Review Article

# CONSOCIATION OF OPHTHALMOLOGY AND DENTISTRY: A REVIEW

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**ABSTRACT:**

**Introduction:** Until now, very limited attention has been given to the linking between dental occlusion and ophthalmology. Therapeutic evidence shows that in dental related cases, mandibular latero-deviation is associated with eye dominance and dysfunctioning of ocular convergence. In the human body, there are several interconnected mechanisms that form a single structural system, making the pathological situation of one specific region impact or affect any other region. Clinically, it was claimed that if dysfunction is found in eye development, it is usually correlated with human brain and craniofacial defects. The main intention of the research was to appropriately analyse and find the association between human eye with dental variables.

**Methodology:** This review tries to enhance the knowledge regarding linking between opthalmics and dentistry by exploring several existing research that are associated with the subject. The paper is based on a systematic review to determine whether there is an association between Opthalmics and Dentistry. **Results:** The finding shows that there is an association between ophthalmology and dentistry. For instance, visual anomalies and malocclusions, incorporation between temporomandibular diseases, occlusal characteristics, and the preference of ocular convergence abnormalities.

**Keywords:** Visual anomalies, Dental Occlusions, Opthalmology, Dentistry, Ocular Disorders

## INTRODUCTION

Ophthalmology and dentistry are quite similar in brief, as both are broad terms. Both organs are highly specialised and sensitive among other organs of the human body. In the human body, there are several interconnected mechanisms that form a single structural system, making the pathological situation of one specific region impact or affect any other region [1]. The skeletal muscles associated with the skull, lower jaw, spine, limb, and pelvis are associated functionally and anatomically. Henceforth, it performs a significant role in the coexistence of several dysfunctioning of these single structure units. Several resources emphasize on providing keen observations regarding the study of anatomical and functional connectivity between dental occlusion and vision such as visual anomalies and malocclusions [2,7,8], incorporation between temporomandibular diseases, occlusal characteristics, and the preference of ocular convergence abnormalities [13]. Other researchers explored optical abnormalities among children with numerous dentoskeletal malocclusion [4, 9,15].

There is a strong correlation found among the oculomotor and trigeminal functioning. The oculomotor mechanism comes from the occipital somites along with the tongue muscles and the suboccipital muscles. This framework operates in a cooperative manner to control and manage the

functioning and position of the head and neck. On the other hand, the trigeminal system indicates the association between the somatic functions. Along with branchial that are collected from the proprioception of a couple of somatic functioning and oculomotor muscles [2]. Most complex and the largest cranial nerve is the trigeminal nerve among 12 nerves. It is responsible for transporting impulses to the face, mucous membrane and other functions of the head. It is a nerve that contains proprioceptive fibres and is a motor nerve for the muscles of mastication. The ocular nuclei is responsible to control and manipulate the eye position inside a orbit. The afferent impulses obtained from the vestibular nuclei and transported to the nuclei fibres which control the movement of the head and neck. The ocular proprioceptive afferents have similar subcortical stations which are responsible for receiving signals from vestibular stimuli [4].

The main concern of the research was to appropriately analyse and find the association between human eye variables with dental malocclusion. The following section of the research review comprehensively throws light on the studies focused on craniofacial development, eye disorder and malocclusions. After seeking the discussion, the related studies were focused on determining the methodology, finding, and objective of the distinct literatures observed and represented (tabular form). Subsequently, moving toward the suggestion section where the finding and the future scope of the review paper has been illustrated and a conclusion was drawn that reflects the compilation of the study.

## BACKGROUND

The development of craniofacial structures is based on distinct cartilage bones that are present in the head and the neural crest because they belong to articulated cartilage and dermal osseous tissue. There is a relationship with the craniocerebral facial osseous tissue that is found under the brain and intracranial sensory organs comprising olfactory, optic and otic organs. The mesial cervical area is based on the tooth supporting maxillary bones, the rhinal and orbit bones, circummandibular bones and opercular bones [5]. The stomatognathic system is an element of the craniocerebral system and is represented as an entrance to outer stimuli showing its correlation with occlusion and masticatory muscular system. Numerous studies have analysed that alteration in the ocular section changes head and skeletal positioning. On the other hand, the modification in dental occlusion has an impact on fluctuations and visibility [6]. As the researcher [7] also indicates the association between strabismus and molar type malocclusion. Other research illustrates that there is a clinical incorporation among the occlusal second molar and it is linked with fusional vergence defect [9].

