent some of these oral manifestations as well as to provide a better management and treatment. Furthermore, oral changes were investigated based on the subjects' self-report, which conditioned the investigation on the patients' memory and perception of their own health. It should also be noted that despite the robustness of the study design and sample determination, patients who expressed interest participated in the study, and it was not possible to carry out a draw to choose potential participants. This constraint arose from the specific characteristics of the study site, as well as the health status and availability of the patients. However, strengths include collecting data from patients with tumors from different locations, representing a health region with more than 400,000 inhabitants. This is because the oncology center that served as the population base for carrying out the study is the only one to provide oncological treatment via public health system in the specified region. Additionally, it is important to mention that oncological treatment is predominantly performed in public health system in Brazil[3]. Moreover, the study employed an adequate sample size, using instruments and techniques widely recognized internationally[39,40] to evaluate the conditions investigated. Future studies should explore in greater depth the associations and non-associations observed here, particularly the lack of association between radiotherapy and oral complications based on clinical data as well as to investigate how these complications can impact daily lives of the patients by means tools assessing quality of life.

V. Conclusion

Antineoplastic treatment is recognized as being associated with oral manifestations. Patients undergoing chemotherapy or the combination of chemotherapy and radiotherapy are more susceptible to oral problems, such as mucositis, taste changes, and dietary changes. Cancer patients must be monitored before, during, and after antineoplastic therapy by a dentist, included in a multidisciplinary team, to offer a holistic approach to patient care and prevent and control the occurrence of such complications. Options of treatment with reduced negative impact on oral health and well-being of the patients should be encouraged towards the view of the continuity between oral and general health, and, thus, assist the effectiveness of treatment, as well as promoting good health, well-being, and quality of life for these patients.

Authors Contributions

B.M.S.M.M., P.C.M.X., and M.C.F.B. participated in data collection and e databank interpretation. B.M.S.M.M. drafted and critically revised the manuscript. L.A.F., E.J.P.O., and D.C.L participated in conception and study design. E.J.P.O. participated in databank construction and interpretation.All authors reviewed and approved the final version of the manuscript.

Conflicts of Interests/Competing Interests

The authors declare having no conflicts of interest.

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Concomitant Extraction of Wisdom Teeth with Bilateral Sagittal Split Osteotomy (BSSO): A Case Series

By Nadeen Haj Ahmad, DDS , Faisal Quereshy, MD, DDS, FACS & Dale Baur, DDS

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Abstract- *Aim:* To investigate the incidence of postoperative complications (including pain, nerve damage, swelling and infection) associated with the concomit an textraction of wisdom teeth at the time of bilateral sagittal split osteotomy procedures.

Materials and Methods: A retrospective evaluation of eight patients who underwent concomitant removal of their lower wisdom teeth (either fully erupted, partially or fully bone impacted)atthetime of their surgical procedure (Bilateral sagittal split osteotomy with/without LeFort 1 procedure/ genioplasty). All patients presented to the Oraland Maxillofacial Surgery Department at Case Western Reserve University. Postoperative complications (including pain, nerve dysfunction, swelling and infection) were examined at regular follow-up appointments after their surgical procedure.

Results: A total of eight patients were examined for post operative complications. All patients confirmed the presence of mild pain/discomfort/swelling in the short-term post operatively.

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Concomitant Extraction of Wisdom Teeth with Bilateral Sagittal Split Osteotomy (BSSO): A Case Series

Nadeen Haj Ahmad, DDS [α], Fa isal Quereshy, MD, DDS, FACS [σ] & Dale Baur, DDS [ρ]

Abstract- ***Aim:*** **To investigate the incidence of postoperative complications (including pain, nerve damage, swelling and infection) associated with the concomitant extraction of wisdom teeth at the time of bilateral sagittal split osteotomy procedures.**

Materials and Methods: **A retrospective evaluation of eight patients who underwent concomitant removal of their lower wisdom teeth (either fully erupted, partially or fully bone impacted) at the time of their surgical procedure (Bilateral sagittal split osteotomy with/without LeFort 1 procedure/ genioplasty). All patients presented to the Oral and Maxillofacial Surgery Department at Case Western Reserve University. Postoperative complications (including pain, nerve dysfunction, swelling and infection) were examined at regular follow-up appointments after their surgical procedure.**

Results: **A total of eight patients were examined for postoperative complications. All patients confirmed the presence of mild pain/discomfort/swelling in the short-term postoperatively. Nerve sensation changes (V3 hypoesthesia) were also noted in the short and medium-term follow-ups but greatly improved in the long term.**

Conclusion: **The concomitant extraction of bilateral wisdom teeth at the time of the surgical procedure (with/without a LeFort 1 or genioplasty) has no significant or permanent complications associated with the BSSO procedure.**

I. Introduction

One of the most common procedures used to repair mandibular abnormalities is the bilateral sagittal split osteotomy (BSSO) [(1)], which can also be used to correct obstructive sleep apnea as well as musculoskeletal disorders [(1)]. Nonetheless, it includes a wide range of postsurgical challenges, ranging from the more typical ones, such as an unfavorable or a "bad" split or inferior alveolar nerve injury, to the less common infections and bleeding [(1)]. A "bad" split can be attributed to a number of causes that can include limited surgical experience, a faulty surgical technique, or even patient-related factors like old age [(1)]. It has been discussed in the literature, however, that a major factor in this complication can be due to the concomitant extraction of third molars at the time of the surgery [(1)]. The timely extraction of third molars when performing a sagittal split osteotomy has been a source of debate [(2)]. Several studies in favor of extracting wisdom teeth at the time of surgery suggest that patients end up with fewer postoperative complications and financial burdens [(2)]. Opponents of this suggestion claim that the decreased instances of "bad" splits outweigh the increased intraoperative technical difficulties as well as the surgical operating time [(2)]. The typical approach was the extraction of wisdom teeth at least 6 months prior to surgery, so the introduction of such a methodology has raised questions regarding more postoperative complications associated with it [(1)]. Some of these include infections, problems in soft tissue healing and relapse as well. But more recently, the concomitant extraction of wisdom teeth at the time of the BSSO procedure has been preferred since patients will not have to undergo a second surgical procedure with its associated diminished quality of life after [(1)]. A study done by Verweij et al. concludes that doing so ultimately depends on the surgeon's discretion and the patient's preference [(3)]. The authors present a series of nine patients who underwent a BSSO along with extracting their third molars +/- upper third molars. In some cases, patients had to undergo an additional LeFort 1 procedure or genioplasty when necessary.

II. Materials and Methods

A retrospective analysis of eight patients who were subjected to BSSO with/without another surgical procedure such as Le Fort1 or genioplasty along with the extraction of their wisdom teeth at the time of surgery. All patients were recruited at follow-up appointments which were categorized into short-term (up to 4 weeks), medium-term (up to 8 weeks), and long-term (more than 8 weeks). Patients were examined regarding the presence of postoperative complications at each follow-up visit, including pain, nerve damage, swelling and infection). Our inclusion criteria was: patients who under went extraction of wisdom teeth at the time of the BSSO procedure.

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III. Results

Below is a review of our eight patients in terms of any postoperative complications at their postoperative follow-up appointments. A table at the end of the discussion summarizes the complications present in each patient bilaterally. Since not all patients appeared for all their follow-up appointments, not all patients have their results at short-term, medium-term and long-term follow-ups. Results are taken directly from patients' postoperative progress notes.

Case (1):

A 16-year-old female underwent extraction of all wisdom teeth along with an anterior iliac crest graft to the mandible and a BSSO.

Medium-term follow-up: No pain, no swelling, no infection, right V3 paraesthesia, left V3 hypoesthesia, and intact VII bilaterally.

Long-term follow-up: No pain, no swelling, no infection, right V3 paresthesia, left V3 hypoesthesia, intact VII bilaterally.

Case (2):

A 21-year-old female with a cleft lip/palate, class III malocclusion with maxillary and mandibular hypoplasia. Her surgical procedure included the extraction of all wisdom teeth (#1,16,17 and 32) at the time of the BSSO and the three-piece LeFort 1 surgery.

Short-term follow-up: minimal pain, minimal swelling, no infection, bilateral V2 hypoesthesia, intact V3 and VII.

Medium-term follow-up: intact V2, bilateral V3 hypoesthesia.

Case (3):

A 19-year-old male with maxillary deficiency, mandibular prognathism, and a 1.5 cm anterior open bite. His surgical procedure, which consisted of a BSSO, LeFort 1, and extraction of all wisdom teeth, was complicated by suspected malignant hyperthermia which resulted in immediate postoperative ICU admission.

Short-term follow-up: minimal pain, minimal swelling, right cranial nerve V2, V3 paraesthesia, improving left V2 and an intact left V3.

Medium-term follow-up: minimal swelling, completely resolved left side innervation, slowly improving right side innervation.

Long-term follow-up: no pain, no swelling, no infection, resolution of IAN paraesthesia.

Case (4):

An 18-year-old female patient with maxillary hypoplasia, mandibular hyperplasia, and chin deviation to the left. Her surgical procedure involved LeFort 1, BSSO, genioplasty and extraction of the fully-bony impacted #1, #16, partially-bony impacted #17 and soft-tissue impacted #32.

Short-term follow-up: appropriate healing with nerves intact but with some hypoesthesia.

Medium-term follow-up: Mild edema mainly in the upper lip, improving hypoesthesia sensation.

Case (5):

An 18-year-old female with hypertension and depression taking Zoloft as her only medication as stated. The patient has maxillary deficiency and mandibular excess, with a bilateral posterior crossbite.

Radiographic examination revealed fully bony impaction of teeth #17 and #32. The patient's surgical procedure was a BSSO, LeFort 1, and extraction of bilateral wisdom teeth(#17 and #32).

Short-term follow-up: Minimal swelling with no significant pain. Bilateral V2 hypoesthesia and V3 paraesthesia.

Medium-term follow-up: The patient only had left V3 hypoesthesia.

Long-term follow-up: Class III occlusion relapse on the left side (in the anterior and premolar region) with class I occlusion on the molar side bilaterally. The patient suffered slight V3 hypoesthesia in her chin and lower lip.

Case (6):

A 17-year-old female with a retrognathic mandible with ADHD; taking Adderal. The patient is also an active smoker of about 3-4 cigarettes/day. Radiographic examination reveals fully bony impaction of all wisdom teeth (#1,16,16 and 32). Her surgical procedure involved a BSSO with the extraction of all third molars.

Short-term follow-up: Some infection was noted on the left side due to food debris, and amoxicillin 500mg was prescribed. Some tenderness, erythema, and bilateral V3 hypoesthesia were noted.

Case (7):

An 18-year-old female with a skeletal class III relationship and a mandibular midline shift to the left. Her surgical procedure involved a LeFort 1(with bone grafting), BSSO and the extraction of bilateral wisdom teeth which were partially erupted.

Short-term follow-up: Minimal discomfort and edema with no pain or infection. The patient had bilateral inferior alveolar nerve(IAN) and V3 hypoesthesia.

Medium-term follow-up: Bilateral numbness of the lower lip and chin.

Long-term follow-up: No pain or discomfort but her only complaint was a bilateral IAN anesthesia.

Case (8):

An 18-year-old male with sleep apnea and an extensive history of cleft lip/palate surgeries. His surgical procedure involved a LeFort 1, bilateral BSSO and the extraction of bilateral wisdom teeth which were impacted.

Short-term follow-up: Bilateral minimal edema with tolerable pain.

Medium-term follow-up: Bilateral mental nerve hypoesthesia.

IV. Discussion

Despite the bilateral sagittal split osteotomy procedure being one of the most common procedures used to correct mandibular deformities, the timely extraction of present wisdom teeth is highly debatable [3,4] Some authors would favor the extraction of third molars prior to surgery as it increases the operation's surgical difficulty while others advocate their extraction intraoperatively, due to the diminished need for a second surgery and its associated postoperative complications [3]. Having postoperative complications due to a second surgical procedure can have its own social and financial implications for the patient, as they might need extra days off work/school for postoperative healing [5]. There is no definite answer as to whether intraoperative extraction of wisdom teeth is associated with a greater risk of intraoperative complications, such as a "bad" split, or any more significant postoperative complications. One prospective cohort study showed that doing so would reduce postoperative neurosensory dysfunction due to less chance of IAN manipulation and entrapment, without significantly increasing operating time or the incidence of unfavorable fractures [6]. According to a paper by David S. Precious, it is not justified to expose the patient to two separate procedures when all steps can be done safely and efficiently in the same setting, at the same time [7]. A proper anatomical approach is taken, where cuts are performed through the greater sagittal length of the impacted wisdom teeth, exposing the position of the IAN along with the tooth [7]. An additional randomized controlled clinical trial by Marimuthu et al. that is in favor of the concomitant extraction of wisdom teeth at the time of BSSO proves that there is no extra risk of postoperative infection due to the presence or absence of wisdom teeth intraoperatively; suggesting doing it all at the same setting to maximize patient's comfort [8]. As for the social and financial implications of having a combined surgery, a study done at Salisbury Hospital concluded that carrying out a single procedure would lessen the financial burden on patients [due to less time off work], decrease surgery-associated anxiety and even decrease the postoperative neurosensory deficit [9].

