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Forensic Odontometallurgical Study: Study On The Correlation Of Elemental Concentration Of Dental Calculus With That Of The Habitual, Environmental / Geographical And Occupational Exposures Among The Gujarati Population

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ABSTRACT:- *Forensic Odontology is one of the fast developing and most important Subject in Forensic Science with the numerous researches has been done in the area of Dentistry. The specific aspect of identification of individual through dentition finds less number of research works. Application of dentistry for the purpose of identification through age estimation and sexdetermination has been done a plenty. While establishing the identification through secondary characteristics, there are hardly any studies available using non-invasive methods. An attempt has been in this study to establish the correlation between geographical influences with the concentration of dental minerals. It is also to establish the influence of exposure of various chemicals due to occupation with the quantitative presence in the dental calculus. A total of 135 subjects have been studied for the examination of elemental components with their quantity in the dental calculus. Significant results were obtained for the association of chronic exposure with the accumulation of minerals in the dental calculus. This can be contemplated as Geographical & Occupational Marker for any individual with the Qualitative and Quantitative Analysis of elements those are present in the dental calculus by EDXRF method (Energy Dispersive X-Ray Fluorescence Spectroscopy)*

Key words: *dental calculus, elemental content, occupation, geographical marker, EDXRF*

INTRODUCTION

Forensic science is the application of scientific knowledge to aid in the administration justice. Forensic Odontologyis one of the branches of Forensic Science which involvesthe dental knowledge for the purpose of legal and criminal issues. The major area of activity of forensic odontology is the identification of human beings, either dead or alive. This is more so in case of mass disasters. The corpse is usually badly mutilated. Identification in such conditions become very difficult as there is least chances of getting a viable tissue for the DNA analysis.

Dental identification of humans occurs for a number of different reasons and in a number of different situations. Dental identifications have always played a key role in natural and manmade disaster situations and in particular the mass casualties normally associated with aviation disasters. The dentition as such may be useful after collecting the calculus for the purpose identification through the geographical area, the individual belongs to. Apart from this, the occupation of the individual would also be possible to be established based on the elemental concentration in it. This could be achieved through the analysis by the X-Ray Fluorescence Spectroscopy and the same could be confirmed through the sophisticated techniques such as the TEM analysis.

OBJECTIVES

- To assess the possible association of the elemental concentration in dental calculus of the people with that of the soil of the same areas they live.
- To analyze the concentration of elements in dental calculus of workers of industries and the elemental content in the industrial utilities
- To establish the correlation between elemental composition of the dental calculus of the workers with that of soil samples for possible Geographical marker.

- To establish correlation between elemental component present in dental calculus of workers of various industries with the industrial outputs/ sludge.

Area of the study

The sample population has been considered in the industrial areas of the Thermal Power Station (Coal based electricity generation) Ahmedabad, Bhavnagar Port (Coal yard) and Alang ship breaking yard.

Materials and Methods

Description of the sample

DentalCalculus is defined as a hard deposit that is formed by mineralization of dental plaque on the surfaces of natural teeth and dental prosthesis, generally covered by a layer of unmineralized plaque. **Inorganic content:** Elements like Calcium (Ca) (39%), Phosphorus (P) (19%), Carbon Dioxide (CO2) (1.9%), Magnesium (Mg) (0.8%), traces of Sodium (Na), Zinc (Zn), Strontium (Sr), Bromine (Br), Copper (Cu), Manganese (Mn), Tungsten (Sn), Gold (Au), Aluminium (Al), Silicon (Si), Iron (Fe), Fluorine (F).

SAMPLING:

Prior to the collection of the samples, informed consent has been obtained from the subjects after explaining to them about this study. Permission has been obtained from the respective authorities of the organizations wherever the samples have been collected from.

