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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%

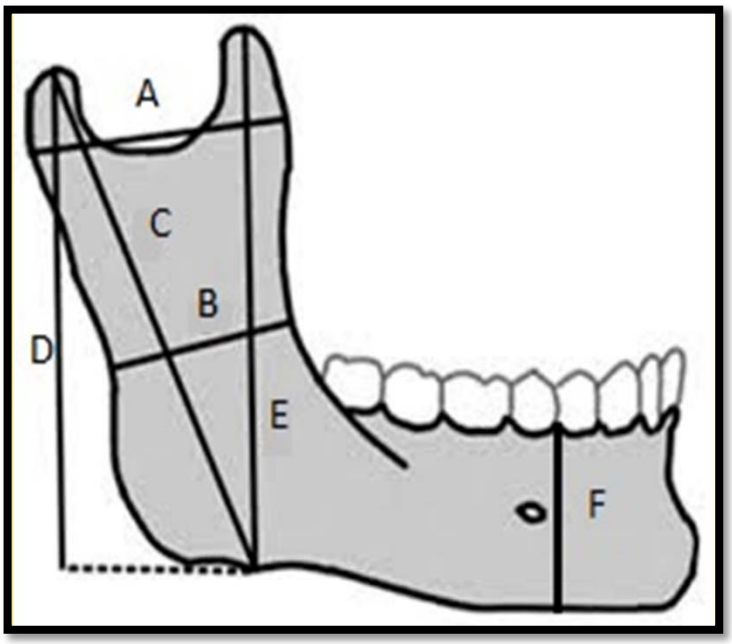

Fig. 1: Image showing measurement from the reference lines drawn from the anatomic landmarks of the mandible. (Diagram showing mandibular ramus measurements adapted from Saini et al. (17))

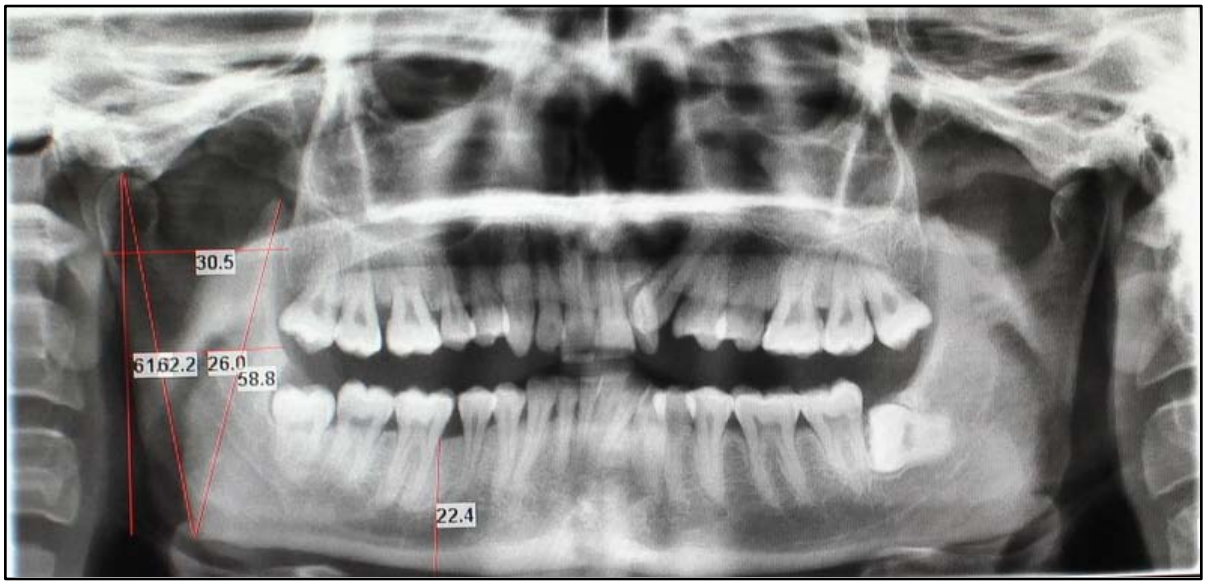

Fig. 2: OPG image showing measurements taken on the right side of the mandible.

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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*

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

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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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Tips for writing a good quality Medical Research Paper

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of medical research then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

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

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

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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Global Journal of Medical Research

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