A different study that was done to analyze the common practices among the members of the French Society of Stomatology and Oromaxillofacial Surgery concluded that the majority of surgeons prefer to have a period of six months between the extraction and the BSSO procedure; stating that the presence of wisdom teeth intraoperatively would complicate the procedure [10]. This is supported by the results of the study by Eshghpour M et al. that was carried out on 140 patients undergoing BSSO; concluding that the presence of these impacted wisdoms would increase the risk of a "bad" split during the operation (11).

On a different note, questions regarding the favorable displacement of the inferior alveolar nerve(IAN) after the extraction of wisdom teeth before the BSSO have risen. A study with a radiological analysis of the CBCT of 30 different patients has been conducted; negating the influence of the extraction on the route of the IAN [12].

Our aim here in this case series is to investigate the presence of any notable postoperative complications associated with extracting wisdom teeth at the time of the designated surgical procedure. Eight patients, with an age range of 16-21 years, had their lower wisdom teeth extracted at the time of their bilateral sagittal split osteotomy procedure with/without LeFort1 and/or genioplasty. A bilateral examination for each patient was done postoperatively as each side can be examined and treated as a separate entity. These complications included pain, swelling, infection, and nerve damage. Minimal pain or swelling was noted for most patients on their short-term follow-up appointments.

Slight paraesthesia/hypoesthesia was noted on the medium and long-term follow-ups with a resolution of the majority of the remaining complications.

As a conclusion, the concomitant extraction of wisdom teeth at the time of the BSSO poses no extra major postoperative complications; as evidenced by our eight patients. It is rather a technique that comes with a reduced need for a second surgical procedure and its associated complications.

V. Limitations

- Our case series has some limitations in terms of standardizing the intervals between our patients' follow-up appointments. Since not all patients showed up at exact follow-up appointments, their visits were categorized and standardized into short-term, medium-term and long-term follow-up appointments.
- Results were taken directly from follow-up and postoperative notes.

Patient #	Age	Gender	Side	Pain	Swelling	Nerve dysfunction	Infection	"Bad" split
Patient(1)	16	Female	Right	Absent	Absent	V3 paraesthesia	Absent	-
			Left	Absent	Absent	V3 hypoesthesia	Absent	-
Patient(2)	21	Female	Right	Minimal	Minimal	V2 hypoesthesia	Absent	-
			Left	Minimal	Minimal	V2 hypoesthesia	Absent	Absent
Patient(3)	19	Male	Right	Minimal to absent	Minimal to absent	V2/V3 paraesthesia (eventually resolved)	Absent	-
			Left	Minimal to absent	Minimal to absent	Absent	Absent	-
Patient(4)	18	Female	Right	Absent	Absent	Some hypoesthesia	Absent	-
			Left	Absent	Absent	Some hypoesthesia	Absent	-
Patient(5)	18	Female	Right	Absent	Minimal	Absent	Absent	-
			Left	Absent	Minimal	V3 hypoesthesia	Absent	-
Patient(6)	17	Female	Right	Minimal	Absent	V3 hypoesthesia	Absent	-
			Left	Minimal	Absent	V3 hypoesthesia	Mild	-
Patient(7)	18	Female	Right	Absent	Minimal	V3 anesthesia/hypoesthesia	Absent	-
			Left	Absent	Minimal	V3 anesthesia/ hypoesthesia	Absent	-
Patient(8)	18	Male	Right	Minimal	Minimal	Mental nerve hypoesthesia	Absent	-
			Left	Minimal	Minimal	Mental nerve hypoesthesia	Absent	-

(-): Data was not present/available.

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Evaluation of the Knowledge of Dentists from the State of Alagoas about the Preventive Means for Periodontal Disease

By Luan Carlos Miranda de Aquino , Pedro Floriano de Almeida Lins, Camila Ventura Bezerra, Mônica Larissy dos Santos & Mariana Sales de Melo Soares

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Keywords: *periodontal disease, oral hygiene, prevention, biofilm.*

GJMR-J Classification: *NLM Code: MLM Code: WU 240*

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Abstract- The aim of this study was to evaluate the degree of knowledge of dentists from the state of Alagoas regarding the preventive means of periodontal diseases. The crosssectional observational study was carried out using an online questionnaire with 14 questions related to the preventive means of periodontal disease. 154 questionnaires were collected and answered by dentists registered on regional dental council of Alagoas. The sample was chosen by convenience without distinction of specialization and gender. 154 professionals were evaluated, 100% of the interviewees answered that knew some means of preventing periodontal disease and the most prevalent method known by the professionals was Oral Hygiene Instruction 98.7% and the dental floss 98%. Regarding the knowledge of these professionals about the types of brushing techniques, 95% affirmed know the techniques and 5% did not. The results observed in this study showed satisfactory knowledge of dentists from the state of Alagoas about the means of preventing periodontal diseases, on the other hand, the smallest part of the interviewees does not.

Keywords: periodontal disease, oral hygiene, prevention, biofilm.

Abstrato- Avaliação do conhecimento de cirurgiões-dentistas do estado de Alagoas sobre os meios preventivos da doença periodontalResumo: O objetivo do trabalho foi avaliar o grau de conhecimento de cirurgiões-dentistas do estado de Alagoas quanto aos meios preventivos das doenças periodontais. O estudo realizado foi do tipo observacional transversal com aplicação de questionário online com 14 perguntas relacionadas aos meios preventivos da doença periodontal. Foram coletados 154 questionários respondidos por cirurgiões-dentistas inscritos no conselho regional de odontologia de Alagoas, escolhidos por amostra de conveniência sem distinção de especialização e gênero. Dos 154 profissionais avaliados, 100% dos entrevistados responderam conhecer algum meio preventivo da doença periodontal, e que os métodos de prevenção mais conhecidos pelos profissionais avaliados foram a Instrução de Higiene Oral com 98,7% e o uso do fio dental com 98%. Com relação ao conhecimento desses profissionais sobre os tipos de técnicas de escovação 95% afirmam que tem conhecimento das técnicas e 5% não conheciam. Diante dos resultados observados no estudo, o conhecimento dos cirurgiões-dentistas do estado de Alagoas quanto aos meios preventivos das doenças periodontais é satisfatório, uma vez que a maioria conhece algum meio de prevenção para doença periodontal, por outro lado a menor parte dos entrevistados não conhecem os tipos de escovas e técnicas disponíveis para alcançar com mais eficácia a prevenção das doenças periodontais.

Palavras-chave: doença periodontal, higiene oral, prevenção, biofilme.

I. Introdução

As doenças periodontais são patologias da cavidade oral que podem levar a destruição dos tecidos de suporte dos dentes. O principal fator etiológico são os microrganismos do biofilme dental, ainda assim, essas doenças resultam da interação desses microrganismos com a resposta imunoinflamatória do hospedeiro que pode intensificar os danos aos tecidos levando a uma lesão irreversível (Socransky e Haffajee, 2002; Teles et al., 2013).

O biofilme dental é uma matriz organizada derivada de glicoproteínas salivares e produtos microbianos extracelulares que se forma nas superfícies duras e não escorregadias da boca (Addy et al., 1992). É composto por microrganismos, componentes provenientes da saliva, sangue, fluido gengival e restos alimentares, e que se não removido adequadamente pode ocasionar destruição dos tecidos periodontais (Lindhe et al 2005; Ditterich et al., 2007). De acordo com os estudos de Löe et al. (1965) e Theilade et al., (1996), se o biofilme supragengival, depositado recentemente, não for removido por qualquer prática de higiene oral, após 2-3 semanas aparecerá alterações que resultarão no estabelecimento da gengivite.

As medidas de controle do biofilme realizadas por conta própria podem ser essenciais na prevenção da doença periodontal (Hujoel et al., 2005). A escovação diária regular é estratégia fundamental para prevenir e controlar doenças periodontais, promove a desestruturação do biofilme supragengival e reduz o número de patógenos periodontais (Worthington et al., 2019). Isso implica em um melhor entendimento de como o cirurgião dentista devem abordar de forma mais eficaz a questão da promoção da saúde bucal com seus pacientes.

Nesse contexto, a instrução de higiene oral é um meio preventivo, no qual o profissional demonstra o método de escovação adequado, seguido de

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método de escovação adequado, seguido de recomendações sobre a frequência e tipos de dispositivos usados para a remoção do 2010). Os meios de intervenções educacionais, remoção profissional de biofilme, motivação e o conhecimento da relação das doenças periodontais com fatores de risco, também são formas de prevenção primaria das doenças bucais (Hancock e Newell, 2001).

Os profissionais da saúde têm a responsabilidade de atuar na prevenção de patologias, minimizando os riscos e promovendo condições favoráveis para que se torne possível alcançar e manter a saúde bucal. Por outro lado, os pacientes também precisam ser conscientizados sobre o seu papel nos cuidados com a saúde (Bardal et al., 2011). Um estudo sobre um modelo de promoção de saúde relatou que a prevenção começa pela análise da interação entre o paciente e o profissional de saúde bucal. Dessa forma, aspectos relacionados aos níveis cognitivos, afetivos, ambientais e comportamentais devem ser abordados concomitantemente (Inglehart e Tedesco, 1995).

Os métodos preventivos aplicados por cirurgiões-dentistas são importantes e necessários para melhorar os hábitos e o comportamento dos indivíduos, procurando modificá-lo ou aperfeiçoá-los, visando á melhora do seu estado de saúde (Saminsky et al., 2015). Apesar da prática de higiene oral ser fundamental para manter a saúde periodontal, tais práticas podem ser prejudicadas pela desinformação, ignorância, cultura e crenças religiosas (Sayeg et al., 2005).

Visando fazer uma reflexão sobre a importância da prevenção das doenças periodontais como estratégia de promoção de saúde bucal, o presente trabalho tem objetivo de avaliar o grau de conhecimento de cirurgiões- dentistas do estado de Alagoas quanto aos meios preventivos das doenças periodontais através de um questionário com questões específicas sobre o tema, sobretudo, enfatizando a importância da atuação do cirurgião-dentista como coadjuvante no êxito da prevenção de doenças periodontais.

II. Materiais e Métodos

O presente estudo foi desenvolvido no Centro Universitário Mário Pontes Jucá (UMJ), sendo encaminhado e aprovado pelo Comitê de Ética em Pesquisa da Faculdade Estácio de Alagoas, estando de acordo com a Resolução 196/96 do Conselho Nacional de Saúde.

O estudo é do tipo observacional transversal com aplicação de questionário gerado de forma online e enviado por email para os cirurgiões-dentistas selecionados por amostra de conveniência. Foram coletados 154 questionários respondidos por CDs inscritos no conselho regional de odontologia de Alagoas (CRO-AL). Os CDs que não apresentavam inscrição no CRO-AL foram excluídos da pesquisa.

Primeiramente, foi disponibilizado um Termo de Consentimento Livre e Esclarecido (TCLE) para todos os sujeitos da pesquisa (ANEXO 1) informando e esclarecendo os sobre todas as condições do projeto de pesquisa. Os CDs selecionados, foram avaliados por meio de questionário (ANEXO 2) elaborados pelos autores dessa pesquisa. O questionário engloba 14 perguntas específicas sobre o tema do estudo com opções de respostas que permitiu a avaliação dos dados de forma pertinente aos objetivos da pesquisa. Não foi imposto tempo limite para responder as perguntas.

Os benefícios diretos ao responder o questionário foram através da divulgação de informações e esclarecimentos sobre o tema proposto nesse trabalho e os benefícios indiretos serão os resultados desta pesquisa que permitirá uma maior compreensão e a importância do papel do CD no tratamento periodontal dos pacientes.

Os dados obtidos foram apurados e registrados em banco de dados elaborados no Software Microsoft Excel versão 2010, onde foram calculadas as frequências absolutas e relativas de cada umas das 14 perguntas realizadas no questionário.

III. Resultados

O Gráfico 1 mostra que os meios de prevenção da doença periodontal mais conhecidos pelos cirurgiões-dentistas foram a Instrução de Higiene Oral com 98,7% e o Fio dental com 98,7%, enquanto que 78,5% dos CD responderam a raspagem como método de prevenção.

Gráfico 1: Frequência Absoluta e Relativa das Respostas Sobre o Conhecimento dos Mètodos Preventivos da Doença Periodontal

Em relação às orientações dos métodos preventivos, 100% dos CD afirmaram orientar seus pacientes sobre a higiene oral. Quando perguntados sobre a frequência com que orientam os pacientes, 90,3% afirmaram que sempre realizam orientação de higiene oral e 9,7% responderam que fazem isso às vezes (Gráfico 2). 99% dos profissionais entrevistados afirmaram que conhecem os tipos de cerdas das escovas dentais, e apenas 1% não conhece. O Gráfico 3 mostra a frequência do tipo das escovas recomendadas para pacientes com doença periodontal 75,9% responderam indicar escova macia, 52,6% extra macia e 4,5% escova média.

