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Intra-Sinus Calcifications

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Highlights

Role of Allergy in Nasal Polyposis

Cone Beam Computed Tomography

Discovering Thoughts, Inventing Future

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Forensic Dental Cremation Recovery and Analysis-A Review Article

By Hari Krishnan, Devika Kumar, N. Girija, Thamarai Selvan, Taruna Malhotra
& Niveditha Manoharan

Gujarat Forensic Sciences University

Abstract- Teeth are amongst the most resilient structures of the human body. The dentition and dental works are commonly preserved, in most cases where the exposure of a body to a heat source and hence becomes a reliable source of the DNA. Dental works such as an implant, restoration, crown etc. are preserved till very high temperatures. An effort has been made to study the main articles on dental cremation recovery and to express it in a systematic manner.

Keywords: forensic odontology, cremation, temperature, recovery.

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Forensic Dental Cremation Recovery and Analysis-A Review Article

Hari Krishnan ^α, Devika Kumar ^σ, N. Girija ^ρ, Thamarai Selvan ^ω, Taruna Malhotra [¥]
& Niveditha Manoharan [§]

Abstract- Teeth are amongst the most resilient structures of the human body. The dentition and dental works are commonly preserved, in most cases where the exposure of a body to a heat source and hence becomes a reliable source of the DNA. Dental works such as an implant, restoration, crown etc. are preserved till very high temperatures. An effort has been made to study the main articles on dental cremation recovery and to express it in a systematic manner.

Keywords: forensic odontology, cremation, temperature, recovery.

I. INTRODUCTION

The systematic recovery and analysis of incinerated teeth can provide information related to age, sex and even help the forensic investigator to positively identify the victim. Teeth being the most resilient structure of the human body, are commonly preserved with the dental works at least partially after cremation. Various studies have been conducted around the globe on this and very relevant conclusions have been made. It is very important for a forensic investigator to have deep understanding in these studies because it can be used in a variety of ways not only to establish the identity but also in finding leads to solving crimes.

II. SEARCH, RECOVERY AND LABORATORY PROCEDURES

Archeological method of evaluation is the most reliable method to recover the cremated teeth. The extend of the cremains have to be estimated before excavation. One of the reliable ways for searching is by establishing grid pattern, Christopher W.Schmidt in his book "The analysis Of Burned Human Remains" states that the grid can vary from 1×1m to 5×5 m but this can be enlarged or decreased as per needs⁽¹⁾. Excavation of the cremains can be done with a soft towel or with tongue depressors or wooden sticks. Schmidt also emphasizes the chances of finding cremains in small drainage ways or animal burrows nearby. Sieving of sediments through a 1/8 in screen is important in recovering minute samples from the scene.⁽¹⁾

While Schmidt advices to transport the recovered specimen in plastic bags which is kept into labelled glass or plastic vials⁽¹⁾, Fairgrieve SI suggests to transport the cremains in a paper bag to promote gradual drying if they are moist and to prevent the growth of mildew⁽²⁾

Cleaning the teeth using soft tooth brush and tap water is the first step in the laboratory. The examiner should note down and document the findings on the specimens like restorations or any pathological condition. Schmidt recommends to keep a fine mesh screen on the drain while washing specimen in the sink.⁽¹⁾

Mineer et al in 1990, reported that clear acrylic spray paint is a good stabilizing agent for reconstruction because of its ready availability and affordability⁽³⁾. But reconstruction of fragments less than 1/8 in is extremely difficult⁽¹⁾. One of the challenging task in reconstruction of the fragments is to distinguish the anterior root from the posterior root. Usually, in severely burned molars root will separate and each separated root will look almost like anterior roots. In 2005 Schmidt reported the presence of the notch or spur on molar root which is absent in anterior root and found it possible to reconnect separated posterior roots by matching corresponding spurs and notches^(1,4)

III. ANALYSIS

a) Cremated Dental Tissues

One of the most reliable means of determining the positive identifications of charred remains is through the comparison of ante mortem odontological records with the post mortem odontological observation of the victim. Teeth are the ideal source of information to draw upon for individualization due to the fact that they are the most indestructible components of the human body. This statement is supported by the paleontological recovery of teeth exceeding that of bone. (Robinson et al 1998).

Even though the facial soft tissue and tongue acts as an effective insulator to the teeth, prolonged exposure to fire or higher temperature can directly affect the teeth by fracturing enamel, cementum and dentine. Bohnert et al in 1998 studied the effect of fire on the skull and concluded that when human body is exposed to a fire temperature of 670-810°C by 20 minutes only sparse soft tissue remains in the face. The dental

Author ^α ^σ ^ω [¥] [§]: Post Graduate Forensic Odontology Student Gujarat Forensic Sciences University. e-mail: harikrishh6@gmail.com

Author ^ρ: Associate Professor, Dept. of Chemistry Devaswom Board Pampa College.

remains even in such an advanced state of destruction have the potential to provide the location and types of dental works (Robinson et al 1998) ⁽⁵⁾.

In addition to the routine crown analysis of the dental remains, tooth root analysis is a very important step in establishing the identity of the victim. The roots are commonly preserved intact due to the protected nature of being situated in the alveolus. This may be compared to the anti-mortem dental records for similarity. Extra care should be taken to examine the discontinuity in the cemento-enamel junction. In such areas an expert can locate the remnants of a filling which are no longer present. Confirmation of evidence of dental work using a scanning electron microscope is recommended in these situations (Fairgrieve, 1994) ⁽⁶⁾.

b) Microscopy

The study of incinerated dental tissues microscopically provides valuable information about the maximum temperature to which it is exposed. In 1975, Harsanyi reported the appearance of small crevices in enamel at 300°C and increase in size and number as the temperature increases. By 500°C, he observed a crevice network and multi-angular plates. The formation of granules on the surface of the enamel occurs at 700°C while a fusion of the granules was visible at 900°C. At 1000°C enamel microstructure is unrecognizable ⁽⁷⁾. Shipman et al. did a similar study in 1984 and reports a 'dimple' development at the surface of enamel as the temperature approaches 300°C. He noticed the formation of rounded particles by 500°C ⁽⁸⁾. However, both the studies agree that the previously formed granules will coalesce into larger, smooth globules and eventually fuse below 1000°C.

As per Harsanyi 1975, in cementum by 300°C the evaporating water results in a lifting of the tissue layer from the underlying dentine. By 700°C a finely granular surface is observed, and he reports that the original cemental structure is no longer visible. When the temperature reaches 900°C he observed granular surfaces which is penetrated by deep and wide crevices and the original structure was found to be decomposed. Dentine when heated to 300°C, dentinal tubules are found opened but the morphology seemed to be unaffected. By 700°C he reports the narrowing of tubules, and anastomoses between tubules was not visible by 900°C and by 1300°C structures have decomposed and fused into granules of varying size ⁽⁷⁾.

c) Pulp Tissue and DNA

The extent of the cremation is a major determining factor in the success of isolating and amplifying DNA. If there is surviving fibrous muscle tissue and cartilaginous material, then there is a strong possibility of obtaining DNA. Once the body has been reduced to calcined bone fragments and powdered, the DNA extracted prior to cremation was compared with that extracted from commercially prepared remains

(vonWurmb-Schwark, 2004) ⁽⁹⁾. The DNA which is extracted after the cremation did not confirm to that of pre cremation DNA that was profiled by STR's because the remains were likely contaminated through processing and handling. This only leaves the DNA from teeth as possible means of identification since the pulp is protected and isolated in the chamber from external contaminations (Duffy 1989, Sweet and Sweet 1995) ⁽¹⁰⁾⁽¹¹⁾.

Williams et al in 2004 started the use of DNA from incinerated deciduous dentition as a means of sexing cremains. They found that they were able to isolate and analyze DNA, specifically the amelogenin locus for sex determination. Deciduous teeth which were subjected to temperature from 100 -500°C for 15 minutes, out of which some teeth which were heated to 400°C provided a reliable source of DNA but not all ⁽¹²⁾.

Duffy et al in 1991, in their study experimented with fresh pig head subjected to an open fire. A temperature of 500-700°C produced only 75°C in the pulp chamber of the pigs teeth. But cremation remains with calcined dentition and with heat induced fractures are not candidates for DNA analysis of any type ⁽¹³⁾.

d) Restorations

Using identical temperature scheme Savio et al 2006 ⁽¹⁴⁾ examined the effect of heat on restored teeth having amalgam, composite and endodontic fillings. The changes observed in various restorative materials can be used to calculate the maximum exposure temperature and a skillful and careful examiner can predict the fuel responsible for the damage.

