Prevalence Of Malocclusion Between Naturally Conceived Children And Children Conceived By Assisted Reproductive Technology

Fares Abdulaziz Alatawi[1]*, Heba Tariq Jan[1], Ibrahim Salim Zaal Albalawi[1], Mohammed Ali Alshehri[1], Nujood Salem Alatawi[1], Amjad Mohammad Alonazi[1], Mohammed Mansour Shaman Alenezi[1], Mohammed Ahmed Mohammed Asiri[1], Ibrahim Mohammed Ghibban[1], Ahmed Mansour Shaman Alenezi[1], Turki Saad Hamed Alsulaimani[2], Abhal Nasser Ali Alharthi[3], Inad Adel Alharbi[4], Muayad Anbarserri[5], Mansoura Rashed Alrashedi[6]

[1]Tabuk Health Cluster, King Abdullah Ibn Abdul Aziz Rd, 9291, Al Sa'adah, Tabuk 47914, Kingdom of Saudi Arabia.
[2] Makkah Health Cluster, King Faisal Hospital, Prince Majed Ibn Abd Al Aziz, 7451, Al Maabdah, Makkah 24236, Kingdom of Saudi Arabia.
[3]Bisha Health Affairs General Directorate, Al Nasim, Bisha 67841, Kingdom of Saudi Arabia.
[4]Qassim Health Cluster, Tarafiyyah Rd-6291, Buraydah 52367, Kingdom of Saudi Arabia.
[5]Riyadh First Health Cluster, North Wing, Gate D, Al Akaria Plaza, Riyadh 11622, Kingdom of Saudi Arabia.
[6]Hail Health Cluster, Hospitals and Health Care, Al Masif District, Hail-55471, Kingdom of Saudi Arabia.
*Corresponding author
E-mail: Dr.fares-as@hotmail.com (Dr. Fares Abdulaziz Alatawi)
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Abstract

Assisted reproductive technology (ART)-conceived children currently make up a sizable fraction of the population. It's critical to monitor these kids and determine if their dental risks are higher than those of naturally conceived (NC) kids. There has been a lot of effort in this sector in the last several years. The dental manifestations of ART-conceived infants,

including neonatal birth abnormalities, growth and physical health, as well as dental manifestations including attrition, periodontal inflammation, habit retention, etc., will be summarized in this study. The majority of children produced through ART are healthy. Since new ART approaches are being presented on a regular basis, it is imperative that children receiving ART be followed up with continuously. Today, there are more than 10 million infants born globally as a result of assisted reproductive technology (ART) and delivery rates continue to climb, accounting for up to 5.1% of US births and 7.9% of birth cohorts in Europe. Initially, a variety of drugs are utilized to stimulate ovulation throughout the ART procedure, gametes are gathered, and embryos are high amounts of progesterone are utilized to promote the luteal phase, and the cells are cultivated in an in vitro environment before being frozen and thawed. There is no information available on the prevalence of malocclusion between Naturally children conceived by Assisted Reproductive Technology. Despite the little number of research on the relationship between children conceived by Assisted Reproductive Technology and Dental Malocclusion. More thorough study is needed to fully understand this association, this article summarizes the information, theories and scant studies that are currently available on the subject.

Key words: Malocclusion, NC, ART, DAI, TMJ, ICMART, Periodontal, Inflammation.

Introduction

Occlusion, according to Angle, is the typical relationship between the teeth's occlusal inclined planes when the jaws are closed [1]. The location of the teeth with respect to the alveolar process's basal bone and the surrounding teeth and/or to the teeth across from them [2]. Malocclusion is the third most common oral illness, behind periodontal disease and dental caries. It is a health issue that has drawn a lot of attention [3]. Malocclusion is considered a public health issue due to its great occurrence, which may have a detrimental effect on patients' psychological wellness, social engagement, and quality of life [4]. Different psychosocial effects are associated with the same kind of malocclusion [5]. After tooth cavities, the World Health Organization now ranks malocclusions as the third most common oral health issue as well as gum diseases [6]. There

are several hypothesized etiological reasons for malocclusion [7]. In this case, the main causes are genetic, environmental, and ethnic variables. Genetics and malocclusion are strongly correlated because some forms of malocclusion, such Class III relationship, run in families [8]. The ethnic component works similarly; for instance, a bimaxillary protrusion is more common in African origin than in other ethnic groups [9]. Conversely, the process of functional adaptation to external stimuli influences the surrounding tissues, such as the soft tissue, bone, and dentition, and can lead to a variety of malocclusion issues [10]. Anomalies related to tooth size, shape, extra teeth, dental caries, and early loss of primary teeth are some of the dental arch-related causes of malocclusion [11]. An individual or population's degree and severity of malocclusion can be measured using indices like the Dental Aesthetic Index (DAI), the Index of Orthodontic Treatment Needs (IOTN) [12], or the Angles classification. The terminal plane relationship of the second molars in the primary dentition is noted in order to forecast potential future malocclusions [13].