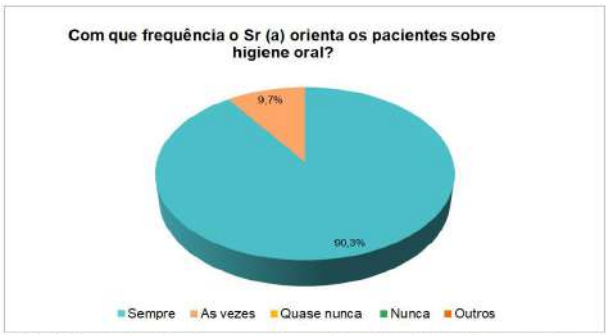

Gráfico 2: Frequência Relativa da Pergunta "Com que Frêquencia o Sr (a) Orienta os Pacientes Sobre Higiene Oral?"

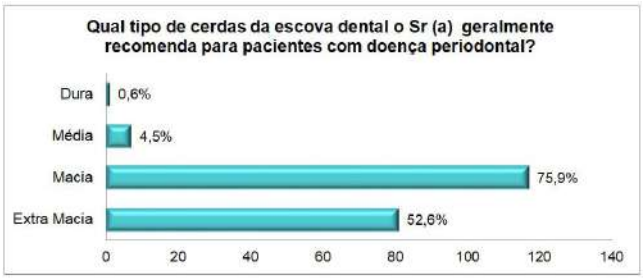

Gráfico 3: Frequência do tipo de cerdas recomendado para pacientes com doenca periodontal

Dos dentistas avaliados 79% afirmaram também conhecer os tamanhos das escovas dentais, enquanto que 21% responderam que não conheciam. Sobre o tamanho recomendado das escovas dentais para pacientes com doença periodontal, o Gráfico 4 demonstra que 57% responderam que recomendavam o tamanho da escova de acordo com o paciente, enquanto que 10% recomendam qualquer escova.

Gráfico 4: Frequência Relativa do Tamanho das Escovas Recomendado Para Pacietes com doença periodontal

Com relação ao conhecimento desses profissionais sobre os tipos de técnicas de escovação 95% afirmam que tem conhecimento das técnicas e 5% não conheciam. As técnicas mais indicadas pelos CD para pacientes com doença periodontal foram a técnica de Bass Modificada com 39,6% e a técnica de Bass com 28,5% (Gráfico 5).

Gráfico 5: Frequência Relativa das Têcnicas de Escovação Para Paciente com Doença Periodontal Indicadas Peios Prodissionais

Sobre a troca da escova dental, 73% aconselham a cada 3 meses e 4% dos CD responderam a cada 6 meses.

Gráfico 6: Frequência Relativa da Pergunta "Você Prienta o Paciente a Escovar Quantas Vezes ao dia?"

Em relação ao fio dental, 92% dos entrevistados afirmaram fazer demonstração do uso do fio dental para seus pacientes e 8% não fazem a demonstração (Gráfico 7). Sobre a frequência do uso do fio dental 35% dos CD responderam orientar os seus pacientes usar o fiodental 3x ao dia.

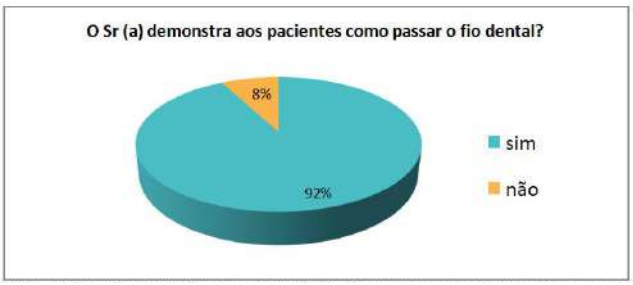

Gráfico 7: Frequência Relativa da pergunta "O Sr. Dempmstra aos pacientes como passar fio dental?"

IV. Discussão

O presente trabalho apresenta uma visão abrangente com informações sobre o nível de conhecimento dos CD sobre os meios preventivos da doença periodontal. De modo geral foi observado que todos os dentistas que responderam ao questionário conhecem e aplicam algum meio preventivo da doença periodontal. Este resultado era o esperado visto que os profissionais são treinados e capacitados durante a formação acadêmica para ser papel essencial na promoção da saúde dos indivíduos.

Na prática diária, os CD devem fornecer conselhos baseados em evidências para cada um de seus pacientes. Além das evidências científicas, devem ser levados em consideração para a tomada de decisões assertivas, a experiência clínica, preferências do paciente e os dispositivos disponíveis no mercado (Sälzer et al., 2020). No presente trabalho os meios preventivos mais conhecidos pelos CD foram a Instrução de Higiene Oral com 98,7%, o fio dental com 98% e escovação dental com 97%. Ferreira e colaboradores (2013), em uma pesquisa nos

consultórios particulares e na rede pública do município de Vassouras (RJ), observaram que quando os CD foram questionados sobre a importância de explicar para os pacientes a relação de causa e efeito da placa bacteriana com a origem da doença, a grande maioria dos dentistas, tanto da rede pública (71,43%) quanto da rede particular (76,92%) responderam que sempre esclarecerem essa relação.

A importância das medidas de controle do biofilme dental é enfatizada em diversos trabalhos na literatura (Claydon, 2008; Chapple et al., 2015). Estudos de longo prazo observaram que práticas adequadas de higiene bucal na população se correlacionam com a diminuição da prevalência da periodontite (Hugoson et al., 2008; Skudutyte-Rysstad et al., 2007). O ponto chave, portanto, é formar profissionais para educar e motivar os pacientes na seleção adequada de técnicas e táticas de prevenção, uma vez que não há uma única que seja indicada para toda a população, dadas as variações na destreza manual, anatômica tipos de cavidades orais e origens psicossociais (Duque et al., 2020).

Instruções de higiene oral repetida ao longo de uma série de visitas com reforço das atividades de cuidado domiciliar foram propostas por Rylander e Lindhe, (1997). No presente trabalho quando perguntados sobre a frequência com que orientam os pacientes, 90,3% afirmam

que sempre realizam orientação de higiene oral e 9,7% responderam que fazem isso às vezes, ou seja, a grande maioria tem a preocupação em esclarecer sobre a higiene oral, destacando assim, a importância da relação entre profissional e paciente através da comunicação. Marin e colaboradores (2011) cita que, o bom sucesso do tratamento odontológico depende dessa comunicação, destacando programas de incentivo associado à higiene oral como estratégias fáceis e efetivas para retirada do biofilme e cuidado das doenças bucais, tendo destaque na busca em atingir uma melhor qualidade da saúde bucal. É importante ressaltar que a orientação é dada de forma individual a cada paciente assim como seu plano de tratamento.

Na análise dos resultados deste estudo, 99% dos CD afirmam ter conhecimento em relação aos tipos de cerdas das escovas dentais. 75,9% dos profissionais afirmaram que recomendam escovas de cerdas macias para os pacientes com doença periodontal e 52,6% indicam as de cerdas extra macia. Newman e colaboradores (2016) afirmaram que quanto mais macia a cerda maior será sua flexibilidade, facilitando a higienização abaixo da margem gengival com a técnica de escovação sulcular, dessa forma atingindo maior parte dos espaços proximais. Estudos demonstram que escovas com diferentes tipos de cerdas apresentam resultados distintos quando avaliados a remoção do biofilme e potencial lesão aos tecidos bucais. As cerdas duras e médias removem melhor o biofilme da superfície dental quando comparadas às do tipo macia, contudo, causam maiores danos ao tecido gengival e podem também causar abrasão (Carvalho, 2007; Zanatta, 2011). Foi demonstrado também que a variação no arranjo dos tufos das cerdas tem influencia na eficiência da escovação, indicando que escovas com cerdas em ângulo cruzado parecem funcionar melhor do que ascerdas planas ou multinível (Slot et al., 2012).

Na recomendação dos CD para as técnicas de escovação em pacientes com doença periodontal, as mais recomendadas foram as técnicas de Bass modificada com 39,6% e a técnica de Bass com 35%. Uma pesquisa realizada com professores da disciplina de periodontia de algumas Universidades do Nordeste observou que as técnicas mais adotadas pela disciplina de periodontia eram as técnicas de Bass com 46,2% e técnica de Bass modicada com 38,5% (Brito et al., 1999), corroborando com o presente estudo. A técnica de Bass modificada é uma reformulação da original, além dos movimentos de frente e trás, acrescenta movimento de vibração e varredura nos dentes anteriores de cima para baixo, e nos dentes posteriores de baixo para cima. O sucesso dessas técnicas em pacientes com doença periodontal é muito eficaz, pois a remoção do biofilme na junção dentogengival desestrutura todo o acumulo de microrganismos estabelecendo uma boa saúde periodontal (Newman et al., 2016). Pinto (2008) mostra que as técnicas de escovação específicas podem ajudar individualmente cada paciente de acordo com as suas limitações e necessidades, ou seja será necessário avaliar o paciente de forma exclusiva.

Em relação a frequência que o CD orienta o paciente a escovar os dentes por dia, foi observado que 63% dos profissionais indicam a escovação 3 vezes ao dia. Um estudo demonstrou que a saúde gengival é mantida quando os intervalos de remoção do biofilme dental são mais frequentes que a cada 48 horas (Löe, 1971). De acordo com a Associação Dental Americana (ADA) a escovação deve ser realizada pelo menos duas vezes ao dia, pois a grande maioria dos indivíduos não consegue eliminar todo biofilme em uma única escovação, e a repetição melhora oresultado final.

Analisando a frequência da troca da escova dental obtivemos um valor de 73% dos entrevistados motivando a sua substituição no período de 3 meses. A recomendação para a substituição é em média de 3 a 4 meses, embora a quantidade de desgaste visível das cerdas não

V. Conclusão

O presente trabalho com cirurgiões dentistas do estado de Alagoas demonstrou que os cirurgiões-dentistas conheciam e recomendavam algum meio preventivo da doença periodontal de forma satisfatória. Os CD tem papel essencial na prevenção das doenças periodontais e deve avaliar e implementar estratégias

para melhorar a educação e a aquisição de bons hábitos de saúde oral e de vida saudáveis da população.

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Silver Diamine Fluoride in Dentistry: A Review of Clinical Applications and Future Prospects

By Dr. Shivam Patel BDS, Dr. Ritul Patel BDS & Dr. Harpreet Hundal BDS

Abstract- This review critically examines the utilization of Silver Diamine Fluoride (SDF) in modern dentistry, focusing on its clinical applications, limitations, and prospective areas for further investigation. Positioned as an alternative to conventional caries management strategies, particularly in addressing the prevalent issue of childhood caries, SDF has garnered attention for its potential to minimize patient anxiety associated with traditional dental procedures.

Drawing insights from studies conducted in various regions, including Japan, London, Cuba, Brazil, and Nepal, the article highlights the substantial efficacy of SDF in arresting both cavitated and incipient carious lesions. Noteworthy is its role as a viable option when restorative treatment for primary teeth is impractical. The review emphasizes SDF's unique application in managing early childhood caries and underscores its significance in preserving the structural integrity of deciduous teeth and supporting jawbone development.

Keywords: silver diamine fluoride, dental caries, atraumatic restorative techniques, dentin hypersensitivity, caries arrest, fluoride, pediatric dentistry, preventive dentistry, dental staining, potassium iodide, oral health.

GJMR-J Classification: LCC Code: RK361

Strictly as per the compliance and regulations of:

Silver Diamine Fluoride in Dentistry: A Review of Clinical Applications and Future Prospects

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Abstract- This review critically examines the utilization of Silver Diamine Fluoride (SDF) in modern dentistry, focusing on its clinical applications, limitations, and prospective areas for further investigation. Positioned as an alternative to conventional caries management strategies, particularly in addressing the prevalent issue of childhood caries, SDF has garnered attention for its potential to minimize patient anxiety associated with traditional dental procedures.[0]

Drawing insights from studies conducted in various regions, including Japan, London, Cuba, Brazil, and Nepal, the article highlights the substantial efficacy of SDF in arresting both cavitated and incipient carious lesions. Noteworthy is its role as a viable option when restorative treatment for primary teeth is impractical. The review emphasizes SDF's unique application in managing early childhood caries and underscores its significance in preserving the structural integrity of deciduous teeth and supporting jawbone development. Furthermore, it explores the use of SDF as an indirect pulp capping agent, highlighting its potential to render residual softened dentin harmless. While acknowledging the clinical advantages of SDF, the review addresses its primary drawback – the aesthetic staining of treated lesions. Proposed strategies, such as post-treatment application of Potassium Iodide, are discussed considering this concern, necessitating further investigation. Safety concerns, including skin and clothes staining and the metallic taste associated with SDF, are discussed alongside strategies for stain removal. Contrary to fears of dental fluorosis, the review synthesizes evidence suggesting minimal toxicity risk when used topically. Future research directions are explored, encompassing SDF's role in atraumatic restorative techniques, topical fluoride applications, and its impact on various restorations. In conclusion, this comprehensive review critically evaluates SDF's clinical applications, limitations, and future perspectives, contributing to a scientific foundation for its integration into contemporary dental practices.