Up to 600°C amalgam and composite restorations showed no change in shape and dimensions. The amalgam restoration on exposure to 800 - 1000°C didn't show any dimensional change but large fissures were formed at the junction between the dental tissues and fillings. At the same temperature composite restoration was in place but in an altered shape. At 1100°C amalgam restorations partially maintained its shape whereas composite restoration showed remarkable alteration of shape.

Endodontic fillings showed no change up to 200°C. At 400°C radiopacity which was less regular was seen. There was a presence of radio transparent areas and the shape and dimension was slightly altered. From 600-1100°C all these features could be appreciated with an additional specific "honeycomb" appearance.

The melting point of restoration with gold purely depends upon the percentage of gold in the filling material. It is clear that irrespective of the material used, the restorative material serves as an aid to identify the individual and estimate the temperature attained by the dental structures in question. Correlating with fire resistance of different material will provide the maximum temperature to which the tooth and the dental work is exposed. However, the range of material used in

restorative dentistry is truly overwhelming and special study has to be conducted for different products.

e) *Dental Prosthesis*

As per the study conducted by Kalpana et al in 2010, Ni-Cr metal crown at temperature 400 °C for 5 min showed little loss of glaze. By around 15 min the marginal seal was lost at the cervical area. By 30 minutes, the crown was blackened and the crown could be displaced. When the temperature was increased to 1100°C for 15 minutes, the crown showed a rough, crumpled surface and decomposed core leading to dislodgement.⁽¹⁵⁾

In case of ceramic crown, 400°C for 5 min produced loosening of crown without much change in color or texture. Till 15 min, there was no change for ceramic, but there was a distinct margin resulting in shifting of crown, as per the observation. 30 min produced pitted surface with slight discoloration, core creased resulting in displacement of crown. 1100°C for 15 min resulted in loss of morphology, change of glaze, texture to uneven patchy pattern and displaced/exfoliated crown⁽¹⁵⁾.

In case of complete denture prosthesis, when it was heated in the skull to 400-600°C for 10 min, only front teeth of the acrylic denture was burnt. When the heating was continued to 16 min, till the region of premolar was burnt (Rotzher et al 2004)⁽¹⁶⁾.

f) *Dental Implants*

Berketa et al in 2010 tested the survival of batch numbers within dental implants following incineration. They found out that the batch number of the implants survived heating to 1125°C when an abutment was attached to the same. Those implants without abutment following incineration revealed that their numbers were totally obscured by the oxidation layer formed⁽¹⁷⁾.

In another study, Berketa et al 2011 evaluated the reliability of implants for person identification after cremation by placing implants in fresh adult sheep head which is incinerated to a maximum temperature of 780°C. He concluded that implants resisted the features such as size, shape, thread and pattern necessary to identify the type of implant. But the detachment of implant from the mandible could have implication for scene recovery. As a conclusion Berketa et al recommends to collect debris from around and below the location of head⁽¹⁸⁾.

g) *Mass Disaster*

Mass disasters is usually recognized as any event in which there is a sudden occurrence of a large number of deceased individuals. In cases like aircraft crash, where cremation of remains to the point of calcination may occur, victims are usually identified through the use of recovered dental structures (Barsley et al 1985)⁽¹⁹⁾. In explosions, building fire etc., establishing even the minimum number of individuals

deceased is a tough job. A reliable way to manage the situation is to use an area of the skeleton that is particularly dense and less likely to be eradicated by a perpetrator for estimation of the number. The region of the first molar (M1) socket in the mandible can be a reliable region to examine. The advantage of this is that the mandible in this area is very dense with a bone thickness that approaches 1 to 2 cm. Further, if there is no M1 socket, the body of the mandible in this area is dense enough that it typically survives a fire⁽²⁾. Thorough search of the scene and recovery of even the minutest sample is mandatory in these cases. When very small fragments have been found from the site, scanning electron microscope will be of much help. Oblaker et al in 2002 used SEM/EDS to determine the elemental composition of the specimen. Bones and teeth have diagnostic proportions of calcium and phosphorous which can be used to distinguish it from other materials.

IV. CONCLUSION

Identification of the cremains is the primary duty of a forensic scientist, and the expertise of the scientist is tested by the condition of the cremains recovered. Thorough knowledge about the heat induced alterations of dental and associated structures, careful searching of the scene and accurate reconstruction of the recovered specimens, sometimes to the microscopic level is necessary for positive identification of the victims. Since a large amount of population is undergoing Orthodontic treatment these days an extension of the study can be done on Orthodontic brackets and wires to understand the heat resistance.

Dentistry is a field in which new materials from different manufactures are often being introduced. Standardization of materials used for dental work should be monitored by the dental practitioners and manufactures to provide ideal properties including thermal resistance.

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Cone Beam Computed Tomography Study of Intra-Sinus Calcifications

By Amine Khadija, Yassine Lahlou, Siham Chemlali, Jamila Kissa, Amina Gharibi
& Mohammed Baite

Summary- Introduction: The intra-sinus calcifications are quite rare clinical entities and may be responsible for some sinus pathologies. The purpose of our work is to describe the intra-sinus calcifications, to identify their features and also the various sinus lesions in relation.

Material and methods: In this retrospective descriptive study, we reviewed radiological images obtained from cone beam acquisitions at a dental radiology center. The following variables were evaluated: the number, the shape, the location, the dimension, the nature and the localization of intra-sinus calcifications.

Results: 300 cone beam images were examined. 3% of cases of intra-sinus calcifications were found. The prevalence is as follows: Women accounted for 77.8% of the sample compared to 22.2% of men. A single calcification was found in 22.2% of cases, two calcifications in 44.4% of cases, and more than two calcifications in 33.4% of cases. The calcifications are located at the peripheral level in 88.9% of cases and at the central level in 11.1% of cases. The survey revealed that 35.7% of the calcifications are measuring less than 1 mm. 14.3% between 1 and 2 mm, 21.4% between 2 and 5 mm and 28.6% greater than 5 mm.

Keywords: maxillary sinus, calcifications, cone beam computed tomography.

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CONE BEAM COMPUTED TOMOGRAPHY STUDY OF INTRA SINUS CALCIFICATIONS

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Cone Beam Computed Tomography Study of Intra-Sinus Calcifications

Amine Khadija ^α, Yassine Lahlou ^σ, Siham Chemlali ^ρ, Jamila Kissa ^ω, Amina Gharibi [¥] & Mohammed Baite [§]

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Discussion and conclusion: The intra-sinus calcifications show great variability. The cone beam is highly beneficial in finding incidental radiological images and the diagnosis of intra-sinus calcifications.

Keywords: maxillary sinus, calcifications, cone beam computed tomography.

I. INTRODUCTION

Several sinus lesions reported in the literature are related to a great inter-individual anatomical variability (1,2). Among them are intra-sinus calcifications, which are defined as calcified masses in the maxillary sinus (3). Bowerman has introduced the term maxillary "antrolith" to distinguish it from nasal calcifications called "rhinoloth" (4). The study of intra-sinus calcifications has two major interests. They are found in maxillary sinusitis, especially in non-invasive

fungal sinusitis type "fungal ball" (5, 6,7). They also constitute an element to be noted during the preoperative radiological assessment for maxillary sinus augmentation surgery. To reduce per- and post-augmentation surgery. To reduce per- and post-operative complications during bone augmentation surgery, it is essential to be knowledgeable of the anatomy of the maxillary sinus but also of the various incidental findings including intra-sinus calcifications (8). The promising advances of cone beam allow a better understanding of the cases, a more precise diagnosis and therefore a better treatment (9).

The aim of this work was to carry out a descriptive study of intra-sinus calcifications in a Moroccan adult population using cone beam acquisitions. This description included the number, shape, location, size and nature of intra-sinus calcifications. The loco-regional environment of these calcifications has also been studied. From these elements, the pathogenesis responsible for these intra sinus calcifications has been discussed.

II. MATERIALS AND METHODS

We performed a retrospective descriptive study carried out on the basis of cone beam images. The patients were examined between 2014 and 2016 at a dental radiology center for suspicion of included canines, implant surgery, ODF treatment, or sinusitis. The inclusion criteria were full visibility of the two maxillary sinuses on cone beam, and a sufficient images quality. The exclusion criteria were patients under 12 years of age, low resolution images, and the presence of metallic artefacts. All cone beam radiographic examinations were performed at a dental radiology center. The device has the following properties: setting 90 Kv, 10 Ma. The exposure time was 18. 402s. To collect the data necessary for our work, we have prepared a questionnaire with different parameters in order to study the two maxillary sinuses of each cone beam:

- 1) Sex
- 2) The shape of calcifications

We deduced four categories of shapes of intra-sinus calcifications from coronal sections: fine punctate, linear, round or nodular. When the shape of calcification was similar to a polygon or rectangle, it was classified as nodular. When the calcification was globular, it was

Author ^α: Professor, head of periodontics department of Casablanca dental school, Morocco. e-mail: aminekhadija@gmail.com

Author ^ρ ^ω [¥]: Periodontics Department, Casablanca Dental School, Casablanca, Morocco.