## DISCUSSION

Until now, very limited attention has been given to the linking between dental occlusion and ophthalmology. Therapeutic evidence

shows that in dental related cases, mandibular lateral deviation is associated with eye dominance and dysfunctioning of ocular convergence. Several studies have identified an anatomical functional correlation between dental occlusion and vision. This section comprehensively explores existing research that took place in the last few years. For easy comprehension the subject can be sub-categorised as follows-

**Relationship between Visual Defects and Dental Malocclusions**

Several research studies have explored that there is a correlation among the particular occlusion molar classes and its impact on refractive visual abnormalities. Other than this, it has also shown a link between ocular convergence and occlusal vertical malocclusions [8]. However, other researchers disagreed with the observation and found that there was no correlation between the molar classes and ocular mortality as well as convergence dysfunction [7]. Despite the determination certain parameters decide the presence and absence of any type of ocular motility abnormalities or convergence dysfunction which is irrespective of individual defect category. As the researcher [7] also indicates the association between strabismus and molar type malocclusion. Other research illustrates that there is a clinical association among the occlusal second molar and it is linked with fusional vergence defects. This disorder can be treated if early screening of vergence deficiencies is accomplished before they become a symptom. This can prevent the possibility of developing Strabismus. It has also been argued that dysfunctioning and dental malocclusion can be interrelated and lead to the possibility of visual abnormalities. The study [8] also recommended that the children prefer to take orthodontic screening to explore occlusion dysfunctioning as the second molar link must be cautiously identified in the early stages of visual deficiency. They might be correlated with refractive errors, aberrations, and binocular functioning.

Hereditary syphilis which is pathologically responsible for the Hutchinson triad, also identifies the incorporation of the eye and the teeth as pathological syndrome. This triad was found to be associated with distinct domains of therapeutic treatment, specifically ophthalmology, otology and dentistry. The triad is responsible for introducing several anomalies such as interstitial keratitis, deafness, and the conventionally malformed teeth of the second diphyodont along with other modifications are the indicators found linking with hereditary syphilis [1]. All these changes were responsible for teeth diseases and altering its shapes such as truncated cones, cauliflower shape of the crown. And this led to instigating other pathological issues like crystalline lenses. The example of such dysfunctioning is rickets in the teeth, which are responsible for changing the shape of the teeth and adversely impact the enamel and grow severe.

**Role of the eye in craniofacial development**

The development of craniofacial structures depends on intricate sets that form the combination of native and migratory cell populations and are responsible for a

complicated structure, tissue, and sensory organs of the face. The cranial neural crest is present in the core and acts as a transient population of migratory stem cells. They are responsible for producing distinct facial tissues comprising bone, cartilage, interconnected cells, and other nerves [10]. Further support in patterns and elements like ectodermal and mesodermal features. The eye is effectively complicated on its own, as its progenitor involves components covering from neural, outer covering ectoderm, neural crest, and mesoderm. The cooperation and the collaboration among diverse components such as the ectoderm, neural crest, and mesoderm assist in proper functioning of signalling waves, provide pathways for cell movement and control gene expression. If dysfunction was found in eye development, it is usually correlated with human brain and craniofacial defects [11]. The eye also acts as a prominent organiser of craniofacial structures because of several reasons-

- The central neuroanatomic position of the eye vessel comes under the craniofacial structure.
- The morphogenic signals that initiate from the eye assist in identifying the nearby pattern and specifically retinol acid.
- Intercorrelation was associated with eye, face, and forebrain buildup.

Another study [5] that analysed the development of craniofacial features in the fish "Astyanax mexicanus". It was interpreted that changes in the formation of the eye by transplanting the embryonic lens or removing the optic vessel exhibited eye dependent and independent procedures that modified the surface fish and cave fish facial structure. For determining the craniofacial skeleton characteristics, the study utilised tooth supporting maxillary bones, the rhinal and orbit bones, circummandibular bones and circumorbital bones. All these bones play a significant role in identifying changes in distinct cave fish. The findings recommend that development of the cave fish craniofacial structure is manipulated by distinct development even though some has a direct correlation with eye degeneration and others are not relevant with the dysfunctioning of the eye. The number of caudal teeth on the lower jaw is also affected by lens ablation is an interesting finding.