Couples may consider IVF therapy for a number of reasons, including tubal pathology, infertility in males, endometriosis, and hormonal disruptions, aging mothers, genetic anomalies, and miscarried pregnancies repeatedly. Louise Brown is the first child born through in vitro fertilization. In 1978, she was born in England's Oldham General Hospital [12]. Lesley Brown, her mother, experienced obstruction in her fallopian tubes. But there is a danger associated with ART. The odds of having a kid with a birth defect such as genetic abnormalities, low birth weight, or preterm delivery are 1.8% greater than those of a naturally conceived child. Numerous investigations and research projects conducted all around the world have demonstrated the direct relationship between dental health and overall physical health. Nevertheless, Chronic periodontitis is widely recognized to be associated with type II diabetes, heart disease, low birth weight infants, preterm births, and low birth weight kids. More recently, it has also been connected to issues with men's and women's reproductive health and fertility [13]. Data show that various febrile illnesses and chronic infections that the expectant mother has are the cause of developmental defects like cleft palate and enamel hypoplasia. The fetus is constantly influenced by the stimuli the expectant mother exposes it to from the moment of conception until birth, a notable rate of failure for the different techniques.

The national health oral survey or individual studies are often used to evaluate the epidemiology of malocclusion, although recent systematic evaluations have been carried out among Chinese and Iranian children [14]. To give objective information to healthcare stakeholders and enable the allocation of healthcare resources based on objective epidemiological data, statistics on the prevalence of malocclusion and the total demand for orthodontic treatment are crucial in this context. Additionally, the training of dental and orthodontic healthcare professionals as well as the logical planning of every facet of orthodontic treatment depend heavily on this knowledge [15]. Data on the prevalence of malocclusion were gathered for the Third National Health and Nutrition Examination Survey (NHANES III), conducted in the United States between 1989 and 1994 [16]. Angle "normal occlusion" was found to be 30% prevalent, whereas Angle Class I, II, and III malocclusion was found to be 50–55%, 15%, and less than 1% prevalent [17]. There is no information available on the prevalence of malocclusion between Naturally children conceived by Assisted Reproductive Technology. Despite the little number of research on the relationship between children conceived by Assisted Reproductive Technology and Dental Malocclusion. More thorough study is needed to fully understand this association; this review article summarizes the information, theories, and scant studies that are currently available on the subject.

Assisted Reproductive Technology

ART stands for assisted reproductive technology and is a substitute method of getting pregnant. It is an infertility therapy. Examples include intrauterine insemination (IUI) and in-vitro fertilization (IVF) [18]. IVF is an assisted reproductive technique that involves fertilizing a woman's egg with a man's sperm in a lab dish [19]. Couples may choose to pursue IVF therapy for a number of reasons, including tubal pathology, infertility in males, endometriosis, hormonal imbalances, advanced maternal age, genetic disorders, and repeated miscarriages. Louise Brown is the first child born through in vitro fertilization. In 1978, she was born in England's Oldham General Hospital. Lesley Brown, her mother, experienced obstruction in her fallopian tubes [20]. Today, there are more than 10 million infants born globally as a result of assisted reproductive technology (ART) and delivery rates continue to climb, accounting for up to 5.1% of US births and 7.9% of birth cohorts in Europe [21]. Initially, a variety of drugs are utilized

to stimulate ovulation throughout the ART procedure, gametes are gathered, and embryos are high amounts of progesterone are utilized to promote the luteal phase, and the cells are cultivated in an in vitro environment before being frozen and thawed [22].