Author ^σ [§]: Private practice, Casablanca, Morocco.

classified as round. When the calcification was similar to a straight, it was considered as linear.

- 3) *The location of the calcifications in the maxillary sinus*: central, peripheral.
- 4) *The number of calcifications*.
- 5) *The size of calcifications*: Four proposals were chosen for this variable: Less than 1 mm, between 1 and 2 mm, between 2 and 5 mm, greater than 5 mm. The value was determined by the measurement tool at scale 1; The largest according to coronal sections.
- 6) *Unilaterality*
- 7) *The nature of intra-sinus calcification*: pathological calcifications of dental origin found in aspergillus sinusitis as a result of an overflow of dental paste, calcifications related to dental residues displaced in the sinus, and idiopathic intra-sinus calcifications incidentally found whose circumstances of occurrence are unknown.

Characteristics of associated lesions:

- *Thickening of Schneider's membrane*: The measurement was performed between the point where the mucous thickening was maximal and the sinus floor.
- *Sinus ventilation*: has been evaluated by the freedom of the ostium of the maxillary sinus.
- Polyp and cyst: were determined by the presence of homogeneous, mono or poly-geodic sinus opacity with a regular contour.
- *Oro-antral communication (OAC)*: has been determined by the sinus membrane perforation.
- Presence or not of an inflammatory process of dental origin: was determined by the presence or not of a peri-apical lesion.

- Extra-sinus location of the calcifications: maxillary, mandibular.
- Condition of the sinuses with calcifications: healthy or pathological. A sinus is considered normal if there is no mucous thickening or a thickening less than 2 mm is observed. The underlying tooth may be healthy, decayed, extracted, with or without peri-apical reaction.

A descriptive statistical analysis was performed using the epi software. Info 7.

III. RESULTS

The study involved cone beam images of 300 adult patients, including 194 women (64.67%) and 106 men (35.33%). 3% of intra-sinus calcifications were found. The prevalence of intra-sinus calcification was as follows (Table I): Women accounted for 77.8% of the sample compared to 22.2% of men. A single calcification was found in 22.2% of cases, two calcifications in 44.4% of cases, more than two calcifications in 33.4% of cases (fig 1). The calcifications were located at the peripheral level in 88.9% of cases and at the central level in 11.1% of cases (fig.2). 35.7% of calcifications were less than 1 mm, 14.3% between 1 and 2 mm, 21.4% between 2 and 5 mm and 28.6% were more than 5 mm (Figure 3). The shape of the calcifications was round in 21.4% of cases, nodular in 42.9% of cases, linear in 7.1% of cases and punctate in 28.6% of cases (fig.4). The calcifications were in a single sinus in 66.7% of cases and bilaterally in 33.3% of cases. Intra-sinus calcifications were idiopathic in 77.8% of cases. On the other hand, they were linked to an overflow of dental paste in 11.1% of cases and to a residual root in 11.1% of cases.

Table 1: Prévalence of lesions

Type de lésion	Pourcentage(%)
Thickening of the Schneider membrane	88.9
Polyp	44.4
Cyst	0
Oro-Antral Communication (OAC)	0
Inadequate Sinus Ventilation	77.78
Inflammatory process of dental origin	55.56
Pathological sinus condition	88.89
Maxillary position	11.11
Mandibular position	11.11

IV. DISCUSSION

Maxillary sinusitis of dental origin are frequent affections of the ENT sphere, consisting of 10-12% of all maxillary sinusitis (10). The posterior maxillary teeth maintain an intimate relationship with the sinus floor; The latter extends from the first premolar to the maxillary tuberosity (9). The meta-analysis carried out in 2010 by Arias et al (11) reported that the major factor responsible

for odontogenic sinusitis was caused by iatrogenic maneuvers: dental avulsion, intra-sinus implant placement, overflow of root canal filling materials. The presence of foreign bodies in the sinus cavity constitutes a chronic irritation of sinus mucosa and can induce a thickening of the Schneider membrane as well as the formation of polyps and cysts (12). These foreign bodies create an environment conducive to the development of intra-sinus calcifications (13,14).

On the other hand, the edentulous posterior maxillary region challenges the practitioner with several difficulties; the most important one is the reduction of bone volume in this region. This is due to two concomitant phenomena; The first is the resorption of the post-extraction alveolar bone and the second is the pneumatization of the maxillary sinus (15,16,17). In order to overcome these constraints, several techniques have been developed: bone augmentation (18), short implants (19) or inclined implants (20). However, the stability of the latter is compromised due to the large occlusal forces (21). To prevent these complications, maxillary sinus augmentation with bone grafts has been approved as an interesting solution for reconstructing the deficient bone of the maxillary posterior region provided that the sinus is healthy (22).

The percentage of intra-sinus calcifications reported in this survey was 3%. This limited number is consistent with that found in another study that reported a prevalence of 3.2% (23). Detecting calcifications in the sinus depends on several factors. First, it depends on the radiologist's potential and experience in interpreting volumetric images (24). All radiopacity in the maxillary sinuses does not correspond to intra-sinus calcification. A differential radiological diagnosis must be established. It includes dental fragments, mucous retention cysts, follicular cysts, condensing osteitis, odontome, cementome, fibrous dysplasia, osteogenic sarcomas and foreign bodies (25, 3).

Calcifications may be single or multiple (23). In our study, one calcification was found in 22.2% of cases, two calcifications in 44.4% of cases and more than two calcifications in 33.3% of cases. These results are not in concordance with those found in the literature review of Güneri et al in 2005, which reported that of 26 cases 80.1% had a single calcification, 11.5% had two calcifications and 38.4 % had more than 2 calcifications (25). These differences can be explained by the size of the sample, the nature of the target population whose reason for consultation is predominantly dental, and the radiological interpretation that was performed by different radiologists.

The study found a higher percentage of women than men: 77.8% versus 22.2%. A large incidence in women or an equal distribution is reported (3). However, the study by Nass Duce et al found a frequency of 65% in men and 35% in women (23). These differences are explained by the inclusion and exclusion criteria chosen but also by the size of the sample.

The location of calcifications was a factor analyzed in this work: 88.9% of calcifications were located at the peripheral level while 11.1% at the central level. The location of intra-sinus calcifications has been studied by several authors mainly to distinguish fungal sinusitis from non-fungal (6, 7, 24). All concluded that the calcifications located at the central level would be in favor of a fungal sinusitis whereas those at the

peripheral level would direct the diagnosis towards a non-fungal chronic sinusitis. This factor is important, it allows ENT specialists to diagnose chronic fungal sinusitis type "fungal ball" faster and reduce treatment time and complications in immunocompromised patients (7).

The study of the shape of calcifications is just as important as the location. Round calcifications were reported in 21.4%, nodular in 42.9%, linear in 7.1% and punctate in 28.6% of cases. Different other studies described dissimilar values not only to our values but to each other (26,7,24).

Indeed, the punctate shape was found in 53.8%, 3.8% and 50% of cases in three different studies respectively, while we found it in 28.6% of cases in this work. These differences would be due to the fact that the shape is a subjective qualitative variable that depends on the interpretation of each radiologist according to the chosen cut. However, round calcifications are found only in non-fungal sinusitis whereas fine punctate calcifications are reported only in non-invasive fungal sinusitis type "fungal ball" (7). Also, it has been reported that the metaplastic para-parietal linear calcifications show a slow and ancient evolution in favor of chronic sinusitis. These calcifications must be distinguished from those caused by the presence of an aspergilloma (26).

This study revealed that the size of intra-sinus calcification was highly variable: 35.7% was less than 1%; 14.3% between 2 and 5 mm, 21.4% between 2 and 5 mm and 28.6% greater than 5 mm. No study has assessed the distribution of intra-sinus calcifications according to their size. Only isolated cases of calcifications found incidentally occur, the size of which can reach 3 cm (27). Other studies refer to small calcifications or even micro-calcifications (28). However, if small calcifications are often asymptomatic, large calcifications are accompanied by facial pain, nasal obstruction, epistaxis and require surgery (29,25).