Keywords: silver diamine fluoride, dental caries, atraumatic restorative techniques, dentin hypersensitivity, caries arrest, fluoride, pediatric dentistry, preventive dentistry, dental staining, potassium iodide, oral health.

I. Introduction

Dental caries is a multifactorial bacterial process, a chronic, site-specific progressive disease process resulting from variances in the physiological imbalance between tooth structure and oral biofilm. The process initiates when the pH variation causes a drop in the mineral content of the tooth over time. It is one of the most prevalent diseases known till now. Based on an international epidemiology survey confirms that dental caries is a distinctive disease affecting children in both developed and developing countries[3] The scenario in developing countries is deficient due to the availability of resources such as basic oral hygiene practices and the affordability of dental treatment such as restoration. Thus, unmanaged dental caries indirectly affect their general health and social well-being.[4] For ages, caries have been managed by the mechanical removal of infected portions of the tooth followed by restoration. [5] The choice of restoration solely depends on the operator itself, which can be based on the affordability of high-quality instruments, standard restorative materials, and advanced skills. Then, it also depends on the patient's financial status, which can compromise patient cooperation with treatment. Due to such hurdles in treating caries in the young population, operators are in a dilemma about whether to evacuate all cavitated tooth structures and provide sound restoration. Therefore, the treatment that can withhold caries progression has been pioneered in such unrecognized communities of children [6].

Silver diamine fluoride (SDF), a fluoride-containing agent, has been proven to arrest the caries process and is known to prevent the neoformation of dental caries. [7] As per historians, SDF's first documented use was in Japan's early 1960s-70s; its knowledge could not spread worldwide due to unassumed circumstances. Based on studies conducted in schools in China, SDF has been used since the early 21st century as an anti-cavity agent in school-going children. [8] In various case series and studies during the first decade of the century, SDF was already known as a miraculous, effective agent that could be used to arrest caries. The well-known case series are.

1. Yee *et al.* in Nepal and Braga *et al*. in the United States conducted their studies in 2009 and documented SDF as a 'caries arresting agent' due to the extensive use in their case series and based on their follow-ups. [9, 10]
2. Knight *et al.* in Australia, in their in-vitro studies, proved the properties of SDF as an anti-microbial and caries arresting agent, which was conducted around 2005-09. [11,12]

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All around the world, studies have been conducted in the interest of SDF's clinical implications. Hence, this article will meticulously focus on the roots of this unhesitating agent. This will include its extensive use in preventing and arresting caries in both dentitions.

II. History of Silver in the Dental World

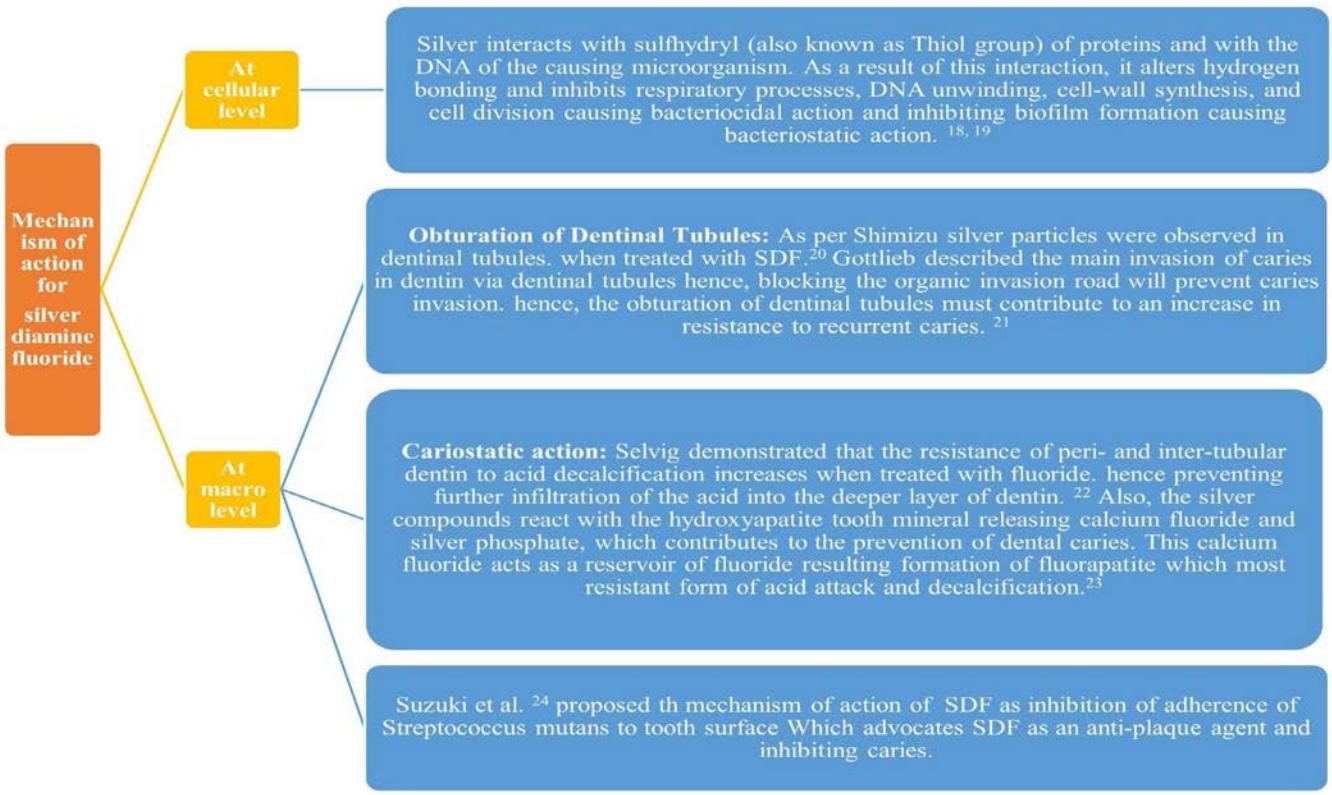
Silver has been used for generations for medical reasons dating as far back as 1000 AD. [13] SDF was developed by Reichi Yamaga, Mizuho Nishino, and colleagues to prevent and treat dental caries [14] and it has been used since its approval in 1970 by PMDA (equivalent to FDA) Japan. This was not globalized because of the language barrier; little evidence is available in English now. Around the 1980s, Australia and Brazil allowed the use of SDF, and in early 2014, the FDA approved it as a medical device to treat dental hypersensitivity. Finally, in 2016, SDF was introduced in the United States as interim caries arresting medicine, and in 2017, Canada approved SDF as a treatment for dental caries. [15]

III. Physical Properties Silver Diamine Fluoride

SDF is a highly alkaline solution with pH = 11 to 13, depending on assorted brands, which does not require a reducing agent such as silver fluoride to make it diamine. Chemically, SDF is more stable than silver fluoride, which can be kept at a constant concentration.[16] SDF is a clear and colorless solution composed of silver's anti-bacterial and fluoride, which helps prevent the progression of caries. The fluoride concentration is 44800 ppm in SDF, the highest in any other fluoride-related product used in dentistry. [17]

IV. Mechanism of Action for Silver Diamine Fluoride

There are mechanisms proposed for SDF. Figure 1 will emphasize the critical tool behind the working of SDF.



V. Clinical Implication of Silver Diamine Fluoride

The following table will emphasize the use of SDF in detail, along with its documented use.

Sr no	Function		Description	Documented uses
1.	Preventive	a. To prevent pit and fissure caries.	The most vulnerable site for dental caries is even more susceptible than smooth surface caries due to the surface structure. The deep pits and fissures make it challenging to self-clean or rinse the surface and detect incipient decay. Studies show topical fluoride has not been beneficial in preventing such caries.	· According to Sato *et al.* (1970) [25] mentioned the effectiveness of SDF in preventing pit and fissure lesions in the first molar and advocated SDF as an antibacterial and caries preventive agent. · Another study conducted by Nishino and Massler in 1977 [26] briefly discussed the caries score of SDF-treated teeth was distinctively less than 8% stannous fluoride or silver nitrate treated tooth.
		b. To prevent recurrent caries	Even after restoring with the best restoration available. The tooth is often vulnerable to bacterial invasion through spaces between the cavity walls and restoration. Hence, the tooth is susceptible to recurrent caries. A slight modification in resistance form is inherent to inhibit such caries growth.[27] Therefore, treating the tooth with SDF before restoration can be functional.	Shimizu and Kawagoe 1976 [(20)] used SDF before restoring a primary tooth and, after 26 months, discovered no recurrent caries.
		c. To prevent caries with minimally invasive treatments.	Treatment in young patients is always known to be strenuous. Especially moisture control is a vast huddle as well, and the sound of the drill sometimes triggers fear or can cause dental anxiety. Hence, SDF would help arrest the caries growth, and later, when the young patient is rational enough to accept the treatment, invasive caries removal would be followed by permanent restoration.	· Yamaga *et al.* [16, 28] Japan is known to be a pioneer in proposing this minimally invasive treatment approach. · Hihara et al. (1994) [29] in Japan, McDonald and Sheiham (1994)[30] in London, Llodra et al. (2005) [31] in Cuba, and Braga et al. (2009) [10] in Brazil all agree with this approach in their studies. · Yee et al. (2009) [19] in Nepal discovered that SDF could arrest cavitated and incipient decay.
2.	Inhibitive	a. To arrest caries in primary teeth	The preschool population categories are often associated with deciduous dentition and are susceptible to 'early childhood caries.' Restoration in primary dentition is always less popular due to their temporary life span. But they play a vital role in the growth of the jaw and, indirectly, the development of the face. Therefore, it is of utmost importance to conserve them. Acute conditions like 'rampant caries' are known for their unpredictable pattern of destruction. SDF is used as an alternative to traditional zinc oxide eugenol restoration. [32]	· Nishino *et al.* (1969) [33] & Moritani *et al.* (1970) [34] discovered an arrested growth of caries in children under SDF therapy compared to the one without it. Lo and Lin (2002) [8] found that SDF successfully arrested dentinal caries in primary anterior teeth in preschool children at a community-based Caries Control Program.
		b. To arrest root caries	The prevalence of root caries in the geriatric population is at its peak, and its incidence is directly proportional to an increase in age.	Tan et al. (2010) [35] and Zang et al. (2013) [36] concluded that SDF effectively arrests root surface caries when applied annually.

3.	Desensitizing	To prevent sensitivity	The composition of SDF has a unique capability of sealing off dental tubules, preventing dental hypersensitivity.	· Gottlieb *et al.* [21] suggested with work that the mechanism behind dentinal hypersensitivity and arresting dental caries are common. · Three researchers, Hatsuyama et al. (1967),37 Murase et al. (1969) 38 and Kimura et al. 39 (1971), have discovered SDF as the most efficacious against erosion and abrasion type of non-caries lesions and desensitizing dentin to cold, heat and mechanical sensations. They could prove that after four applications of SDF, they saw no further effect in desensitization.
4.	Anti-infective	In Root canal treatment	Silver nitrate, combined with ammonia, had been advocated since the early 19th century as a chemical that can sterilize the area, leaving no bacterial species. Similarly, this combination can be employed in treating infected root canals.	· Hiraishi et al. (2010) [40] documented that 3.8% of SDF is used as root canal irrigant or interappointment medicament, which would serve as an antibiotic in nonaesthetic areas where darkening due to SDF is not a significant concern. · Okamoto *et al.* [41] discovered that the application of SDF governs the frequency of treatment. · Mathew *et al.* 2012 [42] found that SDF, when used as an endodontic irrigation solution, has a beneficial effect in sterilizing root canals and circum-pulpal dentin.
5.	Miscellaneous	Community dental health program.	Funding a community health program by a federal or non-federal institution is often challenging. To overcome such financial burdens, SDF can be a replacement or an alternative to the expensive restorative materials and instrumentation used in it.	Bedi and Infirri (1999) [43] pointed out crucial benefits that prove SDF is expensive in controlling caries at a community level.

VI. Limitations of Silver Diamine Fluoride

The major drawback of using SDF to arrest caries is that it imparts staining, usually black. For this reason, SDF is never preferred in the aesthetic zone. To overcome the black staining, applying potassium iodide after SDF application will cause a reaction between the free silver ions of SDF to form silver iodide, a white crystal. Knight *et al.* [12] were the pioneers in establishing this technique.