The gametes and embryos might be harmed by all of these artificial methods. Moreover, ICSI is a more intrusive method of fertilizing an egg than traditional IVF since it involves inserting one sperm directly into the ooplasm [23]. Additionally, ICSI circumvents natural selection at the oocyte membrane, allowing sperm with aberrant structures and genetic makeup to fertilize eggs that might carry genetic abnormalities in their progeny [24]. The majority of research has been on the dental health of couples using ART to conceive. According to certain research, infertility and periodontal disease are related. It was brought up. Compared to patients without periodontitis, patients with periodontal problems require longer to conceive [25]. An Indian study discovered that there was no discernible difference in enamel defects between infants conceived using IVF and those not. In addition, the same researchers looked at tooth attrition in NC and IVF offspring, but they couldn't find any appreciable differences [26].

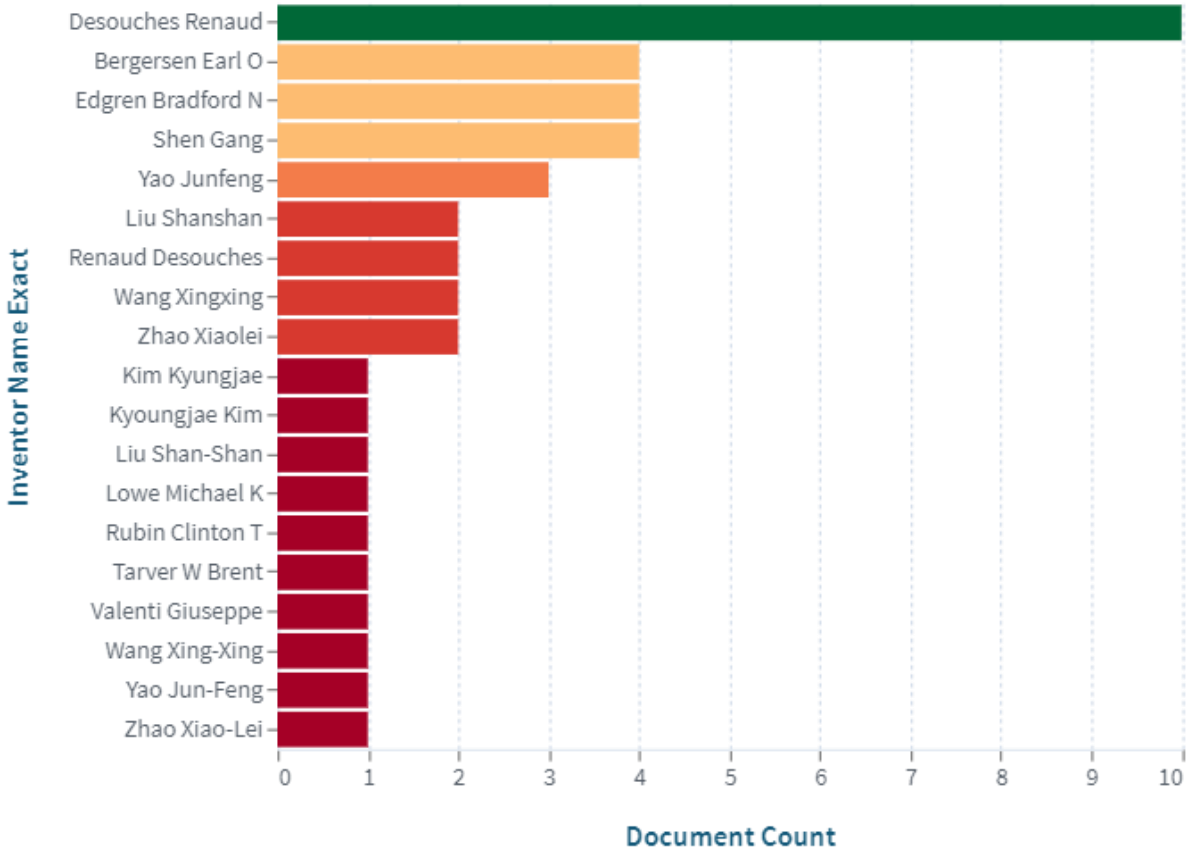

Figure 1: Shows citation rankings. The article authorised by Destouches Renaud et al, Bergersen et al. stood out as the top-ranked publication with the highest number of citations.