In our study, the distribution of intra-sinus calcifications according to their location showed that in 66.7% of cases one maxillary sinus (FIG. 5) was involved, whereas in 33.3% of cases both maxillary sinuses were involved. Nass Duce et al. And Güneri et al. studied the unilateral or bilateral localization of intra-sinus calcifications (23,25). They reported a higher frequency of unilaterality compared to bilateral location, which agrees with our results. The presence of intra-sinus calcifications in a single sinus would be considered as a major sign in favor of non-invasive fungal sinusitis type "fungal ball" (5).

The distribution of calcifications according to their nature revealed that 11.1% of cases were related to an overflow of paste, 11.1% were related to residual root and 77.8% of calcification cases were considered idiopathic. The presence of foreign bodies in the sinus was strongly incriminated in intra-sinus calcifications

(30). Nass Duce et al reported that of 26 cases of intra-sinus calcification, 16 had a history of dental extraction, 61.5% versus 11.1% in our study. (23) The comparison is difficult given the lack of information in patient records. The overflow of dental paste in the sinus and its consequences has been widely discussed in several studies. Haanaes et al showed that toxins from a necrotic pulp could cause decalcification of the bony wall between the periapical region and the maxillary sinus, which would increase the risk of extrusion of root canal filling materials into the maxillary sinus (31).

Dental paste in the maxillary sinus may favor the development of a fungal infection with aspergillus called aspergillosis (32). Non-invasive aspergillosis of maxillary sinus is associated with 50% of the presence of endodontically propelled root canal filling cement. (30) Two types of cement were the most implicated: zinc oxide eugenol and calcium hydroxide (33,34). Zinc is considered as a growth factor of aspergillus. It leads to impaired epithelial function by mucociliary paralysis associated with edema and soft tissue hyperaemia, which will disrupt the sinus drainage and lead to an accumulation of calcium salts causing intra-sinus calcification (30). On the other hand, calcium hydroxide constitutes both a chemical irritant and a foreign body. The calcification process is due to subsequent tissue necrosis (31). Its anti-inflammatory and antibacterial effect would explain the absence of symptoms in patients with intra-sinus calcification (13,25).

Intra-sinus calcifications are classified as true and false calcifications depending on the origin of the nucleus. The source of true calcifications is an endogenous nucleus such as mucus, pus or mycoses, whereas the origin of false calcifications is exogenous, that is to say foreign bodies such as residual roots or paste overflow (29). Calcifications of exogenous origin have been the subject of several studies (23,25). However, no consensus has yet been reached to explain the process responsible for the occurrence of endogenous calcifications.

Several theories are put forward. First, the ventilation of the maxillary sinus would be responsible. The ventilation of the maxillary sinus via its ostium is essential to maintain its biological balance. It was found decreased in 78% of the cases in our work. Mucus in the sinus plays a major role as a protective colloid so that the salts do not concentrate. (36) However, once the inflammation is established, sinus ventilation is impaired, sinus drainage is compromised, mucous secretions accumulate, increase PH, change the mineral environment and lead to the precipitation of calcium salts which would lead to the formation of intra-sinus calcifications. (29)

Second, the formation of idiopathic calcifications of endogenous origin is linked to the osteogenic power of the Schneider membrane. Srouji et al. analyzed the osteogenic potential of the human

maxillary sinus Schneider membrane using in vitro and in vivo assays. (37) Samples of the membrane were used to prepare cell cultures for histological studies. The results showed that the cells derived from these membrane extracts grow in culture and express markers of osteoprogenitor cells (alkaline phosphatase, protein 2 specific to bone morphogenesis, osteopontin, osteonectin and osteocalcin). Mineral deposits have also been found including phosphate and calcium ions. Once differentiated, these membrane-derived cells were transplanted in vivo. Therefore, histological evidence of osteogenesis has been found at the site of transplantation. The results of this study showed the presence of osteoprogenitor cells at the Schneider membrane and asserted its osteogenic potential. However, the precise location of these osteoprogenitor cells among the layers constituting the Schneider membrane was not determined. The authors have referred to the richly vascularized chorion but also to the connective tissue similar to the periosteum next to the maxillary bone. The osteogenic potential of the Schneider membrane has been approved by several authors and in several studies. (38,39) It would explain the significant success of dental implants (93.5%) placed in the atrophied maxillary posterior region; With a residual bone of 5 mm to 9 mm: these implants are placed "in a tent pole" without using bone substitutes but only by providing space for the blood clot (40). This technique eliminates the high cost of bone substitutes but also reduces the risk of post-operative complications related to bone grafting (41). Indeed Schneider's membrane plays the role of framework for the multiplication of bone cells and their maturation (42). More studies are needed to be able to predict bone formation by focusing on the individual potential of each patient. (40)

The thickness of the sinus mucosa was measured in several studies. In the present study, thickening of the sinus mucosa was reported when the thickness of the mucosa was greater than 1 mm. (FIG. 6). Its prevalence was 88.9%. Other studies have reported a prevalence ranging from 48.4% to 66% (2,8). This difference may indicate that the presence of intra-sinus calcification is a contributing factor to the thickening of the sinus mucosa. It should be noted, however, that thickening of the sinus mucosa is not necessarily a sign of pathology. Allergic reactions and smoking are factors correlated with an increase in the thickness of the sinus mucosa. (43)

Antral polyps are the most common benign pathologies of the maxillary sinus. Their prevalence varies between 1.4% and 25% (2,8). Our study found a prevalence of 44%. This high frequency would indicate a relationship between the presence of antral polyps and intra-sinus calcifications.

In our study, 55% of calcifications were related to inflammatory processes of dental origin. A study of

sinus abnormalities reported that 64.3% of these abnormalities were related to dental inflammatory lesions. (44) This value is in accordance with the results of our work. Estrela et al report large bone formation in the maxillary sinus associated with periapical inflammatory lesions of endodontic origin (45). These periapical lesions would act on the periosteum constituting the internal surface of Schneider's membrane. They would result in osteolysis leading to bone formation through immature bones containing a high number of osteocytes and collagen fibers. (46) These reactive osseous formations are to be distinguished from intra-sinus calcifications.

The study of the state of maxillary sinus revealed that in 88.9%, the sinus is pathological. This result is consistent with another study that reported 80.8% of the sinuses containing calcifications were pathological. (23) The inflammatory and pathological condition of the sinus is essential for planning for sinus augmentation surgery. It involves effective communication with the ENT specialist in order to avoid post-operative complications specific to each pathology (26).

In addition to intra-sinus calcifications, this study made it possible to identify calcifications in the

maxillary (11.1%) and the mandible (11.1%). Radiopaque alterations in the maxillary and mandibular region are often found incidentally. They always raise the question of diagnostic and therapeutic consequences. It should be noted that radiological signs guide the differential diagnosis but it is the clinical signs and especially histological examinations that confirm the definitive diagnosis. (47)

V. LIMITATIONS OF THE STUDY

This study has been limited by a number of factors:

- The study was conducted retrospectively in a dental radiology center. The reasons for consultation were mainly implant surgery, an inclined canine suspicion and an ODF treatment, hence the low prevalence of intra-sinus calcifications found.
- Only adult patients were included in the study; but, analysis by age group was not possible given the lack of information on patient records.

Competing interests:

"The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper."