Another drawback SDF has can be related to the operator as well. SDF tends to stain skin, clothes, or anything that encounters it. Sometimes, these stains are permanent or stay for a long time. Moreover, SDF has a metallic taste, occasionally unpleasant for the patients. Furthermore, in surrounding structures in the oral cavity, SDF can cause gingival or mucosal irritation.

VII. Conclusion

Silver Diamine Fluoride emerges as a promising agent in the contemporary armamentarium of dental care, showcasing its efficacy in caries arrest, indirect pulp capping, and dentin hypersensitivity management. While its aesthetic consequences pose a challenge, ongoing research endeavors and potential strategies, such as the post-treatment application of potassium iodide, indicate a commitment to refining its clinical application.

This review consolidates evidence from diverse studies worldwide, comprehensively evaluating SDF's clinical applications, limitations, and future perspectives. As dentistry progresses toward more patient-centered and minimally invasive approaches, Silver Diamine Fluoride stands as a beacon of innovation, contributing to the evolution of preventive and therapeutic strategies in the field.

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Down Syndrome - Trisomy of Chromosome 21: Medical Considerations, Physiological, and Oral Health Perspectives

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Summary- *Objective:* This study aimed to investigate the intricate physical, systemic, and stomatological characteristics of individuals with Down Syndrome, a condition characterized by trisomy 21, known for its unique features that can influence dental treatment protocols.

Materials and Methods: A descriptive, observational, cross-sectional study was conducted on a convenient sample of 42 individuals aged between 0 and 18 years with Down Syndrome. The participants underwent structured interviews with caregivers, medical history assessments, physical examinations to evaluate systemic and physical conditions, as well as oral health evaluations encompassing the visible biofilm index, gingival condition, ICDAS (International Caries Detection and Assessment System), and INI (Invasive Treatment Need Index).

GJMR-J Classification: *NLM Code: WS107, WU113*

DOWNSYNDROMETRISOMYOFCHROMOSOME21MEDICALCONSIDERATIONSPHYSIOLOGICALANDORALHEALTHPERSPECTIVES

Strictly as per the compliance and regulations of:

Down Syndrome - Trisomy of Chromosome 21: Medical Considerations, Physiological, and Oral Health Perspectives

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Results: The research sample revealed a plethora of characteristics, including a high prevalence of respiratory diseases (71.4%), overweight or obesity (59.5%), heart disease (57.1%), obstructive sleep apnea (54.8%), behavioral challenges during care (61.9%), cleaning difficulties (40.5%), macroglossia (69%), bruxism (61.9%), suboptimal biofilm index, varying degrees of gingivitis, and a low incidence of dental caries.

Conclusion: Patients with Down Syndrome showcased specific physical, systemic, and stomatological traits that can markedly influence oral health status, oral hygiene routines, and behavior during dental procedures. This emphasizes the critical importance of dentists possessing an in-depth understanding to implement tailored management strategies aimed at enhancing the overall health and well-being of these unique individuals.

I. Introduction

Down Syndrome (DS), also known as Trisomy of Chromosome 21, is a condition characterized by the presence of an extra chromosome 21, resulting in trisomy 21 [1-6]. There are three ways in which this genetic anomaly can occur: free trisomy (error in division during meiosis), Robertsonian translocation (fusion of chromosomes 13, 14, 15 with 21), and mosaicism (presence of both normal and trisomic cells at the same time)[7]. It is the most common genetic anomaly worldwide, with an incidence of 10-14 per 10,000 live births [4-8].

The physical characteristics of individuals with DS include short stature, shortened extremities (hands, feet, fingers, nose, and ears), a single transverse palmar crease, wide spacing between the first and second toes with a deep groove near the plantar surface, underdeveloped genitals, brachycephaly, a wide and short neck, almond-shaped eyes that are relatively distant from each other, oblique palpebral fissure, inability to seal the lips completely, narrow nasal bridge and nasopharynx, low-set ears, prominent cheeks, adenotonsillar hypertrophy, and thin and sparse hair. They generally have a docile and affectionate temperament [9-12].

Individuals with DS may also experience generalized muscular hypotonia, congenital heart disease, pulmonary hypertension, obstructive sleep apnea, hearing and vision impairments, thyroid disorders (75% hypothyroidism and 6% hyperthyroidism), diabetes, obesity, motor deficits, celiac disease, neurological issues with language and cognitive delays, epilepsy in 26% of cases, and premature aging that can lead to Alzheimer's disease. Gastrointestinal disorders, such as necrotizing enterocolitis, may also be present in 16% of newborns. Hypovitaminosis D and low bone mineral density can lead to osteoporosis in adults. The altered immune system in individuals with DS makes them more susceptible to infections [1, 3-5, 7-8, 10, 13-18].

In terms of oral changes, individuals with DS may exhibit mouth breathing, xerostomia, narrow maxilla, mandibular protrusion, narrow and deep palate, fissured lips and tongue, macroglossia, temporomandibular dysfunction, and malocclusion, with Class III and unilateral or bilateral crossbites being the most common. Dental structure abnormalities such as agenesis, delayed tooth eruption, taurodontia, microdontia, hypodontia, hyperdontia, and enamel

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hypoplasia are also observed. There is a higher prevalence of premature periodontal disease, tooth exfoliation, gum bleeding, candidiasis, cheilitis, and acute necrotizing ulcerative gingivitis. These characteristics can impact chewing, speech articulation, swallowing, and speech abilities [3, 10, 19]. Recent studies suggest that individuals with DS have differences in their oral microbiota, with lower levels of Streptococcus mutans in their saliva[3].

Dental surgeons play a crucial role in maintaining the oral health of these patients, requiring the use of specialized techniques and attention during consultations, particularly regarding the type of medication used [19]. Specific diseases such as diabetes, celiac disease, and leukemia can also have oral implications that demand dental attention [10]. Another example is the use of expanders in the first year of life to stimulate jaw development, muscular and lingual strength, and improve airway clearance, sleep quality, and tongue positioning [2, 12, 19]. Therefore, it is essential for dental professionals to have knowledge about DS, its systemic implications, and oral characteristics, as well as specific skills needed to provide appropriate care for these patients. This research aimed to investigate the physical, systemic, and stomatological characteristics of individuals with Down Syndrome.

II. Methods

a) Study Design and Ethical Considerations

A descriptive, observational, and cross-sectional study was conducted on a convenience sample of individuals diagnosed with Down Syndrome. Volunteers underwent structured interviews with their responsible caregivers. This study was approved by the Institutional Research Advisory Committee (CAPI) and Research Ethics Committee (CEP) of UNOESTE, under protocol number 023415. Informed consent was obtained from the guardians before the evaluation of the individuals.

b) Study Population

A total of 42 individuals with Down Syndrome, aged between 0 and 18 years, participated in the study. Data collection occurred at the Dental Specialties Center of Presidente Prudente. Inclusion criteria included individuals aged 0-18 years, diagnosed with Down Syndrome, and written consent from responsible caregivers to participate in the research.

c) Clinical Examination

Responsible guardians were interviewed to assess oral hygiene practices and behavioral characteristics of the volunteers. Additionally, systemic conditions, general physical health, dental status, and stomatological features were evaluated.

d) Stomatological Evaluation

The amount of visible biofilm on the teeth surfaces of the volunteers was assessed using an index[20], which assigned scores from 0 to 5 based on biofilm thickness and adhesion. Gingival health status was evaluated using a sterile periodontal probe, with scores ranging from 0 to 2 based on the presence and severity of gingivitis. The International Caries Detection and Assessment System was utilized to classify tooth surface conditions and identify carious lesions[21]. The Invasive Needs Index (INI)[22] was employed to determine the extent of involvement of teeth with active carious lesions requiring invasive treatment.

e) Statistical Analysis

Descriptive analyses of the data included absolute and relative frequencies, with quartiles calculated for the ICDAS and INI indices. All statistical analyses were performed using the R program [23]. The significance level chosen was 5% (p=0.05).

III. Results

In Table 1, it was observed that 52.4% of the sample is male, with the majority being white (83.3%) and illiterate (66.7%). The average age of the sample is 12.4 years, a minimum of 5 and a maximum of 18 years.

Table 1: Descriptive Analysis of Participants' Demographic and Literacy Characteristics (n=42)

Variable	Category	Frequency (%)
Gender	Masculine	22 (52.4%)
	Feminine	20 (47.6%)
Race	White	35 (83.3%)
	Brown	2 (4.8%)
	Black	4 (9.5%)
	Yellow	1 (2.4%)
Literate	No	28 (66.7%)
	Yes	14 (33.3%)
	Mean (standard	Median (minimum value –
Age years)	12.4 (7.9)	9.5 (5.0 – 18.0)

Regarding systemic conditions (Table 2), it is observed that the majority have respiratory diseases (71.4%), overweight or obesity (59.5%), heart disease (57.1%) and obstructive sleep apnea (54.8%). %). It is hygiene and 61.9% have a behavioral barrier making hygiene and 61.9% have a behavioral barrier making dental care difficult.

Table 2: Frequencies and Percentages of Sample Participants According to Systemic Conditions (N=42)

Variable	Frequency (%)
Respiratory diseases	30 (71.4%)
Overweight or obesity	25 (59.5%)
Heart disease	24 (57.1%)
Obstructive sleep apnea	23 (54.8%)
Hypothyroidism	17 (40.5%)
Atlanto -occipital instability	13 (31.0%)
Gastrointestinal disorders	9 (21.4%)
Anemia	7 (16.7%)
Convulsion	5 (11.9%)
Diabetes	3 (7.1%)
Hyperthyroidism	0 (0.0%)
Does not allow assistance due to behavioral barriers	26 (61.9%)
Difficulty brushing	17 (40.5%)

In Figure 1 it can be seen that all participants have an oblique palpebral fissure (100.0%) and the majority have short stature (78.6%), a single transverse palmar crease (78.6%), feet with wide space between the first and second fingers (59.5%) and shortening of the extremities (hands, feet, fingers, nose and ears) (54.8%).

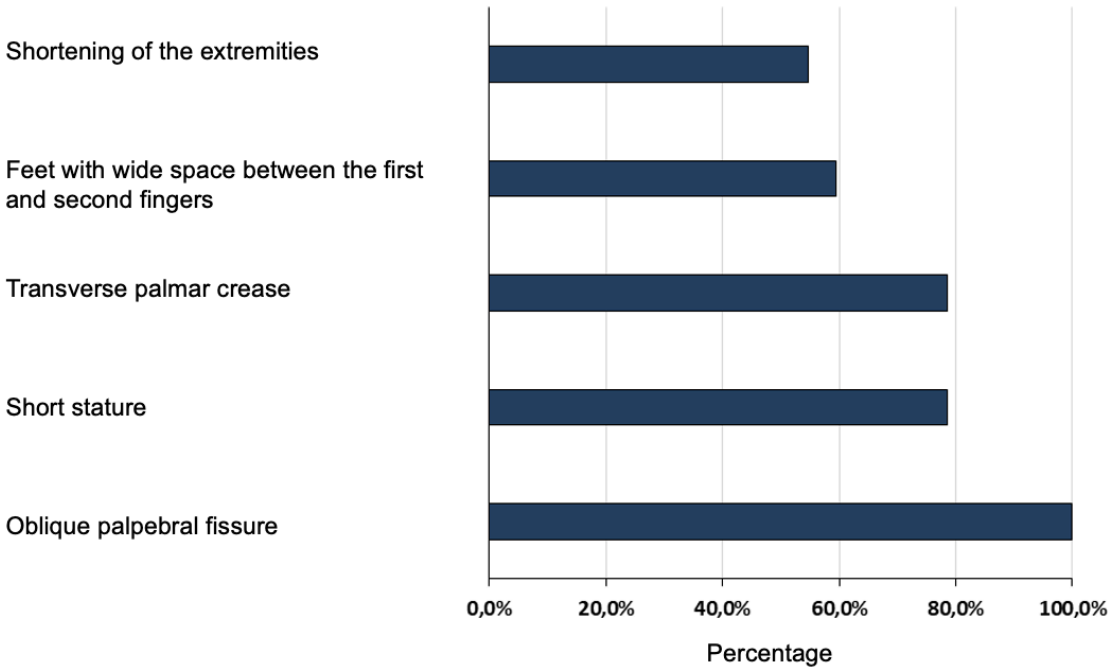

Figure 1: Percentage of Participants In Relation to Physical Characteristics (N=42)

Regarding oral characteristics (Table 3), it is noted that the majority have macroglossia (69.0%), bruxism (61.9%) and microdontia (57.1%). Furthermore, half of the sample had a conoid tooth (50.0%) and prolonged retention (50.0%). It is also noted that 45.2% have agenesis and 45.2% have a fissured tongue.