1. **Dental Calculus:**

Standard samples(STD) were collected from random Gujarati population from the Department of Periodontology, with the permission of the authority of Ahmedabad Municipal Corporation (AMC) Dental College and Hospital, Khokhara, Ahmadabad, Gujarat (India). The samples were collected with their personal history that they have not been exposed to heavy metals by means of occupation or any other factors (most of the Subjects are professionally teacher, shop keepers, , etc.) . It was made sure that the standards are age and gender specific with that of the sample population under study.

Thermal Power Station (TPS) samples were collected from the workers of the Gujarat State Electricity Corporation Limited (GSECL) with the permission of The Chief Engineer, power generation; Gandhinagar Thermal Power Station which is a Coal based Electricity generation unit ,Thermal Power Station, Gujarat (India). The workers were allotted to do welding and soldering, Coal unloading, supervision, helping in various tasks.

Bhavnagar Port (BH) samples were collected from the workers of the Gujarat Maritime Board (GMB) with permission of The Head of the Mechanical Department, Gandhinagar, Gujarat; The Environment Officer Of Gujarat; The Port Officer of Gujarat Maritime Board, Bhavnagar Port. Here, The Coal and Potash has been imported from many years and from various countries along with that the repairing of the ships, tugboat, barge, dredger, etc. **Alang Port (AL)** samples were collected from the workers of the Gujarat Maritime Board (GMB) with permission of The Head of the Mechanical Department Gandhinagar, Gujarat; The Environment Officer of Gujarat; The Port Officer of Gujarat Maritime Board, Alang Port and The Director of Safety Training Institute, Gujarat Maritime Board, Alang Port. Here, the expired ships are imported from all over the world and demolished or breaking up the whole ship, there are almost all the metal gas cutting works have been done. Metals like Titanium, Silver, copper, Iron, etc. The workers are allotted to do welding and soldering, gas cutting, scraping paints, removal of the furniture, crockery, removal of hazardous and expired oil which is used in machinery of ship, etc.

2. **Soil:**

Thermal Power Station (TPS) Soil samples were collected from the opposite side of Gujarat Forensic Sciences University as Gandhinagar standard soil samples (GHSTS), and other two categories are inside and outside the TPS which are TPSIS and TPSOS from the Gujarat State Electricity Corporation Limited with the permission of The Chief Engineer Generation; Gandhinagar Thermal Power Station which is a Coal based Electricity generation Thermal Power Station, Gujarat (India). **Bhavnagar Port (BH) Soil** samples were collected from the Bhavnagar district residential area as Bhavnagar standard soil (BHST), from the coal yard site mixture of soil (BHMS) and slurry (BHSS) found at the Gujarat Maritime Board (GMB) with permission.**Alang Port (AL) Soil** samples were collected and Alang is a part of

Bhavnagar District so only mixture of soil collected from one of the ship breaking yard of the Gujarat Maritime Board (GMB) with permission.

3. **Coal:** samples from Bhavnagar Port (C-1) and Thermal Power Station (C-2).

Type of sample	Category		Labeling
Dental Calculus	Standard		STD 1, STD 2…
	Thermal Power Station		TPS 1, TPS 2…
	Bhavnagar Port		BH 1, BH 2…
	Alang Port		AL 1, AL 2…
Soil	Thermal Power Station	Standard	GHSTD 1, GHSTD 2…
		Inside	TPSIS 1, TPSIS 2…
		outside	TPSOS 1, TPSOS 2…
	Bhavnagar Port	Standard	BHSTD 1, BHSTD 2…
		Mixture of soil	BHMS 1, BHMS 2…
		slurry	BHSS 1, BHSS 2…
	Alang Port	Mixture of soil	ALS 1, ALS 2…
Coal	Bhavnagar Port		C-1
	Thermal Power Station		C-2

SAMPLE COLLECTION , PREPARATION and PRESERVATION

DentalCalculus samples were collected with the use of sterilized hand scalers and Personal Protective Equipments (PPE), both supragingival and subgingival calculus samples were collected in the plastic container and dipped in 70 % ethanol for 12 hours and then air dry the samples. This idea for using 70 % ethanol is because most of bacterial infection control can be achieved and dental calculus does not get dissolved in Ethanol. The sterilization bean was used for the transportation of the sterile instruments and Personal Protective Equipments (PPE), once the sample collection is done the samples were transported back with proper Sterilization. And plastic containers are air tight which allowed the easy handling and transportation of the samples along with infection control.