**Dental occlusion modifies gaze and posture stabilisation**

Uninterrupted receptive impulses from the eyes, labyrinth, and muscles and joints instruct the personnel about the placement of the body. Usually there is a correlation between the oculomotor and trigeminal system. The oculomotor consists of tongue and suboccipital muscles and their work is to manage head and neck placement. Repercussions of dental occlusion were identified upon postural and gaze stability [12]. Postural controls were identified in two data sets of the students who belong from the sports group based on intercuspal occlusion, centric correlation, physiological side lateral occlusion and contralateral occlusion. To determine the influence of these samples upon orthostatism. The results indicate that the quality declines postural manages and gaze consolidation. The sequence of splints were found among the most suitable for centric correlation least for lateral occlusion.

Several works highlight the indication that vision has a prominent and direct role in controlling postural actions. Further, occlusion affects posture because of vision impact. It also explores that there is a correlation between dental occlusion and visual focusing as more prominently, the study [13] analyses the effect of posture and on visual convergence. The finding shows that ocular mortality dysfunctioning was present in 45% of males in comparison to 57% of females' cases. The prominent reason behind ocular mortality was association with malocclusion, as 67% of the patients found with malocclusion (class III) in comparison to malocclusion (class II) 59% of patients. On the other hand, the convergence defect was found in class I and class II in an equal manner wth no evidence found in class III malocclusion.

## PREVALENCE OF EYE DISORDER WITH MALOCCLUSIONS

### i) Hyperopia and strabismus

Visual anomalies happen because of distinct factors like genetics or environmental occurrences. These eye dysfunctions like Myopia, Astigmatism, Hyperopia and Strabismus are normally influenced by the specific genes. For instance, certain instant events that happen in the prenatal or postnatal duration are responsible for these dysfunctioning and lead to the crystalline dimension morphology and location of formina. Hyperopia is a defect in which the incoming signal does not directly reach the retina because convergence takes place into a focused image and results in blurry vision.

Another prominent defect was Strabismus, in this situation the visual axis of the eye is unparalleled, and this makes eyes as if it is looking in a distinct direction. The symptoms of both the disorders are clear but the root cause of its prevalence was unidentified. Although, several researches identified that it was caused prominently in the Central Nervous System as it handles the oculomotor system. Morphological transformation was associated with extra ocular muscles and was responsible for deviating the optic nerve in most of the cases.

The study [2] determined several sources that indicate that visual dysfunction can be found in the usual mass; however, very few studies found correlation of visual anomalies with highly diffuse situations like Malocclusions. The stomatognathic and ocular system is associated under the anatomical and neuropsychic science. Thus, the investigation intends to show the predominance of Hyperopia and Myopia dysfunction specifically focusing on the south indian paediatric samples. The finding shows that 47% children were suffering with myopia and malocclusions (class II) as well as 21% of the samples were associated with malocclusions (class III). Simultaneously the cases of hyperopia and its association with maculossion were identified as 11.7% of children having malocclusions (class II) and 3.9% of children suffering from malocclusions (class III).

The study [7] categorised cases of sagittal malocclusion into three classes. After the determination of ophthalmology, the optical dysfunction was found in Hyperopia (8.6%) and strabismus (3.6%) although the result was not affected by gender. It also determines that there is an association between oculus and stomatognathic function, though there is no appropriate incorporation between visual anomalies with malocclusions. However, the study did not find any discrimination in the preference for hyperopia or strabismus in distinct classes of malocclusion.

In-vitro studies have been conducted to interpret the impact of maxillary expansion on strabismus. Meanwhile other in-vitro studies have hypothesised that alters in the nasopalatine acquired frequent maxillary expansion that might be considered with distinct bone features. This also comprises blood vessels and nerves carrying orbital anomalies. The research [14] explores the case study of a patient who is suffering from strabismus and taking proper treatment for malocclusions (class III). Furthermore, she was suffering with transverse maxillary disorder. After 60 days of treatment, study showed that patient who were not taking any ophthalmological treatment had persistent optical defect and relapsed after 180 days.

### ii) Astigmatism

Astigmatism is a dysfunctioning of the eye which mostly occurs because of abnormal curvature of the eyeball. It is responsible for blurry vision because when light enters the eye, it is unable to be appropriately distributed to the retina because of abnormal curvature. It is classified as a refractive error. This abnormality is commonly associated with other defect: myopia and hyperopia. The research [8] tries to identify the prevalence of astigmatism through an ophthalmological evaluation. Among the 322 samples, 18% of the participants were found to have astigmatism, investigated after performing the ophthalmological evaluation. The finding also reveals that there is a positive association between astigmatism and cross-bite. On the other hand, there is no correlation identified among other malocclusions. Further, there is no demographic influence associated with astigmatism or malocclusion.