Table 3: Frequencies and Percentages of Sample Participants According to Oral Characteristics (N=42)

Variable	Frequency (%)
Macroglossia	29 (69.0%)
Bruxism	26 (61.9%)
Microdontics	24 (57.1%)
conoid tooth	21 (50.0%)
Extended retention	21 (50.0%)
Agenesis	19 (45.2%)
fissured tongue	19 (45.2%)
Angular cheilitis	10 (23.8%)
Fusion	2 (4.8%)
Supernumerary	1 (2.4%)
Macrodontics	0 (0.0%)
Twinning	0 (0.0%)

Table 4 presents the results of biofilm indexes, gingival condition, caries experience (ICDAS) and need for treatment. It can be seen that 45.2% of the sample had the biofilm index classified as deficient. Furthermore, 42.9% and 9.5% have mild and severe gingivitis, respectively. Regarding ICDAS, it is observed that 47.6% have index 0, no or little change in enamel translucency. It is also observed that 47.6% present some need for treatment, with 11.9% requiring extraction due to an extensive carious lesion while 52.4% do not need any treatment.

Table 4: Distribution of Sample Participants According to Biofilm Indexes, Gingival Condition, Caries Experience and Need for Treatment (N=42)

Variable	Frequency (%)
Macroglossia	29 (69.0%)
Bruxism	26 (61.9%)
Microdontics	24 (57.1%)
conoid tooth	21 (50.0%)
Extended retention	21 (50.0%)
Agenesis	19 (45.2%)
fissured tongue	19 (45.2%)
Angular cheilitis	10 (23.8%)
Fusion	2 (4.8%)
Supernumerary	1 (2.4%)
Macrodontics	0 (0.0%)
Twinning	0 (0.0%)

[1] *ICDAS:* International Caries Detection and Assessment System (0: No or little change in enamel translucency; 1: visible initial change in enamel; 2: clear change visible in wet enamel or beyond areas of pits and fissures; 3: discontinuity (microcavity) located in the enamel that may appear opaque or discolored. 4: Shadowing of the underlying dentin; 5: Clear cavity with visible dentin; 6: Clear extensive cavity with visible dentin (involving more than half of the surface). 2 [INI]: Invasive Needs Index (0: No need for treatment; 1: Atraumatic Restorative Treatment (ART); 2: Conservative Pulp Therapy (TPC), PPD, Pulpotomy; 3: Radical Endodontic Treatment; 4: Exodontia for Extensive Carious Lesions (Exo).

IV. Discussion

Given the results observed, table 1 shows a higher frequency of illiterate patients. Studies indicate that these individuals have the capacity to learn and acquire new skills, but at a slower rate. From the first years of life until early adulthood they have good cognitive development, but as they age, they may experience a decrease in their abilities associated with a possible process of dementia [9].Approximately 65% of patients with the syndrome may be affected by cognitive impairment that can be observed through understanding and producing language. As a consequence, this can affect communication and understanding between a patient with Down syndrome and the dentist in a dental clinic[24].

In relation to systemic characteristics (Table 2), the results showed a difference in the frequency of respiratory diseases, reaching 71.4%, while in another study [1] it was demonstrated a rate of up to 36%. Research estimates that overweight or obesity in these individuals may be associated with a slow basal

metabolism, hypothyroidism or inadequate eating habits[18]. In the results above, 59.5% of overweight or obesity and 40.5% of hypothyroidism were observed, which may indicate a relationship between these factors.

In patients with DS, the congenital heart defect is widely observed in 40% to 60% of individuals, which is confirmed in this research with 57.1% (Table 2), highlighting the importance of an early diagnosis of this condition to reduce the rates of morbidity and mortality[16]. Furthermore, cardiac patients are at greater risk of developing Infectious Endocarditis when undergoing invasive procedures, due to transient bacteremia and the deposition of microorganisms in compromised cardiac tissues, and the use of antibiotic prophylaxis is recommended according to the American Heart Association protocol. When these patients undergo cardiovascular surgery, they may use oral anticoagulants, increasing the chance of bleeding during dental surgical procedures1[25].

Bacterial endocarditis is a severe and life-threatening human infection. Patients at risk for this infection include those with congenital heart disease (CHD), such as individuals with Down syndrome, with the primary etiological factors being microorganisms found in the oral cavity[26].

Another characteristic that has a high prevalence in the literature and proven in the results above is obstructive sleep apnea (Table 2) with around 30% to 60% often associated with macroglossia (11), the use of maxillary expanders has been used for effective treatment[19]. It was also observed that 61.9% of patients with DS presented behavioral barriers with difficulty in receiving care (Table 2), this is due to high rates of hyperactivity, agitation, tantrums and impulsivity. According to the literature, these individuals have better visual than verbal learning, the association of objects as rewards and positive reinforcement are ways to increase their responsiveness[9].

The physical characteristics found were oblique palpebral fissure, short stature, single transverse palmar crease, feet with wide space between the first and second toes and shortening of the extremities (Figure 1), which reinforces the present literature [1,5]. The following oral characteristics were found most frequently: macroglossia, bruxism, microdontia, conoid teeth, prolonged retention, agenesis and fissured tongue (Table 3), which reinforces characteristics described in other studies[3,19,27]. Bruxism[27], prolonged retention and agenesis are associated with occlusal changes that can occur in these patients[12].

In table 4, the presence of biofilm (45.2%), mild gingivitis (42.9%) and severe gingivitis (9.5%) was observed in patients with DS, proving the relationship between these two factors and also demonstrating their association with difficulty in cleaning.

The low prevalence of caries is a factor reported in studies that can be proven by the results obtained in this research with the presence of 47.6% in the ICDAS zero index, this would be justified by prolonged retention, agenesis, change in the chronology of tooth eruption, differences in salivary flow, microbiota, pH, buffering capacity/saliva composition[3] and presence of microdontia[27]. However, 42.9% had ICDAS above 3, that is, with shadowing of the subadjacent dentin, a clear cavity in visible dentin or a clear extensive cavity with visible dentin, which is also reported in a smaller number of studies. This condition may be related to factors such as: poor hygiene, less manual dexterity, less access to dental care, use of medication, inadequate diet and negligence on the part of caregivers [28].

V. Conclusion

Patients with Down Syndrome are characterized by specific physical, systemic, and stomatological traits that may impact oral health, hygiene maintenance, and behavior during dental treatment. The findings indicate prevalent and significant dental necessities in individuals with DS. Notably, a high proportion of subjects exhibited poor oral hygiene (45.2%) and mild gingivitis (42.9%). Furthermore, a majority of participants displayed distinctive oral features, including macroglossia (69.0%), bruxism (61.9%), and microdontia (57.1%). Common systemic conditions among these individuals encompass respiratory ailments (71.4%), overweight or obesity (59.5%), and cardiac anomalies (57.1%). These outcomes underscore the importance of a tailored and specialized dental approach to address the unique requirements of this patient population.

Declaration of Interest

The authors report no conflict of interest.

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Tooth Loss among Cancer Patients: Prevalence and Factors Associated with the Position and Number of Missing Teeth

By Ana Beatriz Macedo Vieira Costa, Giovanna Campana Aragão, Ana Carolina Corrêa Silva, Amanda Aparecida de Carvalho, Mariane Carolina Faria Barbosa, Daniela Coelho de Lima & Eduardo José Pereira Oliveira

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Abstract- *Objective:* to evaluate the prevalence and factors associated with tooth loss according to their number and position in cancer patients in southern Minas Gerais, Brazil. Methodology: a cross-sectional study with a sample of 441 adults undergoing cancer treatment. The outcome was obtained by clinical evaluation of tooth loss, categorizing the participants into: (i) having functional dentition (FD) [presence of 20 or more teeth] without anterior losses; (ii) having FD with anterior losses; (iii) not having FD. Independent variables included socioeconomic situation, health-related habits, general and cancer-related health, oral health, and dental care.

Keywords: *chemotherapy, radiotherapy, tooth loss, oral health, questionnaires and surveys.*

GJMR-J Classification: *NLM Code: WU 113*

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Tooth Loss among Cancer Patients: Prevalence and Factors Associated with the Position and Number of Missing Teeth

Ana Beatriz Macedo Vieira Costa [α], Giovanna Campana Aragão [σ], Ana Carolina Corrêa Silva [ρ], Amanda Aparecida de Carvalho [ω], Mariane Carolina Faria Barbosa [¥], Daniela Coelho de Lima [§] & Eduardo José Pereira Oliveira [χ]

Abstract- Objective: to evaluate the prevalence and factors associated with tooth loss according to their number and position in cancer patients in southern Minas Gerais, Brazil. Methodology: a cross-sectional study with a sample of 441 adults undergoing cancer treatment. The outcome was obtained by clinical evaluation of tooth loss, categorizing the participants into: (i) having functional dentition (FD) [presence of 20 or more teeth] without anterior losses; (ii) having FD with anterior losses; (iii) not having FD. Independent variables included socioeconomic situation, health-related habits, general and cancer-related health, oral health, and dental care. Bivariate and multiple multinomial logistic regression models were used in data analysis, with (i) as the reference group. Results: 27.29% presented FD without anterior losses; 6.04% had FD with anterior losses; and 66.67% did not have FD. There was a strong possibility of having FD with anterior loss for those who have an income < 1 minimum wage (OR: 0.04; CI95%: 0.01-0.80) and those who did not report flavor alteration (OR: 0.31; IC95%: 0.10-0.90). Individuals with a greater chance of not having FD were older subjects (OR: 1.06; CI95%: 1.02-1.10), less educated (OR: 0.15; CI95%: 0.02-0.81), those who use prosthesis (OR: 63.97; CI95%: 20.22-202.22), those with no periodontal pockets (OR: 0.17; CI95%: 0.07-0.43), and those who brush their teeth < 3x/day (OR: 0.22; IC95%: 0.09-0.53). Conclusion: tooth loss, including anterior losses, has a relevant impact on this population and socioeconomic and oral health conditions are determinants of this outcome.

Keywords: chemotherapy, radiotherapy, tooth loss, oral health, questionnaires and surveys.

I. Introduction

According to the Global Burden of Oral Conditions of 1990-2010, tooth loss is among the 100 conditions that most impacted humanity, affecting 2.3% of the world's population[1]. The progressive increase in tooth loss with advancing age represents the sequela of caries and periodontal disease[2] and reflects the lack of access to dental services or even the provision of mutilating services[3]. The absence of teeth can cause impairments in digestion[4] and affect masticatory function, food selection, phonation and facial aesthetics, which favors the development of psychological disorders and has a negative impact on quality of life[5,6]. In addition, it is related to obesity, cognitive dysfunction[7] and other potentially degenerative conditions such as atherosclerosis and cardiovascular diseases[8], reflecting on mortality[9].

National surveys show a high prevalence of tooth loss, especially among the elderly (54%)[10], with a recent trend of decrease in all age groups, but mainly among younger people in the last decades[11]. This decrease is attributed to the combination of improvements in socioeconomic conditions, mostly in education, and the implementation of the National Oral Health Policy, which expanded fluoridation of the water supply and disseminated fluoridated toothpastes, among other measures[2,10,12].

However, tooth loss still represents a concern for the health of Brazilian adults and the elderly[13]. This condition may be more worrisome among cancer patients because of the treatment toxicity[14], their social vulnerability, and their health condition, which can cause oral diseases to be neglected. It should be considered that the incidence of cancer has grown rapidly worldwide, which generates social, general and oral health demands for these groups[15]. According to the National Cancer Institute (INCA), 625,000 new cases of cancer are expected for each year of the triennium 2020-2022 in Brazil[16].

However, few studies focus on tooth loss in this specific population. From this perspective, the classification of the position of tooth losses used in conjunction with its quantification can contribute to the understanding of this outcome, besides assisting in the identification of important aesthetic and functional issues in the planning of oral rehabilitation of these patients[2,17]. This study was carried out considering the usefulness of a classification of tooth loss according to the number and position of missing teeth to identify social, behavioral and oral health determinants not usually detected by traditional evaluations[18]. Also, it was considered how such information can support the

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planning, promotion and prevention of oral diseases in a scenario of scarce specific information[2]. Thus, its objective was to evaluate the prevalence and factors associated with tooth loss, according to the number and position of missing teeth in cancer patients in southern Minas Gerais, Brazil.

II. Material and Methods

a) Ethical Considerations

The procedures used in this study adhere to the tenets of the Declaration of Helsinki and the Resolution 466, December 2012, of the Brazilian National Health Council. The present study was approved by the Research Ethics Committee involving Human Beings of the Federal University of Alfenas (UNIFAL/MG) (CAAE: 40017720.6.0000.5142). In addition, informed written consent was obtained from all participants.

b) Study Design, Scenario and Participants

This study was developed at the facility of a voluntary association for cancer patients in a municipality in southern Minas Gerais, Brazil. It is a non-governmental organization, active in town since 2002 and recognized as a public utility in several spheres[18,19]. The population base was of patients assisted by this association and who are undergoing cancer treatment in a philanthropic organization that serves 24 municipalities in two microregions of the State of Minas Gerais, representing a population of approximately 437,005 inhabitants[20]. These patients were invited to participate in the study in 2021, when the epidemiological conditions of SARS-COV-2 pandemic control enabled its realization.