ED-XRF procedure: Energy Dispersive X-Ray Fluorescence Spectrometer used was the EDX-7000 ©Shimadzu Corporation, Sample cups, Mylar films; Lathe/polishing machine, Air conditioner, and Temperature and humidity indicator.

Result & Discussion: Geographical markers

Comparison of categories

All these values shown are as per the EDXRF Spectrometer results, in Percentage (%). As it is mentioned in the introduction part; Dental Calculus formation occurs over certain period of time and it depends on individual's oral hygiene maintenance. So, the contents of the samples are having dependency on certain factors like Geographical Location, Type of Occupation (Thermal Power Station, Ship Breaking Yard, Coal yard, Battery Manufacturing Factory, Paint and Dye Industry, Etc.) Occupational experience, occupational Exposure (hours of exposure per day and yearly), individuals' oral hygiene maintenance (Brushing once or twice a day/ Using other dental aids like Dental Floss or mouth-wash any other Medical or Dental Pathological conditions etc. Thereby it is expected that the overall elemental percentage according to EDXRF reports of dental calculus for all categories are accumulations of particular elements within the samples over a period of time as well as above mentioned factors. The conversion of percentage (%) to all the units like ppm or mg/m^3 or lbs/tn is possible.

There are some correlations in the soil and dental calculus samples, according to the occupational site and duties carried out by workers; it is possible to establish the relationship between individuals' occupation based on the elemental composition of the soil and dental calculus.

Calcium(Ca) is consistently found as a major component of the Dental Calculus in all the age groups regardless of the difference in categories. The second highest detected element is **Phosphorus (P)** in all categories of Dental Calculus samples. There are elevated levels comparatively in Standard category and lowest in Bhavnagar Port category.

Table – 1: p value (SPSS Statistical Software), Mean Percentage of elements (EDXRF Results)

Elements%	STD	TPS	BH	AL	p Value
Ca	82.869	82.25	80.776	81.89	0.0001
P	15.37	14.763	13.252	13.85364	0.0001
Sr	0.1406	0.1402	0.095	0.0968	0.0001
S	0.987	1.298	2.77	1.781	0.0001
Fe	0.0905	0.25	0.668	0.2965	0.0001
Cu	0.034	0.762	0.13003	0.1343	0.0001
Zn	0.0855	0.2065	0.21503	0.135	0.0001
Mn	0.0032	0.0785	0.15	0.046	0.0001
Ag	0.0265	0.0655	0.035	0.0342	0.064
Ni	0.00267	0.00427	0.00422	0.01534	0.483
Rb	0	0.00527	0	0	0.05

Strontium(Sr): It is found in all soil samples, Bhavnagar standard, Bhavnagar Port, Gandhinagar standard, Thermal Power Station and Alang Port categories from higher to lower levels. But in contrast, in the Dental Calculus samples two nearby Geographical locations are having similar results like in Standard population and Thermal Power Station Categories – 0.1406%, 0.1402% respectively & in Bhavnagar Port and Alang categories – 0.095%, 0.0968% respectively. This is interpreted that there is not much of occupational influence and Strontium levels of Dental Calculus differs as the geographical location differs. It is possible to be established that Strontium can be a **"Geographical Marker"** for identification.

Ratio: The ratio of Ca : P, Ca : Sr and P : Sr has been developed and there is found to be positive correlation between these 3 elements. It is clear that depletion of strontium with depletion the Calcium levels and vice-versa. As the Ca : P ratio has already been established, synergistic effect is also reported with all three elements, Calcium (Ca), Phosphorus (P) and Strontium (Sr).