### iii) Myopia

The occurrence of myopia is exhibited as highly varying in relation to ethnicity because the occurrence of defect is less found in Asian countries in comparison with European countries (as demographic dividend was a prominent factor) as Asian countries' population is more younger. The prevalence statistics fluctuated from 30% in the middle aged in comparison to the 35 to 37% in young age people. The preference for myopia is also classified based on distinct age groups and the most vulnerable group that is subjected to a high rate of prevalence was the middle-age group and female. The intention of the research [15] was to determine the occurrence of myopia in a group of Caucasian orthodontics cases. The finding shows that patients who are suffering with sagittal malocclusion were categorised as Class I, Class II and Class III. The data reviews that myopia or maloculation is not influenced by gender. The higher

significance of occurrence of myopia was associated with (class 2 -division 1) malocclusion while no other indicating effect was found in other classes.

Another study [6] was based on the functioning of Anterior Temporal, Masseter, Sternocleidomastoid and Anterior Digastric muscles in reception to modified optical stimulus in a discipline with imperfect eyesight by means of surface electromyography. To determine the effect of EMG functioning on masticatory and postural muscles among the normal and the myopia paediatric group the researcher used a 15 second electromyographic mean squares. The finding showed that there is a huge difference between the normal group and the paediatric group having myopia, as the tonic activity of the temporal anterior muscle at the open eye was quite different in both the groups.

## RELATED STUDIES

This section reflects the related studies and demonstrates the main theme and finding along with
the method used in these literatures.

| Author | Title | Objective | Findings | Methodology Used |
|---|---|---|---|---|
| Monaco A et al., 2006 | "Visual input effect on EMG activity of masticatory and postural muscles in healthy and in myopic children" | To determine the function of Anterior Temporal, Masseter, Sternocleidomastoid and Anterior Digastric muscles with defective vision capabilities. | The finding shows that there is a significant variation found in the ton functioning of temporal anterior muscles of open eyes among the myopia and normal human eye. | Electromyography Surface (EMG) |
| Monaco A et al., [7] | "Prevalence of Hyperopia and Strabismus in a paediatric population with malocclusions" | The intention of the research is to identify the optical defect and its linking with malocclusion in children. | The finding shows that there is no appropriate incorporation between visual anomalies with malocclusions. | Chi-square test, Fisher exact test. |
| Dufton M, Hall BK, Franz-Odendaal TA. | "Early lens ablation causes dramatic long-term effects on the shape of bones in the craniofacial skeleton of Astyanax mexicanus". | The motive of the research was to identify the influence the lens found associated due to the growth of the surrounding skeleton by ablating lens at distinct by reducing the lens at varying ontogeny. | The finding shows that lens ablation has a significant impact on the skeleton when it is decreased to one dpf in comparison to 4 dpf. | Morphometric analysis |
| Silvestrini-Biavati A et al., | "Clinical association between teeth malocclusions, wrong posture and ocular convergence disorders: an epidemiological investigation on primary school children". | The motive of the research is to keenly observe the incidences of Dental malocclusions along with posture and vision dysfunctioning. | The vertical dimension of occlusion shows a moderate linking with the proper dominant eye. | Cover test and Convergence Test |
| Marchili N et al., | "Dental Occlusion and Ophthalmology: A Literature Review" | The objective of the study is to keenly observe the incorporation between dental conclusion and ophthalmology. | The finding shows that the nervous system and its operation root shows a correlation between vision and dental occlusion. | Systematic approach |

## CONCLUSION

Visual anomalies occur because of distinct factors like genetics or environmental occurrences. These eye dysfunctions like Myopia, Astigmatism, Hyperopia, and Strabismus are normally influenced by the specific genes. Because, if dysfunction is found in eye development, it is usually correlated with human brain and craniofacial defects. An anatomical medical and neuropsychic incorporation among

stomatognathic and ocular systems exists. Subsequently, it may be extracted from the several researches that are keenly observed in this review paper that there is an association between ophthalmology and dentistry. For instance, visual anomalies and malocclusions, incorporation between temporomandibular diseases, occlusal characteristics, and the preference of ocular convergence abnormalities. Other researchers have explored optical abnormalities among paediatrics with numerous orthodontic skeleton domains. Moreover, it was analysed that alteration in the ocular section changes head and neck positioning. On the other hand, the modification in dental occlusion has an impact on visibility. Several works highlight the indication that vision has a prominent and direct role in controlling postural reactions. Further, occlusion affects posture because of vision impact. It also explores that there is a correlation between dental occlusion and visual focusing.

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