To determine the minimum sample required for the study, a stratified random sampling was obtained and partitioned into two age groups: adults and the elderly. The calculation to obtain the minimum sample was based on a population mean (DMFT for populations between 35-44 and 65-74 years in the interior of Southeastern Brazil), used as a reference for the adult and elderly groups by the WHO[21] and obtained in the last national oral health survey[22]. The formulas used are shown in Chart 1 and follow the standards applied in the SB BRASIL study 2010[23].

- Formula 1- sample calculation:

$$n^* = \frac{Z^2 \times S^2 \times deff / TNR}{(X \times \varepsilon)^2}$$

- Formula 2 – Sample adjustment for population size:

$$n^* = \frac{n^*}{1 + (n^*/N)}$$

Where:

n = Final sample size with correction for population size.

n* = Initial sample size.

N = Population size: 1042, with 669 adults and 373 elderly people expected.

Z = limit value of the rejection area: 1,96 (95% of confidence)

X = average CPOD: according to SB Brasil 2010[23]

S^2 = Variance of CPOD: according to SB Brasil 2010.

ε = acceptable margin of error: 10%[22]

deff = "desing effect": 2

- TNR = non-response rate = estimated percentage of loss of sample elements: 20%.

Chart 1: Formulas used to Calculate the Sample Size

To determine the proportion of adults and elderly, a previous study conducted in the same service in 2018 was considered. The minimum sample was estimated in at least 432 participants. The inclusion criteria were: having a confirmed diagnosis of cancer, being under cancer treatment, not having communication difficulties that would prevent the

interview or the intraoral clinical examination, and being 18 years or older.

c) Variables under Study

The outcome of this study was tooth loss, assessed by intraoral clinical examination performed according to internationally recommended parameters[21,24]. Participants were classified as: (i) having functional dentition (FD) [presence of 20 or more teeth] without anterior losses; (ii) having FD with anterior losses; (iii) having no FD.

The independent variables listed for the analysis were divided into the following blocks: (1) Socioeconomic characteristics; (2) Health-related habits (HRH); (3) General Health; (4) Oral health; (5) Oral alterations after cancer treatment; and (6) Dental care. In (1), the variables incorporated were: age group (18-40 / 41-59 / 60-79 / ≥ 80 years); sex; skin color (white and non-white); schooling (0-3 / 4-7 / ≥ 8 years of study); income (< 1 / 1-2 / > 2 minimum wages – according to values in 2021); and whether the participant lives with a partner (yes/no). In block (2), the current smoking habit (yes/no); current alcohol intake (yes/no), and physical activity for more than 150 minutes per week (yes/no) were evaluated.

In block (3), we evaluated multimorbidity (presence of two or more synchronous comorbidities to cancer: hypertension, diabetes mellitus, cardiovascular diseases, gastrointestinal problems, and anemia); polypharmacy (the use of four or more medications at the same time in the last three months [yes / no]); time elapsed since cancer diagnosis (0-1 /≥2 years); previous experience with any type of cancer (yes / no); location of the tumor in treatment or being followed-up (head or neck / other location); types of cancer treatment already performed: surgery (yes / no), medications (yes/no), chemotherapy (yes/no), and radiotherapy (yes/no). In block (4), the variables were: dental prosthesis (does not use and does not need it / does not use but needs it / uses it); presence of caries (yes/no); calculus (yes/no); gingival bleeding (yes/no); periodontal pockets (yes/no); clinical attachment loss (CAL) (yes/no); poor oral health self-assessment (yes/no), and self-perception of need for dental treatment (yes/no). In block (5), the presence of dry mouth, trismus, painful wounds, dormant areas, feeding alteration, flavor alteration, difficulty speaking, and difficulty swallowing were evaluated. In block (6), the variables evaluated were the frequency of daily tooth brushing (0-2 / 3 times or more); last dental appointment (≤1 / >1 year); type of dental service used in the last consultation (public / private), and reason for the last dental consultation (pain / others).

Blocks 1, 2, 3, 5 and 6 were collected exclusively through interviews and recorded in a questionnaire. The variables self-assessment of poor oral health and self-perception of the need for dental treatment from block 4 were collected through interviews, but the clinical conditions (tooth loss, dental prosthesis, caries, calculus, bleeding, periodontal pocket and CAL) were evaluated through intraoral physical examination, as recommended by the WHO's basic manual of oral health surveys[21]. All stages of the study were performed in the physical space of the institution by the researchers themselves, who were properly trained and calibrated (kappa inter examiner = 0.98).

d) Data Analysis

Data analysis was performed by estimating absolute and relative frequencies of the variables, in addition to mean age and standard deviation for the entire sample (Table 1). The bivariate analysis of the association between tooth loss and independent variables was performed using Simple Multinomial Logistic Regression models. The reference category was (i). The independent variables that presented a p-value <0.05 in the bivariate association with the outcome were incorporated into the analysis of multiple variables in the Multiple Multinomial Logistic Regression model. The association estimates were expressed by odds ratio (OR) with 95% confidence intervals. For all procedures, the significance level of 5% ($p<0.05$) was adopted. All analyses were performed using the Stata 14.0 software (Stata Corp LLP, College Station, TX).

III. Results

Table 1 shows a description of the characteristics of the study participants. Mean age was 61.07 (SD ±0.61) years. The sample consisted of a majority of women (53.97%), people who had up to 3 years of schooling (71.66%), and who had a family income up to two minimum wages (83.45%). From all participants, 18.68% currently smoke, 12.50% perform at least 150 minutes of physical activity per week, 23.81% have two or more chronic conditions concomitant with cancer, and 15.07% use at least four daily medications in the last three months. Also, 58.09% have been undergoing treatment for more than a year, and 22.68% of patients had a previous experience with cancer. The most and least used types of cancer treatment were medication (59.32%) and radiotherapy (44.55%), respectively. Regarding oral health conditions, 53.14% use and 87.20% require prosthesis. In addition, 23.19% of participants have active caries, 48.55% presented calculus, and 48.31% periodontal pockets. However, only 10.43% consider their oral health to be poor. The most reported oral alterations after cancer treatment were dry mouth (60.36%) and changes in food flavor (43.54%). Almost half (47.17%) of the sample brushes their teeth at least 3 times a day, 66.97% had their last dental appointment more than one year ago, 66.95% sought private dental care, and pain was the reason for the last consultation for 11.11% of interviewees. The

outcome of the study showed the following distribution: (i) 27.29% of participants presented FD without anterior losses; (ii) 6.04% have FD with anterior losses; and (iii) 66.67% do not have FD.

Table 2 shows the results of the bivariate analysis of factors associated with tooth loss, analyzed according to the number and location of missing teeth, using group (i) as reference. Individuals with a higher chance of having FD with anterior losses were older individuals (p=0.032), those who had lower income (p=0.030), those who use (p=0.013) and those who require (p=0.019) prostheses, those who did not report flavor alteration (p=0.046), and individuals whose last dental consultation was performed in the public service (p=0.006).

Table 1: Description of the Sample of Patients Undergoing Cancer Treatment at an Institution in Minas Gerais, Brazil, 2021

Block	Variable	Category	n	%
Socioeconomic Conditions	Age group	18-40 years	19	4,31
		41-59 years	176	39,91
		60-79 years	217	49,21
		80 ou + years	29	6,58
	Gender	Women	238	53,97
	Skin color	White	229	52,89
	Schooling	≤ 3 years of study	316	71,66
		4-7 years of study	103	23,36
		≥ 8 years of study	22	4,99
	Income	<1 minimun wage	31	7,23
		1-2 minimun wage	327	76,22
		> 2 minimun wage	71	16,55
	Lives with partner	Yes	65	14,74
HRH	Present smoke	Yes	82	18,68
	Present alcoholic	Yes	80	18,14
	Physical activity	>150 min./week	55	12,50
General Health	Multimorbidity	≥2 chronic conditions	105	23,81
	Polypharmacy	≥4 drug	66	15,07
	Cancer time	2 ou + Years	255	58,09
	Previous cancer experience	Yes	100	22,68
	Tumor time	Head/neck	34	7,71
	Surgical treatment	Yes	249	56,72
	Drug treatment	Yes	261	59,32
	Chemotherapy	Yes	251	57,05
	Radiotherapy	Yes	196	44,55
Oral health	Tooth loss	FD, no loss front	113	27,29
		FD, with loss front	25	6,04
		No FD	276	66,67
	Dental prosthesis	Not use and not need it	51	12,32
		Not use but need	143	34,54
		Use	220	53,14
	Caries	Yes	96	23,19
	Calculus	Yes	201	48,55
	Gingival bleeding	Yes	108	26,09
	Peiodontal pocket	Yes	200	48,31
	Periodontal attachment loss	Yes	153	36,96
	Oral health bad	Yes	46	10,43
	Self perception treatment	Yes	239	54,20
Oral changes after cancer treatment	Dry mouth	Yes	265	60,36
	Trismus	Yes	54	12,24
	Wound	Yes	151	34,32
	Dormant áreas	Yes	28	6,35
	Food change	No	187	42,50
		Yes, decrease	182	41,36
		Yes, increase	71	16,14
	Flavor change	Yes	192	43,54
	Difficulty speaking	Yes	53	12,02

	Difficulty swallow	Yes	83	18,82
Dental care	Brushing frequency 3vz ou +	Yes	208	47,17
	Last dental appointment more than 1 year ago	Yes	294	66,97
	Private used service	Yes	292	66,95
	Reason for last consultation pain	Yes	49	11,11

Source: Author

The chances of not having FD were higher among older individuals (p<0.001), men (p=0.021), less educated individuals (p<0.001), those with lower income (p=0.001), those who do not ingest any amount of alcoholic beverages (p=0.006), those with multimorbidities (p=0.001) and polypharmacy (p=0.012), patients who underwent chemotherapy (p=0.001), and those who use (p<0.001) and require (p<0.001) prostheses. Also, among individuals without caries (p=0.040), without calculus (p<0.001), without bleeding (p<0.001), without periodontal pocket (p<0.001), without clinical attachment loss (p<0.001), those who did not report flavor alteration (p<0.001), those who had no change in food intake when compared to those who increased food intake (p=0.018), those who brush their teeth less than three times a day (p<0.001), those who attended their last dental appointment more than one year ago (p<0.001), and those whose reason for the last visit was different from pain (p=0.002).

Table 3 shows the results of the adjusted multiple analysis of factors associated with tooth loss. The individuals with higher chances of having FD with anterior losses were those who have an income lower than one minimum wage (when compared to individuals with an income higher than two salaries, p=0.035) and individuals who did not report flavor alteration after the beginning of their cancer treatment (p=0.030), regardless of their socioeconomic situation, general and oral health. Subjects more likely not to have FD were older individuals (p=0.002), less educated individuals (p=0.028), those who use prostheses (p<0.001), those without periodontal pockets (p<0.001), and those who brush their teeth less than three times a day (p=0.001), regardless of socioeconomic situation, general and oral health.