	STD	TPS	BH	AL
Ca : P	5.4:1	5.6:1	6.1:1	5.9:1
Ca : Sr	589.34:1	586.7:1	850.3:1	845.97:1
P : Sr	109.32:1	105.3:1	139.5:1	143.12:1

	Ca : P : Sr
STD	82.869 : 15.37 : 0.1406
TPS	82.25: 14.76 : 0.1402
BH	80.78 : 13.252: 0.095
AL	81.9 : 13.9 : 0.096

Sulfur (S): in soil samples of both Bhavnagar standards and Bhavnagar occupational, there are elevated levels of Sulfur; and at secondarily present in Gandhinagar Standard and Thermal Power Station soil samples. And least amount found in Alang Port samples for soil. But in Bhavnagar Port category, the highest amount of sulfur is found for Dental Calculus samples. Samples of Alang Port showed second highest contents even though the soil contains least quantity. In Thermal power Station Category for Dental Calculus. This suggests that elevated levels of Sulfur in dental calculus than Standard levels are due to environmental and other factors like Occupation, dietary habits etc.

Iron (Fe): Higher levels of soil iron content for Alang Port, Bhavnagar Standard and Bhavnagar Port; and least amount of soil Iron content inGandhinagar Standard and Thermal Power Station samples. But in Dental Calculus, Bhavnagar Port category is having elevated level, similarly in Alang Port and Thermal Power Station Categories. According to data, Fe levels are found high, among the first three elements in the soil sample and even though occupational influence suggests that the reason for Fe% elevation is Geographical. By these results it can be estimated that Iron can be a **"Geographical marker"** for the Identification.

Table – 2: Comparison of Dental Calculus among Different age group (EDXRF Results)

El%	25-35 years				36-45 years				46 years & above			
	STD %	TPS %	BH %	AL %	STD %	TPS %	BH %	AL %	STD %	TPS %	BH %	AL %
Ca	82.81	82.18	81.4	82.13	82.73	82.95	81.13	81.08	83.04	81.72	79.87	82.3
P	15.36	15.17	14.24	13.88	15	13.68	11.36	13.94	15.6	15.02	13.78	13.71
Sr	0.16	0.08	0.12	0.1	0.14	0.17	0.09	0.09	0.13	0.17	0.08	0.1
S	1.35	3.15	1.6	1.9	1.24	1.3	2.55	2.16	0.98	1.66	4.02	1.38
Fe	0.09	0.5	0.36	0.29	0.11	0.2	0.49	0.32	0.1	0.2	0.96	0.27
Cu	0.04	1.5	0.07	0.17	0.03	0.45	0.11	0.16	0.05	0.73	0.15	0.09
Zn	0.05	0.58	0.25	0.14	0.12	0.25	0.18	0.16	0.12	0.22	0.21	0.11
Mn	0	0.21	0.09	0.05	0.0032	0.022	0.14	0.048	0.0057	0	0.22	0.034
Ag	0.011	0.029	0.015	0.007	0.0082	0.015	0.015	0.011	0.0101	0.01	0.02	0.007
Ni	0.0019	0.00067	0.0034	0.0054	0.0026	0.0016	0.0092	0.003	0.0034	0.0054	0.0034	0.061
Rb	0	0.0527	0	0	0	0	0	0	0	0	0	0

Table – 2: Elemental % Comparison of Soil and Dental Calculus (EDXRF Results)