Fig.1: Three calcifications in the left maxillary sinus

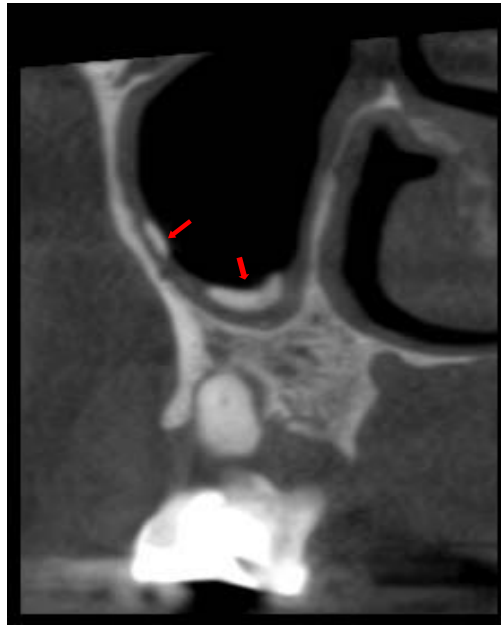


Fig. 2: Peripheral location of intra sinus calcifications

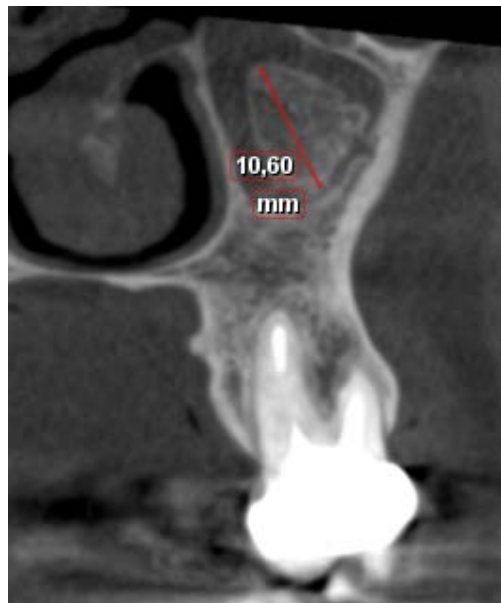


Fig. 3: Intra-sinus calcification greater than 5 mm



Fig. 4: Intra-sinus calcification of nodular shape

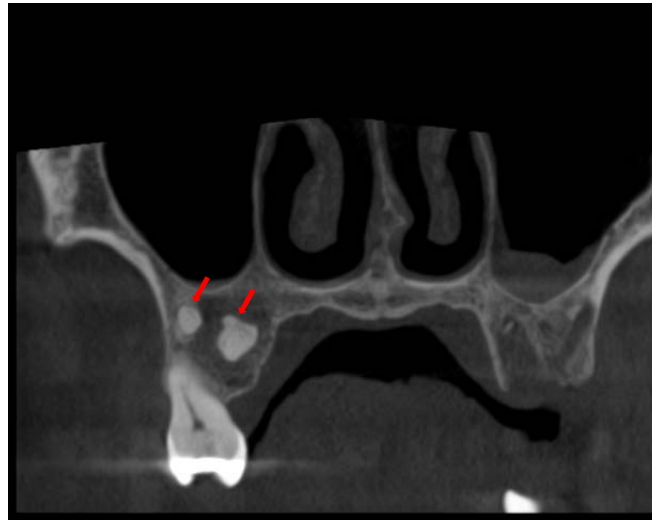


Fig. 5: Unilateral localization of calcifications



Fig. 6: Mucous thickening of the Schneider membrane associated with intra-sinus calcification

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Role of Allergy in Nasal Polyposis

By Dr. S Juthika Rai, Dr. Gourav S Shetty & Dr. Devan P.P

A.J. Institute of Medical Sciences

Abstract- Background: Nasal polyposis has been recognized as a clinical entity since several centuries. The earliest physicians talked about their tendency to recur which is echoed by modern day rhinologists.

Objectives: The objective of this study is to attempt to identify allergy as a major contributing factor in the etiology of Nasal Polyposis.

Materials & Methods: The study consists of 50 patients who presented to the Out Patient Department with nasal polyposis diagnosed by clinical & radiological methods and confirmed by histopathology. These patients were evaluated for the presence of allergy by a detailed questionnaire and clinical examination. Absolute Eosinophil count and serum IgE were estimated. The results were then compiled and compared and data was analysed for statistical significance by Chi Square test. The patients were followed up for a period of 12 months to evaluate recurrence.

Keywords: allergy, nasal polyposis, raised serum IgE.

GJMR-J Classification: NLMC Code: WV 300



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Role of Allergy in Nasal Polyposis

Dr. S Juthika Rai ^α, Dr. Gourav S Shetty ^σ & Dr. Devan P.P ^ρ

Abstract- Background: Nasal polyposis has been recognized as a clinical entity since several centuries. The earliest physicians talked about their tendency to recur which is echoed by modern day rhinologists.

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Results: Out of the 50 patients a majority (78%) of them had Sinonasal polyposis. A significant percent of patients (69%) with Sinonasal polyposis gave a positive history of allergy and significantly high levels of serum IgE were seen in patients of this group. Seven cases showed recurrence on follow up, all of whom showed positive allergic status.

Conclusion: Sinonasal polyposis patients had allergy as their major etiological factor in this study, and the majority of the recurrences were seen in this group. Failure to recognize and treat this association adds to the morbidity of the disease and results in poor treatment outcome.

Keywords: allergy, nasal polyposis, raised serum IgE.

I. INTRODUCTION

Science has progressed through many centuries to the present day. Nasal polyps have been recognized as a clinical entity since several centuries. Nobody is really sure why polyps occur, many theories have been proposed but none confirmative. One of the earliest etiologies proposed was that of allergy. A number of studies done by numerous rhinologists stands to either confirm or contradict this theory. Whatever be the school of thought, there is undeniable evidence that allergy is associated with nasal polyps. Unrecognized allergy almost definitely causes a recurrence thereby initiating the effort to distinguish atopics & non atopics. This study is an attempt to identify allergy as a major contributing factor in the etiology of nasal polyposis on the assumption that isolation of an atopic patient will lead to better treatment of the underlying pathology.

Author α σ ρ: A.J. Institute of Medical Sciences.
e-mails: excelsior999@yahoo.com, gouravshetty@yahoo.com

II. AIMS AND OBJECTIVES

To evaluate the incidence of allergy in Nasal polyposis.

To co-relate allergy and the type of Nasal polyposis.

To evaluate recurrence in Nasal polyposis.

III. MATERIALS AND METHODS

The study consisted of 50 patients with nasal polyps who presented to the Out Patient Department of the Department of Otorhinolaryngology. The study was cross sectionally designed and lasted for 2 years.

Patients who came to the O.P.D with nasal complaints of obstruction, headache, sneezing, itching, loss of smell were examined clinically to diagnose polyps. All cases that were diagnosed clinically were confirmed with histopathological examination.

The diagnosed and confirmed patients based on clinical examination, Diagnostic Nasal Endoscopy (DNE) and radiology (CT PNS), were then divided into 2 categories:

- Sinonasal polyposis – multiple unilateral or bilateral polyps arising from the paranasal sinuses.
- Antrochoanal polyps – single unilateral polyp arising from the maxillary sinus.
- These patients were then evaluated for the presence of allergy by a detailed questionnaire, clinical examination, Absolute Eosinophil count and serum IgE.

The results were then compiled and compared and the data analysed for statistical significance by the Chi Square test for contingency tables.

Inclusion Criteria

All patients presenting to the Out Patient Department with nasal obstruction, sneezing, itching of nose with nasal polyposis.

All patients between the ages of 10 yrs to 80 yrs.

Exclusion Criteria

All patients presenting with nasal complaints due to pathology other than nasal polyposis.

Patients below 10yrs of age, and above 80 yrs of age.

IV. RESULTS

50 patients of nasal polyposis who presented over the period of 2 years, after a detailed examination were grouped into either Sinonasal or Antrochoanal.

Out of the 50 patients, 39 were Sinonasal (78%) and 11 were Antrochoanal (22%). Patients with Antrochoanal polyps mainly presented in the 0-40 age

group while Sinonasal polyposis mainly presented in the 20-80 age groups.

In both groups the majority of the cases were males. Nasal obstruction, and nasal discharge and headache were common in both groups. Sneezing was present in only 1/3 rd of the patients with Antrochoanal polyps as against 3/4 th of the patients of Sinonasal polyposis.

There was no history of Asthma in patients with Antrochoanal polyps as against 1/6 th of the patients with Sinonasal polyposis who gave a positive history of Asthma.

A positive history of Allergy was obtained in 1/5 th of patients with Antrochoanal polyps and in 2/3 rd of patients with Sinonasal polyps. The association among the 2 study groups was highly significant.