Table 2: Crude Analysis of the Association of Factors Related to Tooth Loss in Patients Who Attend the Voluntary Association that Assists Cancer Patients. Alfenas, MG, 2021. n=441. (Continuation)

	Variable		FD with front loss			No FD		
			OR	IC 95%	p	OR	IC 95%	p
Socioeconomic Conditions	Age group		1,04	1,00-1,08	0,032	1,11	1,09-1,14	<0,001
	Gender (ref.: masculino)	Feminine	1,11	0,44-2,82	0,810	0,47	0,30-0,75	0,001
	Skin color (ref.: no white)	White	0,61	0,26-1,48	0,282	0,66	0,42-1,04	0,075
	Schooling (ref.: <3 anos)	4-7 year	0,65	0,27-1,59	0,350	0,16	0,09-0,27	<0,001
		≥ 8 year	0,01	0,00-∞	0,980	0,90	0,03-0,25	<0,001
	Income (ref.: <1 sal mín)	1-2	0,61	0,10-3,56	0,584	0,49	0,16-1,46	0,201
		>2	0,05	0,00-0,75	0,030	0,14	0,04-0,46	0,001
	Partner (ref.: no)	Yes	0,47	0,15-1,50	0,204	0,84	0,42-1,69	0,638
HRH	Present smoke (ref.: no)	Yes	1,61	0,52-4,96	0,401	1,76	0,95-3,27	0,070
	Present alcoholic(ref.: no)	Yes	0,87	0,31-2,39	0,793	0,46	0,27-0,80	0,006
	Physical activity (ref.: <150min)	≥150min.	1,76	0,61-5,06	0,290	0,70	0,37-1,34	0,286
General Health	Multimorbidity (ref.: no)	Yes	2,42	0,82-7,18	0,109	2,97	1,57-5,61	0,001
	Polypharmacy (ref.: no)	Yes	2,5	0,69-9,06	0,163	2,83	1,28-6,13	0,010
	Diagnosis (ref.: <2 years)	≥2 years	2,30	0,89-5,96	0,084	1,30	0,84-2,03	0,235
	Cancer experience (ref.: no)	Yes	0,67	0,21-2,13	0,499	1,17	0,69-1,97	0,548
	Surgical treat. (ref.:no)	Yes	0,87	0,36-2,08	0,761	1,08	0,69-1,69	0,706
	Drug treat. (ref.: no)	Yes	1,43	0,58-3,52	0,432	1,18	0,75-1,83	0,462
	Chemotherapy(ref.: no)	Yes	0,70	0,28-1,75	0,448	0,44	0,27-0,70	0,001
	Radiotherapy (ref.: no)	Yes	1,14	0,48-2,72	0,761	1,02	0,66-1,59	0,908
Oral care	Tooth loss (ref.: no)	Yes	5,4	1,43-20,38	0,013	68,72	26,8-175,6	<0,001
	Dental prosthesis (ref.: no)	Yes	3,87	1,25-12,03	0,019	203,07	27,5-1498,5	<0,001
	Caries (ref.: no)	Yes	2,33	0,96-5,66	0,060	0,58	0,35-0,98	0,040
	Calculus (ref.: no)	Yes	6,47	0,83-50,30	0,074	0,12	0,07-0,21	<0,001

Gingival bleeding (ref.: no)	Yes	2,23	0,92-5,37	0,073	0,42	0,25-0,68	<0,001
Periodontal pocket (ref.: no)	Yes	1,29	0,35-4,82	0,696	0,07	0,04-0,13	<0,001
Periodontal loss (ref.: no)	Yes	1,31	0,53-3,22	0,552	0,26	0,16-0,41	<0,001
SB bad (ref.: good)	Bad	1,78	0,44-7,29	0,417	1,60	0,71-3,60	0,257
Self perception treat. (ref.: no)	Yes	2,42	0,90-6,53	0,080	0,83	0,54-1,30	0,423

Table 3: Crude Analysis of the Association of Factors Related to Tooth Loss in Patients who Attend the Voluntary Association that Assists Cancer Patients. Alfenas, MG, 2021. n=441. (Conclusiom)

	Variable		FD with front loss			No FD		
			OR	IC 95%	p	OR	IC 95%	p
Oral changes after cancer treatment	Dry mouth (ref.: no)	Yes	1,52	0,58-3,94	0,388	0,88	0,56-1,38	0,586
	Trismus (ref.: no)	Yes	0,61	0,13-2,90	0,538	1,06	0,55-2,05	0,861
	Wound (ref.: no)	Yes	1,76	0,74-4,21	0,202	0,81	0,52-1,29	0,388
	Dorment area (ref.: no)	Yes	1,55	0,29-8,17	0,605	1,31	0,51-3,39	0,566
	Food change (ref.: no)	Decrease	0,77	0,30-1,99	0,600	0,89	0,55-1,46	0,658
		Increase	0,404	0,10-1,57	0,190	0,47	0,26-0,88	0,018
	Flavor change (ref.: no)	Yes	0,40	0,16-0,98	0,046	0,44	0,28-0,70	<0,001
	Difficulty speaking (ref.: no)	Yes	0,89	0,18-4,36	0,892	1,59	0,76-3,32	0,214
	Difficulty swallow (ref.: no)	Yes	0,78	0,24-2,52	0,689	0,98	0,56-1,71	0,952
Dental care	Brushing (ref.: no)	3vz ou +	0,52	0,22-1,27	0,153	0,30	0,19-0,48	<0,001
	Last consult (ref.: < 1 year)	≥1 year	0,74	0,31-1,78	0,508	0,31	0,19-0,49	<0,001
	Service private (ref.: public)	Private	0,29	0,12-0,70	0,006	0,71	0,44-1,16	0,179
	Reason for last consult pain (ref.: no)	Yes	0,56	0,15-2,05	0,385	0,36	0,19-0,68	0,002

Source: Author

Table 4: Adjusted Analysis of the Association of Factors Related to Tooth Loss in Patients who Attend the Voluntary Association that Assists Cancer Patients. Alfenas, MG, 2021. n=441 (continuation)

	Variable		With functional dentition but anterior loss			No Functional Dentition		
			OR	IC95%	p	OR	IC95%	p-
Socioeconomic Conditions	*Age*		1,03	0,99-1,08	0,152	1,06	1,02-1,10	0,002
	Gender (ref.: Man)	Women	1,89	0,57-6,27	0,296	0,65	0,26-1,58	0,347
	Schooling (ref.: < 3 years)	4-7 years	0,91	0,32-2,56	0,859	0,29	0,11-0,73	0,009
		≥ 8 years	0,01	0,00--∞	0,989	0,15	0,02-0,81	0,028
	Income (ref.: < 1 salay)	1-2 salary	0,51	0,07-3,97	0,526	0,40	0,08-1,86	0,247
		>2 salary	0,04	0,00-0,80	0,035	0,25	0,04-1,46	0,126
General Health	*Alcoholic* (ref.: no)	Yes	0,69	0,20-2,32	0,55	0,54	0,20-1,48	0,238
	Multimorbidity (ref.: no)	Yes	2,03	0,83-6,34	0,160	2,30	0,83-6,34	0,160
Oral Care	*Use prosthesis*(ref.: no)	Yes	4,15	0,94-18,29	0,060	63,97	20,22-202,22	<0,001
	Periodontal pocket (ref.: no)	Yes	1,63	0,39-6,84	0,502	0,17	0,07-0,43	<0,001

Table 5: Adjusted Analysis of the Association of Factors Related to Tooth Loss in Patients who Attend the Voluntary Association that Assists Cancer Patients. Alfenas, MG, 2021. n=441. (Conclusion)

	Variable		With functional dentition but anterior loss			No Functional Dentition		
			OR	IC95%	p	OR	IC95%	p-
Oral changes after cancer treatment	*Flavor change* (ref.: no)	Yes	0,31	0,10-0,90	0,032	0,62	0,26-1,45	0,276
Dental care	Brushing (ref.: no)	Yes	0,50	0,18-1,39	0,186	0,22	0,09-0,53	0,001
	Last consult (ref.: < 1 no)	≥ 1 year	1,42	0,48-4,17	0,519	1,41	0,59-3,34	0,427

Source: Author

IV. Discussion

As far as we know, this is the first study to evaluate tooth loss and associated factors according to its number and location among cancer patients. There was found a high prevalence of tooth loss and approximately two thirds of the participants suffer from the absence of functional dentition. Among those who have at least twenty teeth, the losses of previous teeth are significant. Lower income and lack of taste alteration were associated with anterior losses, while the absence of functional dentition was higher among older and less educated individuals, those who use prosthesis, those who do not have periodontal pockets, and those who brush their teeth less than 3 times a day.

Regarding the number of teeth lost, two thirds of the participants did not have functional dentition. A study on tooth loss observed that among adults, 9.4% had a maximum of 20 teeth[17]. In the findings of Batista et al.[2], 18.2% of the evaluated lost 12 teeth or more. Yan et al[26] observed that 15.11% of patients reported having more than 10 missing teeth. It is pointed that these comparisons should be analyzed with caution, since the populations evaluated may differ in age and other characteristics that may directly influence the prevalence of tooth loss.

Even with considerable advances in recent decades in the dental area and in health services, Brazil is still a country with a high prevalence of tooth loss and oral health is not attributed due care[27]. The search for dental care in the recent past seems to be associated with the economic situation, in a directly proportional way[28]. With the inclusion of oral health in the Family Health Strategy in 2000 and the Specialty Centers in 2004, it is assumed that younger populations have benefited from the expansion of these services and they have changed from a mutilating and excluding health system to one that focused directly on the individual and on health promotion in an integral and general way[29], contributing to the reduction of tooth loss. Possibly, such actions along with improvements in socioeconomic conditions, especially in education and the health system, such as systemic and topical fluoridation and the widespread use of fluoridated toothpastes[12], contributed to a reduction in the prevalence of dental caries, the main cause of tooth loss in Brazil[2,10].

It is necessary to consider that not only the number, but the position of the missing teeth plays an important role in the determinants and consequences of tooth loss. The posterior teeth may be the most neglected mainly because they are located in non-aesthetic areas, making it difficult to perceive the need for treatment[30]. The posterior teeth, however, have great importance in occlusion, chewing, phonation and have pits and fissures, considered as the first risk zone for caries in permanent dentition. Other studies have found similar results among individuals who have lost up to 12 teeth, including anterior teeth, and who therefore still have posterior teeth, are associated with a greater presence of caries and periodontal disease[17,31]. On the other hand, the anterior teeth exert influence on the appearance of the individual and assume a primordial role in personal and professional relationships. As the importance of facial aesthetics increased, the teeth began to gain relevance as aesthetic components of the smile, which results in an extensive search for treatments and care for the anterior region of the dental arch. While absent posterior teeth generate more noticeable impacts on function, the lack of anterior teeth promotes broader impacts on patients, affecting them not only in terms of pain and functional disabilities, but also in psychosocial dimensions[32].

Lower income and lower schooling were associated with anterior losses and absence of functional dentition, respectively. These data corroborate the literature[2,17,33]. Individuals with lower incomes live in places with less access to dental

treatments and lower water fluoridation coverage[9] and have deleterious health habits such as smoking, ingesting more sugar and brushing their teeth less regularly[34]. The economic situation and the education of individuals seem to be directly associated with the search for dental care[29]. Schooling can be understood in its context as a parameter that contains the cultural, intellectual and educational background of the individual, which jointly will be responsible for determining life habits and attitudes, including those related to health and self-care[3,35]. Understanding how the literature points out the relationship between oral health conditions and schooling is worrisome, since it can be noted that the most socioeconomically vulnerable population is also the most disadvantaged in terms of perception of health care. In addition, having less access to goods and services directly contributes to maintaining precariousness regarding self-care, general health and oral health aspects[3,36].

Bordin et al. (2017) concluded that the low frequency of tooth brushing was associated with fewer years of schooling, poor self-perceived oral health, tooth loss and smoking[37], which corroborates a study conducted in Turkey[38]. Brushing teeth is a daily means of maintaining oral health and the lower frequency of brushing can contribute to the increased prevalence of periodontal disease and dental caries[39]. Patients with better self-assessment of oral health regularly attend dental services, brush their teeth more frequently and consequently develop less oral problems[26].

The change of food flavor was more prevalent among patients with less tooth loss (those with functional dentition without anterior losses). This may reflect the level of self-perception, the interest and concern for oral health of those who have a satisfactory oral health condition. Among these patients, in addition to the number of teeth meeting functional demands, aesthetics also seems to meet expectations due to the absence of anterior losses. Some studies show that the perception of oral problems is higher precisely among those who have more access to dental services and, possibly, better oral health, which contributes to the awareness of its importance in these groups[35].

The absence of periodontal pockets and the use of dental prosthesis were associated with the absence of functional dentition. Without the presence of the dental element, it is not possible to verify the periodontal pocket because, according to the adopted criteria, at least two functioning teeth are necessary to evaluate each sextant[17,31]. This inference also occurs for dental prostheses. The more extensive the tooth loss, the greater the need and use of prostheses[40].

It is emphasized that for cancer patients oral problems may represent a secondary concern in the face of a life-threatening disease, which can alter all perceptions and influences regarding oral health and the patient's life[41]. Adding this fact to the main findings of this study, it is pointed out the need for closer attention to the cancer public and its relationship with oral health. Most importantly, the need to encourage the search for dental treatment as a practice of self-care[42], highlighting the improvement in the clinical status of these patients[43]. This is a priority demand, considering that only one third (33.3%) of the interviewed individuals reported having sought dental care in the last year.

Future studies should investigate the causes of the observed inequalities, in order to base and sustain intervention proposals to change this scenario. The strengths of this study are the use of instruments validated under international standards and widely used[22], which facilitates the comparability of its results with other studies. In addition, it seems that this is the first study to evaluate tooth loss and associated factors according to the number and location of the lost teeth among cancer patients. The limitation of the study is the means of randomization in obtaining the sample, since only the interested individuals sought participation in the study, and its cross-sectional design, which does not allow time inferences. However, it is important to point out the obstacles to obtain the sample with the population studied, given the difficulties generated by the patients' own health status, as well as issues related to the duration and periodicity of oncological therapies.

V. Conclusion

It was concluded that tooth loss has a relevant impact on cancer patients and, among the individuals with the highest number of teeth, the losses of previous teeth were significant. In addition, socioeconomic and oral health conditions were more strongly associated with the absence of functional dentition than anterior losses. These findings point to the need for dental care both in the prevention of tooth loss and in the attention to its resulting sequelae and limitations among cancer patients.

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7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

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9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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