EL	D.C.	SOIL			D.C.	SOIL			D.C.	SOIL		D. C.
%	STD	GHSTD	TPSIS	TPSOS	TPS	BHSTD	BHMS	BHSS	BH	BHSTD	ALS	AL
Fe	0.0905	8.626	8.129	11.669	0.25	26.848	25.17	18.975	0.668	26.848	45.429	0.2965
Ca	82.87	19.107	15.77	14.11	82.25	16.411	18.03	31.548	80.776	16.411	9.105	81.89
Al	0	11.925	10.433	10.529	0	11.531	9.576	5.278	0	11.531	7.913	0
S	0.987	0.3708	1.128	1.1696	1.298	0.471	4.712	9.766	2.77	0.471	0.877	1.781
Zn	0.0855	0.0146	0.059	0.070	0.2065	0.0676	0.074	0.032	0.2150	0.0676	0.481	0.135
Mn	0.0032	0.187	0.162	0.2	0.0785	0.529	0.4486	0.3416	0.15	0.529	0.706	0.046
Cu	0.034	0.032	0.032	0.045	0.762	0.064	0.072	0.063	0.1300	0.064	0.2286	0.134
V	0	0.049	0.0362	0.064	0	0.1176	0.185	0.402	0	0.118	0.0938	0
Ni	0.0027	0.002	0	0.046	0.0043	0	0.046	0.1076	0.0042	0	0.1968	0.0153
Sr	0.1406	0.100	0.0696	0.069	0.1402	0.355	0.124	0.148	0.095	0.3548	0.053	0.0968
Zr	0	0.052	0.062	0.081	0	0.065	0.025	0.0536	0	0.065	0.025	0
P	15.37	0	0	0	14.763	0	0.565	0.215	13.252	0	0	13.85
Br	0	0	0	0	0.0051	0	0.028	0.0796	0.0013	0	0	0.0058
Y	0	0.007	0.007	0.0056	0	0.012	0.018	0.0138	0	0.012	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0.043	0
W	0	0	0	0	0	0	0	0	0	0	0.017	0
Rb	0	0.025	0.021	0.0188	0.0053	0	0	0.0098	0	0	0	0
Pd	0	0.004	0	0	0	0	0	0	0	0	0	0
Ag	0.01	0.007	0.008	0	0.0655	0	0	0	0.035	0	0	0.034
Sm	0	0	0.011	0	0	0	0	0	0	0	0	0
Pt	0	0	0.0038	0.004	0	0	0	0	0	0	0	0
Nb	0	0	0	0.0012	0	0	0	0	0	0	0	0
Ba	0	0	0	0	0	0	0	0	0.1163	0	0	0.88
Er	0	0	0	0	0.0069	0	0	0	0.0011	0	0	0.003

Copper (Cu): higher levels of soil Cu are in samples of Alang Port, Bhavnagar Port and Bhavnagar Standard categories, and least in but almost similar in Gandhinagar Standard and Thermal Power Station categories. But high levels of Copper were found in Thermal Power Station category and secondly similar levels were found in Bhavnagar Port and Alang Port categories for Dental Calculus. Here, Alang Port is a port of Bhavnagar District. For both, Soil and dental calculus sample

copper values are similar thereby it can be estimated that there is not much of occupational influence but is due to geographical influence.

Zinc (Zn) & Manganese (Mn): higher levels in Soil samples of Alang Port, Bhavnagar Standard and Bhavnagar Port categories, and least in but almost similar in Gandhinagar Standard and Thermal Power Station categories. But high levels of Manganese are in Found in Bhavnagar Port category and Secondly levels in Thermal Power Station category and least in Alang Port category for Dental Calculus. This is because of the Coal, Coal burn out (Fly ash) and Coal waste contains heavy metals like Zn &Mn. And for Alang Port category the Soil samples contain higher amount for both types of samples. **Environmental Protection Agency:** Oral Reference Dose **(RfD) of 0.3 mg/kg/day for zinc (IRIS 2005).** EPA has not derived an inhalation reference concentration (Rfc) for zinc. So, collectively the results are indicative that Zinc and Manganese both are Geographicalidentification.