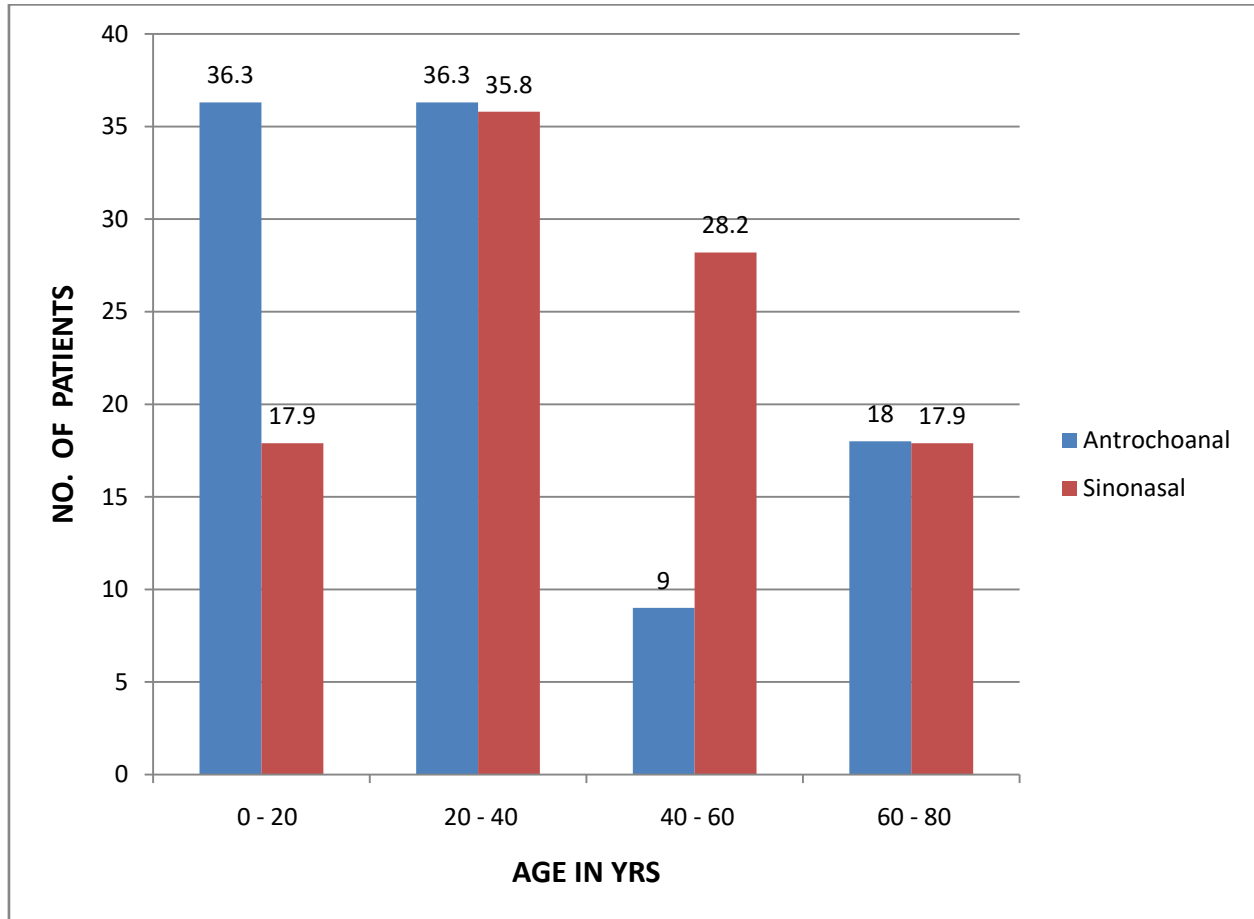


Figure 1: Incidence of Age in Both Study Groups

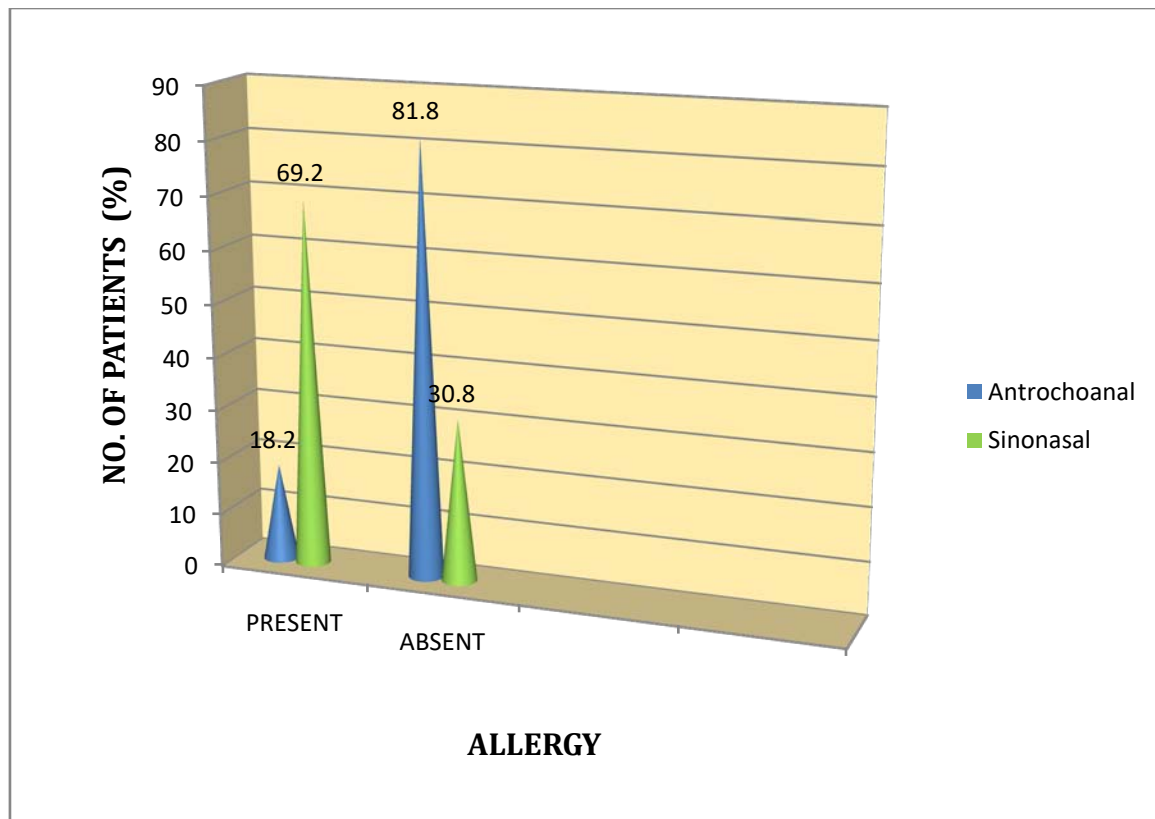


Figure 2: Incidence of Allergy In Both Study Groups

Table 1: Absolute Eosinophil Count

Absolute Eosinophil Count	Antrochoanal No. %		Sinonasal No. %	
Normal	7	63.6	2	5
Elevated	4	36.4	37	95
Total	11	100	39	100

Chi Square test (1) = 15.007 $p = 0.0001$

The estimation of serum Eosinophils in the peripheral blood showed elevated levels in about 1/3 of the patients with Antrochoanal polyps and in almost all

the patients with Sinonasal polyposis which was statistically significant.

Table 2: Serum Total IgE

Level	Antrochoanal No. %		Sinonasal No. %	
NORMAL	7	63.6	2	5
ELEVATED	4	36.4	37	95
TOTAL	11	100	39	100

Chi Square Test (1) = 16.133 $p = 0.0001$

The serum IgE levels were elevated in 36.4 % of the patients with Antrochoanal polyps and about 95 % of patients with Sinonasal polyps which was statistically significant.

When the 2 parameters were considered, 27.3 % of Antrochoanal polyps and 74.4 % of Sinonasal polyps were positive for allergy with a Chi Square test

(1) = 13.50 and $p = 0.0001$ which was statistically significant.

V. DISCUSSION

Allergy has long been implicated as a causative factor in Nasal polyposis. In this study, a consecutive group of 50 patients with nasal polyposis were studied

and evaluated for the presence of allergy by clinical, haematological and immunological methods.

The youngest patient in our study was 11 yrs old and the oldest was 78 years old. Antrochoanal polyps were associated with presentation in the younger age group in our study similar to the study by Choo et al¹ where a majority of their patients with Antrochoanal polyps were below 16 yrs of age.

In our study group, 69 % of patients with Sinonasal polyposis gave a positive history of allergy and 15.4 % gave a positive history of Asthma. This deferred slightly from that quoted by Farrel et al² who detected allergy in 27.83% and asthma in 29% and by Drake-Lee et al³ who noted incidence of allergy in 22 % and asthma in 27.83 % of their patients. The notable exception in our study was the absence of history of aspirin sensitivity.

The Absolute Peripheral Blood Eosinophil Count was elevated in 18.2 % of patients with Antrochoanal polyps and in 84.6 % of patients in Sinonasal polyposis in our study group. Kaldenbach et al⁴ in their study of 58 patients with Sinonasal polyposis found an increase in Absolute eosinophil count in 66%. Sheri et al⁵ in their study of a total of 303 patients with Sinonasal polyposis found that the correlation between raised Absolute eosinophil count and polyposis was 89 %.

The Serum total IgE levels in our study group were elevated in 36.4 % of the patients with Antrochoanal polyps and 95 % of patients with Sinonasal polyposis. Drake – Lee and Barker⁶ in their study of 29 patients showed raised IgE levels in patients with Sinonasal polyposis.

Sin et al⁷ after studying 95 patients with nasal polyposis reported allergy as an etiological factor. The mean serum IgE levels were significantly higher in this group. Bottazzi G et al⁸ studied the association between nasal polyposis and airborne allergen hypersensitivity and concluded that airborne allergens played a relevant role in the pathogenesis of nasal polyposis. Bateman et al⁹ in their paper documented that nasal polyps have a clear association with asthma, hypersensitivity and cystic fibrosis. Pawankar¹⁰ in their article documented that in majority of nasal polyps, eosinophils comprise more than 60% of the cell population.