Silver (Ag): it is not at all present in soil samples of Bhavnagar Standard, Bhavnagar Port and Alang Port categories; on average like 0.0072%, 0.008% minimal amount found in Soil, respectively in Gandhinagar Standard and Thermal Power Station categories. In contrast it is present in all the categories of Dental Calculus including Standard Population samples. There can't be any dietary source except Indian sweet "vark" and still found in Standard population category. Thermal Power station and Standard Population, there is minimal amount of soil silver present and that can be the factor for its presences, respectively. So, in Bhavnagar Port and Alang Port categories it can be due to an occupational influence for the presence of Ag. this clearly suggest that Silver can be an Geographical marker for the Identification.

Nickel(Ni): Soil samples, absent in Bhavnagar Standard category but present in Alang Port, Bhavnagar Port, Thermal Power Station and Gandhinagar Standard from high to low levels. In Dental Calculus samples Nickel is present in all the categories and this linear correlation is also persistent in Occupational site soil samples. There are evidence for Nickel exposure in Ship Breaking Yard and marine transportation, and EDXRF report of Coal samples from Bhavnagar Port and Thermal Power Station is favoring the presence of Nickel. So the presence of Ni in soil and Dental Calculus satisfies Geographical influence. Here in Gandhinagar Standard soil samples Ni is present in minimal amount in Standard Population and Thermal Power Station categories comparatively.

Rubidium (Rb): only present in soil samples of Gandhinagar Standard, Thermal Power Station and very minimal amount in Bhavnagar Port slurry sample. In dental calculus samples only 2 samples out of 25 thermal Power Station in age of 25-35 years are evident. And as per the Thermal Power Station Coal sample EDXRF reports, the presence of lanthanides, specifically Rb, is evident.

Common Elements found in all four categories in ED-XRF and TEM-EDX are: Ca, P, SR, S, K, Fe, Cu, Zn, Mn, Ag, Ni, etc…

Molybdenum (Mo): Mo found in Coal samples of TPS and outside the thermal power station Soil Samples Category also in Dental Calculus samples of Standard population and thermal power station categories. It is valued in steel alloys for its high corrosion resistance and weld ability. Other molybdenum-based alloys that do not contain iron have only limited applications. For example, because of its resistance to molten zinc, both pure molybdenum and molybdenum/tungsten alloy (70%/30%) are used for piping, stirrers and pump impellers that come into contact with molten zinc compounds with S, Si, P. Most high-strength steel alloys contain 0.25% to 8% molybdenum. [*Lide, David R., ed. (1994). "Molybdenum". CRC Handbook of Chemistry and Physics.* ***4****. Chemical Rubber Publishing Company. p. 18. ISBN 0-8493-0474-1.]*

Rare earth elements are found neither in EDXRF Reports nor in Dental Calculus of Standard Population categorybut are detected in all three Dental Calculus Occupational categories in TEM-EDX.

Conclusion:

It is possible to conclude that there is a significant difference in the elemental content of the calculus of the dentition was noted among the population groups under study. It is possible to establish that the elements under the study such as **Strontium (St), Copper (Cu), Silver (Ag), Rubidium (Rb), Iron (Fe), Sulfur (S), Zinc (Zn), Manganese (Mn), Nickel (Ni) and Molybdenum (Mo)** are found to be a significant **"Geographical markers"** for the specific workers of the industries. Elements like **Rubidium (Rb) can be detected at its early age for the workers working in Thermal Power Station.** Thus the elements of the calculus would be a useful marker for the secondary characteristics of identification of the individuals in any case of mass disasters with much ease.

Limitations:

In every scientific study limitations would be an integral part of the study. In this study there are few limitations that are to be addressed. Those are the, sampling of the soil have been done randomly without any consideration of the larger geographical area. In case of industrial area sample also there was random sampling when it is considering about the subject there was random sampling without much emphasis on age and other factors relating to life style and diet. In every scientific study limitation would be the sample size, in this case also sample size was considerably lesser for getting more precise results. As per previously done studies, the distribution of elements differ from supra gingival to subgingival calculus, so for that further study can be done by powdering the samples as here the samples are well preserved it can be prepared and analysed in future.

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Dental Consent and Medical History Form

Dr. Riddhi Thanki, B.D.S. MFO
Date:
Serial No.:

Name:_____

Date of Birth: _ _/_ _/_ _ _ _ Age: Sex:

Occupation: Occ. Address:

Working Hours (per day): Work Experience (yr):

Address:

_____
(Street) (City/town) (State) (Pin code)

Phone: _____ Email: _____

Health Information

1. Are you taking any medication now? ☐ YES ☐ NO

If yes, please list both prescribed and over the counter medications that you take in the space below:

2. Has a dentist or physician ever told you that you need to take antibiotics (penicillin) before having dental treatment? ☐ YES ☐ NO

3. Specify If any dental problem or findings? _____

_____

4. Please check any illnesses or conditions you have EVER had:

☐ Alcohol abuse	☐ Drug Abuse	☐ Rheumatic Fever
☐ Allergies to Medicine(s)	☐ Epilepsy	☐ Shingles
☐ Anemia or blood problems	☐ Glaucoma	☐ Sinus problems
☐ Any Heart Ailments	☐ Heart Murmur	☐ Stroke
☐ Arthritis	☐ Hepatitis A, B, C	☐ Thyroid Problems
☐ Artificial Joint	☐ High Blood Pressure	☐ Tuberculosis
☐ Asthma	☐ Immune system, HIV, AIDS, ARC	☐ Ulcer or colitis
☐ Cancer or Chemotherapy	☐ Kidney problems	☐ Use of tobacco, cigarettes, chew
☐ Diabetes	☐ Liver problems	☐ Sexually Transmitted Disease
	☐ Psychiatric care/emotional problems	

5. **Do you have any other health conditions?** ☐ YES ☐ NO

If yes, please list._____

6. **Do you have a dentist?** ☐ YES ☐ NO

Name of dentist and office location & last visit: _____

7. **What do you do to take care of your teeth and gums?**
   - ☐ Daily tooth brushing
   - ☐ Daily flossing
   - ☐ Inter-dental stimulators
   - ☐ Water jet device

8. **Do you have any pain in your mouth today?** ☐ YES ☐ NO

SUBJECT'S CONSENT FORM

INSTITUTE OF FORENSIC SCIENCE
GUJARAT FORENSIC SCIENCES UNIVERSITY
Sector –9, Nr Police Bhavan,
GANDHINAGAR, GUJARAT.
Telephone: 079-23256365

Date:
Serial No.

Name: _____

Father's/Husband's/ Guardian's Name_____

Age: _____**Gender:** _____**Village/City:** .....

Description of sample: Dental Calculus

Declaration by the Subject

I, _____, hereby declare that the Dental Calculus sample based on a provided transcript has been willingly given by me to Dr. Riddhi Thanki, IFS, GFSU, Gandhinagar for the purpose of conducting her dissertation work.

Collected by:

Signature/thumb impression of Subject:

DECLARATION BY THE SCHOLAR

INSTITUTE OF FORENSIC SCIENCES
GUJARAT FORENSIC SCIENCES UNIVERSITY
Sector –18 A, Nr Police Bhavan,
GANDHINAGAR, GUJARAT.
Telephone: 079-23256365

Date:
Serial No.

I, Dr. Riddhi Thanki, hereby declare that the Dental Calculus samples collected by me from _____, _____are purely for my dissertation work. I assure you that they will not be used for any other purpose than for research work. I further assure that the identity of the subject will not be disclosed.

Dr. Riddhi Thanki
Dept. of Forensic Odontology,
Institute of Forensic Sciences,
Gujarat Forensic Sciences University,
Gandhinagar, Gujarat. India.