In our study, more parameters like polyp fluid IgE, SPT (Skin Prick Test) or RAST (Radio Allergo Sorbent Test) for specific allergen could not be carried out due to prohibitive cost and lack of patient compliance. All the patients in our study with Sinonasal polyposis had raised IgE levels and more than 80 % had evidence of raised peripheral blood eosinophilia.

Out of 50 patients in our study seven showed recurrence in the 12 month follow up period, all of whom showed positive allergic status.

VI. CONCLUSION

Allergy has long since been one of the proposed etiological factors in the pathogenesis of Sinonasal Polyposis. From the parameters used in our study there is a statistically significant association between allergy and Sinonasal polyposis. Failure to recognize and treat this association may result in recurrences, increased morbidity and a poor treatment outcome.

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Malocclusion, Phonetics & Palatography: The Link Express

By Dr. Sayam Patil, Dr. Jakati Sanjeev & Dr. Rutika Patil

Dental College and Hospital

Abstract- Context: A condition that has a stronger link to malocclusion is a forward resting posture of tongue. Correction of tongue function or posture facilitates correction of the lisp, or interdentalization of the /t/, /d/, /n/, and /l/ phonemes. A diagnosis is needed, that distinguishes learned behaviour from obligatory function due to physical deviation. Inquiry into these disorders identifies subgroups characterized by different combinations of functions, occlusion status, speech status, and forces obligating or predicting anterior tongue position.

Aim: To correlate role of phonetics in various malocclusions & evaluate the same palatographically.

Materials & method: The tongue was evenly painted with a thin mix of rubber base putty impression material & the speaker was prompted to say the target word. The entire pattern of contact is photographed / recorded palate graphically in different type of malocclusions.

Conclusion: When Palatography is correlated to different malocclusions, the aetiology of phonetic disturbance can be incurred.

Keywords: malocclusion, phonetics & palatography.

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Malocclusion, Phonetics & Palatography: The Link Express

Dr. Sayam Patil ^α, Dr. Jakati Sanjeev ^σ & Dr. Rutika Patil ^ρ

Abstract- Context: A condition that has a stronger link to malocclusion is a forward resting posture of tongue. Correction of tongue function or posture facilitates correction of the lisp, or interdentalization of the /t/, /d/, /n/, and /l/ phonemes. A diagnosis is needed, that distinguishes learned behaviour from obligatory function due to physical deviation. Inquiry into these disorders identifies subgroups characterized by different combinations of functions, occlusion status, speech status, and forces obligating or predicting anterior tongue position.

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Conclusion: When Palatography is correlated to different malocclusions, the aetiology of phonetic disturbance can be incurred.

Keywords: malocclusion, phonetics & palatography.

Key Messages: Palatography is correlated to different malocclusions & their exact aetiological location of phonetic disturbance is incurred.

I. INTRODUCTION

The multidisciplinary approach in diagnosing speech-language pathology and dentistry is associated with patterns of oral-facial-pharyngeal posture, function related to speech, occlusion & malocclusion. A condition that has a stronger link to malocclusion is a forward resting posture of tongue. Such chronic postures can interfere with eruptive sequence of dentition and lead to malocclusion¹.

Diagnostic attention is directed toward determining whether a tongue-thrust swallow and a forward tongue resting posture coexist in a given patient. When these conditions coexist, a greater link to malocclusion would be expected than from a tongue-thrust swallow alone²⁻⁷. There is evidence that a tongue-forward resting posture / tongue thrust swallow and lisp coexist²⁻⁷. Correction of tongue function or

posture facilitates correction of the lisp, or interdentalization of the /t/, /d/, /n/, and /l/ phonemes.

A diagnosis is needed, that distinguishes learned behaviour from obligatory function due to physical deviation. Primary goal is to retrain labial and lingual resting and functional patterns⁸⁻⁹. Existing research is limited in quantity. Much research is flawed by the use of *ex post facto* methods of study. Inquiry into these disorders identifies subgroups characterized by different combinations of functions, occlusion status, speech status, and forces obligating or predicting anterior tongue position⁸⁻⁹.

Information is needed about relationships among all of the following:

- Tongue morphology, position and movement;
- Lip morphology, position and movement;
- Oral-facial skeleton, including occlusion;
- Variables obligating tongue fronting;
- Biologic activity at the attachment apparatus of the teeth;
- Speech motor control;
- Oral adaptation and compensation; and
- Speech production

Aim of our study was to correlate role of phonetics in various malocclusions & evaluate the same palatographically.

II. MATERIALS & METHOD

The palatographic techniques used in our study was similar to the one summarized by Ladefoged¹⁰⁻¹² 1997, 2003 & modified by Victoria B. Anderson¹³⁻¹⁴ University of Hawaii at Mānoa 2008.

Step 1: A thin mix of rubber base putty impression material (Aquasil, Dentsply™) was used in our study. Chromatic alginate or an “edible paint” mixture of olive oil and powdered digestive charcoal can also be used. Although the speaker is meant to rinse out the mixture, i.e. entirely edible, and can be swallowed without danger.

Step 2: The tongue was evenly painted as far back as is comfort-able for speaker. Application on the tip of tongue was intended to record the speech sounds /t/, /d/ & application on lateral borders of tongue was intended for sounds /s/, /z/ & Th, sh, ch (voiced or voiceless).

Author α: Associate Professor, orthodontics department Tatyasaheb Kore dental college & research centre Kolhapur Maharashtra. e-mail: drsayampatil@gmail.com

Author σ: Assistant Professor, Orthodontics & Dentofacial Orthopaedics, Swargiya Dadasaheb Kalmegh Smruti Dental College & Hospital Nagpur. e-mail: sanjeevjakati@gmail.co

Author ρ: BDS general dental surgeon, private practitioner profile dental clinic & orthodontic centre gokak Karnataka.

Step 3: Then the speaker was asked to return the tongue to a resting position inside the mouth, and keep her / his mouth relaxed and open so that no tongue-palate contact is made. Drooling may or may not occur; either is normal. The speaker was prompted to say the target word by giving its gloss. The palatography mirror was placed in her / his mouth to reflect the articulation,

so that the entire pattern of contact can be seen (see figure 1) which is photographed / recorded.

Step 4: A sample of 10 patients each, belonging to different type of malocclusions were randomly selected from the department & the above procedure was carried out in all of them & the palatographic imprint of the same was recorded.

Table 1⁵: Phonetic type & related Dental problem

Speech sound	Phonetic Type	Target words used	Dental problem
/s/, /z/	Sibilant	Soup, City, Science, Box, Zoo, Xylophone	Lisp due to large gap b/w incisors, missing incisors, open bite
/t/, /d/	Lingualveolar stop	Teeth, Toast, Button, Guitar, Boat, Coat	Difficulty in production related to irregular incisors, supernumerary teeth, tongue tie
Th, sh, ch (voiced or voiceless)	Linguodental fricative	Shop, Share, Chain, Cheese, Church, When, Why, Think, Thumb, This, That	Distortion related to severe open bite, missing incisors

III. RESULTS

The point of contact of tongue to the palate varies for different speech types with differing malocclusal patterns. The same was recorded palatographically. Figure 2-4 represents phonetic speech type /t/, /d/ & phonetic speech type /s/, /z/ & Th, sh, ch (voiced or voiceless).

IV. DISCUSSION

Evaluation of the structure, form and function of tongue is the first step in treatment planning. Sucking habits¹⁶⁻¹⁹, when present, is usually eliminated before treatment for tongue thrust begins. Timing of treatment is following orthodontic treatment, but concurrent and pre-treatment is also common. Emphasis in treatment is on lingual and labial resting postures⁸⁻⁹, but most approaches include a number of muscle retraining exercises, followed by instruction in handling and swallowing of solids, liquids, and saliva. Speech treatment is directed toward normalization of fronted lingual-alveolar consonants. Patients are seen for follow-up sessions for various periods but usually until completion of all orthodontic treatment. Length of treatment varies from 14 to 20 sessions or more, over 3 months to a year, depending on approach, age, and maturity of patient, and timing in relation to orthodontic treatment.

Palatography can be carried out either by a direct method or an indirect method. In the direct method described by Oakley Coles in 1872 he used gum Arabic & flour. During articulation, marking material is transferred to opposite articulator. This contact pattern is videotaped / recorded / photographed & then marked on the palatal cast. The indirect method first described by Kingsley in 1880, he prepared an upper plate of black Indian rubber & covered the tongue with a mixture of chalk & ethanol. The contacts seen on palatal rubber plate were then transferred on to cast as in direct method.

Static palatography (also known as direct palatography) is a way to collect articulatory records about speech sounds that can be used either in field or in the laboratory¹³⁻¹⁴. Palatography creates records of contact pattern of tongue on roof of mouth during an utterance, and when the actual dimensions of palate are known it can be a rich source of data about articulatory strategies. Movements of tongue depend on local conditions like malocclusion. Even though the tongue has an inherent capacity to compensate its position & movements based on the type of occlusion / malocclusion it inevitably causes some kind of disturbance / defect in phonetics.

Other methods of collecting data on speech articulations include *Dynamic palatography* (Hardcastle²⁰ et al. 1989) and *Portable ultrasound* (Gick²¹ 2002).

Dynamic palatography, also known as electropalatography (EPG), uses a plastic retainer-like device implanted with electrodes and worn on palate, to sample information about contact patterns on palate over time. A drawback is that EPG cannot provide information about tongue configurations / size during an utterance.

Portable ultrasound provides information on tongue shape and position during an utterance, but since it tracks soft tissue rather than bone, it cannot show tongue's position with respect to various areas on roof of mouth.

Front most contact on roof of mouth in midline is a common metric for indexing place of articulation (Dart²² 1991.). Since this measure reflects size of cavity in front of constriction, it is associated with spectral shape of bursts (Fant²³ 1960).

Phonological distinctions such as *apical* versus *laminal* lead us to expect differences among categories of speech sounds based on *length of contact* from front to back in midline. Acoustic correlates of contact length relate to relative size and mass of active articulator. Small tongue tip will make a short contact; broader blade will make a longer contact. Expect the tip to be a

quicker articulator than blade, because of its lighter mass and because, being on periphery of tongue, it is more independent of other areas of the tongue. The relative speed of active articulator can relate to voice onset time, amount of friction at burst release, and relative amplitude of bursts (Stevens²⁴ 1998).

While size of cavity in front of constriction can be expected to relate to spectral shape of bursts, *cavity in back of oral closure* can be expected to relate to formant transition loci at edges of neighbouring vowels (Fant²³ 1960). One index of oral cavity size behind the constriction involves measuring uncontacted region behind the constriction. The size of this space is affected by amount of raising of the sides of the tongue body, as well as the rear extent of midline contact; the more contact on the palate, the smaller this area will be.

V. CONCLUSION

Static palatography is a "field-friendly" technique that can provide valuable, detailed information about articulatory characteristics of speech sounds. However, the process is labor-intensive and time-consuming. When it is correlated to different malocclusions & thus the aetiology of the resulting phonetic disturbance / lipping can be incurred. The test can be repeated after the correction of malocclusion as a confirmatory process to know whether the aetiology has been removed or not.


















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Figure 1: Palatographic image. Upper teeth shown at top are reflected in the mirror at the bottom

Type of Malocclusion	Palatographic Imprint Ch / Sh & s / z	T / D
 Normal Occlusion		
 Class I Crowding		
 Class I Crowding		
 Class I Deep Bite		
 Class I Deep Bite		
 Class I Spacing		
 Class I Spacing		

Type of Malocclusion	Palatographic Imprint Ch / Sz & S / Z	T / D
4. 	Class I Spacing 	
1.  → 	Class II Div 1	
2.  → 	Class II Div 1	
1.  → 	Class II Div 2	
2.  → 	Class II Div 2	
1. 	Class III 	
2. 	Class III 	

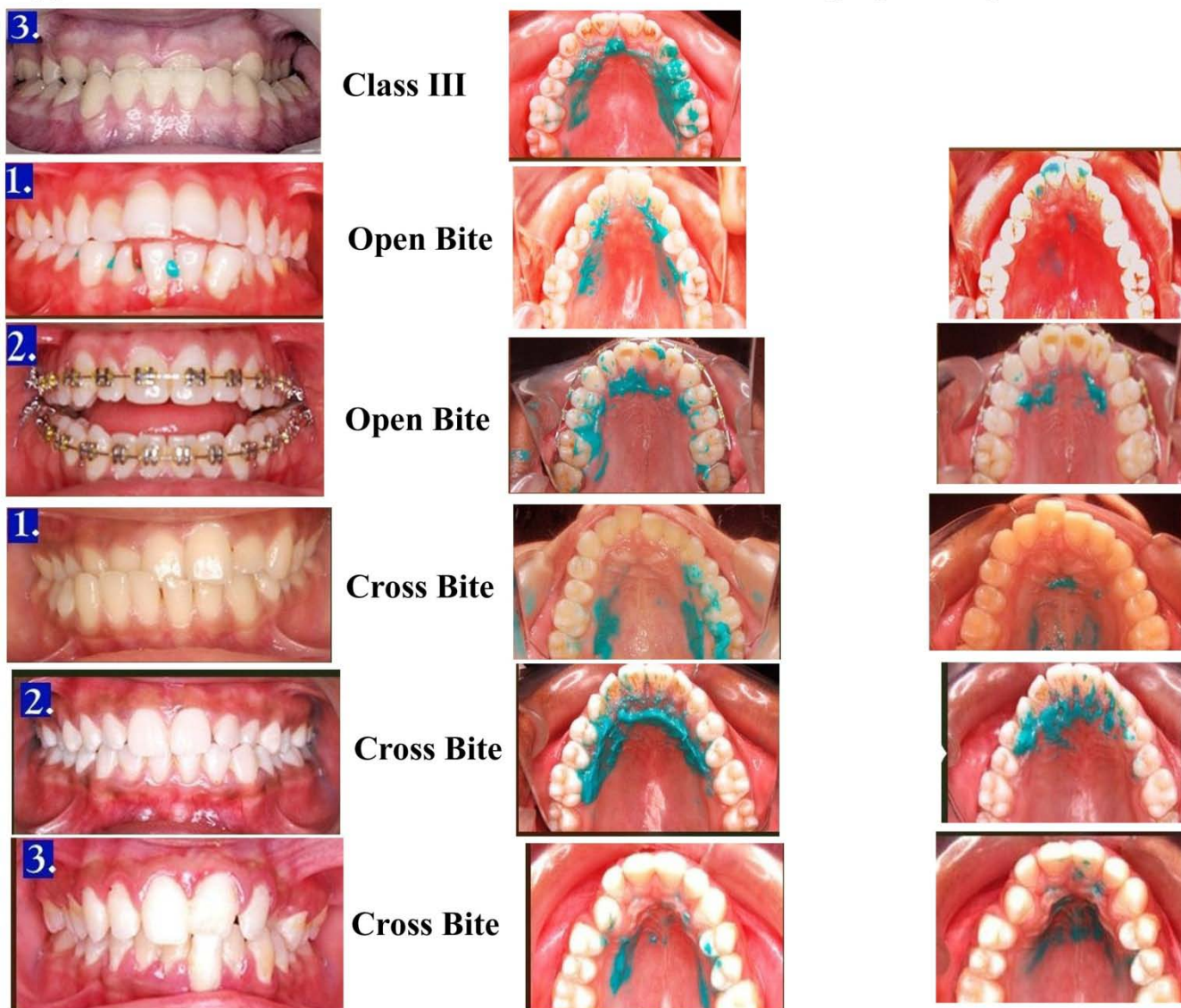
Type of malocclusion**Ch / Sh & S / Z Palatographic Imprint T / D**

Figure 2-7: Different malocclusions & the corresponding phonetic types represented palatographically.

Palatographic image. Upper teeth shown at top are reflected in the mirror at the bottom

Different malocclusions & the corresponding palatographical imprints for phonetic sound type /t/, /d/ & /s/, /z/ & Th, sh, ch (voiced or voiceless).

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21. 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 to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

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

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

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



27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After 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 through which your research is going to be in print to 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 in 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 criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of 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 the progression.

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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 evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

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- Use standard writing style including articles ("a", "the," etc.)
- Keep on paying attention on the research topic of the paper
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- Align the primary line of each section
- Present your points in sound order
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- Use past tense to describe specific results
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Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript-- must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing 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 approach to the problem, relevant results, and significant conclusions or new questions.

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- Reason of the study - 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 quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
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The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
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- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled 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 with every section. If you make the four points listed above, you will need a least of four paragraphs.



- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
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This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement 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 for the least amount of information that would permit another capable scientist to spare 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 object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text 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:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not 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 - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in 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 a 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. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently. You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.



Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise 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 in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to 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 part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
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- Make a decision if each premise is supported, 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 the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One 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 available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.



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<i>Introduction</i>	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
<i>Methods and Procedures</i>	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
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<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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