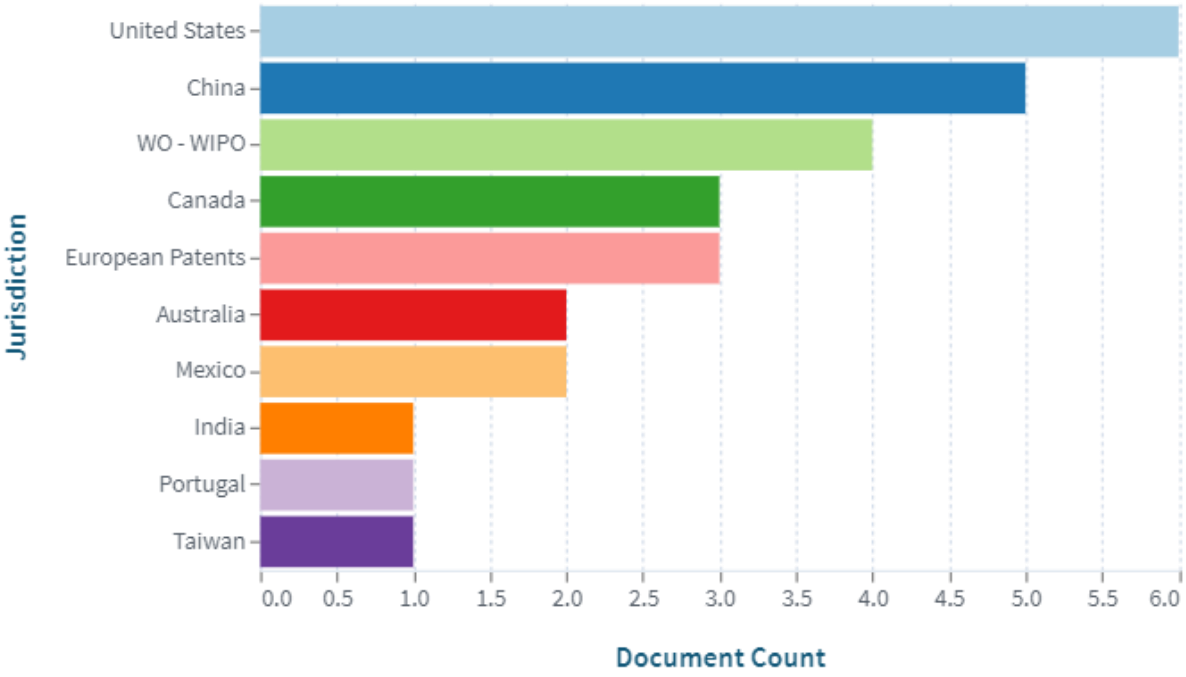

Figure 2: Shows the top 10 countries actively published documents on prevalence of Malocclusion between Naturally Conceived children and children conceived by Assisted Reproductive Technology. It is worth noting that United States has maximum number of publications.

Birth Defects

Additionally, a population-wide cohort research conducted in South Australia by Davies et al discovered a markedly higher incidence of birth abnormalities (8.3%) in those taking ART [27]. In contrast to 5.8% [17 546/302 811] of non-ART pregnancies (OR 1.47, 95% CI 1.33–1.62; multivariate-adjusted OR 1.28, 95% CI 1.16–1.41). Different findings are found in just one multi-centre large-scale research from China Yan et al, which included 15 405 ART children from seven locations [28]. The overall birth defect rate in this research was 1.23% (189/15 405), which did not differ statistically from the 1.35% rate in the Chinese population as a whole. While ART procedures are well-researched variables, some researchers think that infertility is a significant contributing factor to birth abnormalities by Zhu et al., 2006; Rimm et al., 2011 [29,30].

Growth, Physical and Psychological Health

Miles et al. (2007) discovered that, after adjusting for age and parental height, children conceived by IVF/ICSI and aged 5-7 years were noticeably taller than NC controls [31]. Many studies have been published about the physical health of children conceived by assisted reproductive technologies (ART) and Koivurova et al.'s study demonstrates that these children suffer from comparable childhood ailments [32]. ART children, however, may be more susceptible to childhood diseases, according to certain findings (Bonduelle et al; Källén et al.,) [33,34]. Furthermore, it appears that healthy children produced with ART have a higher chance of developing cardiovascular illnesses later in life (Ceelen et al) [35]. It was also discovered that, in comparison to age- and gender-matched controls, the 8–18-year-old children conceived by ART had greater blood pressure and lower fasting glucose levels [36]. I n a assessment of 9–18-year-olds' socioemotional functioning (mean age, 13.6 years) ART-conceived kids based on evaluations from instructors and parents. There were patterns that the parents and teachers of the ART-conceived group experienced, including a decrease in externalizing behaviors and an increase in withdrawn behaviors or depressed symptoms [36]. Nonetheless, the kids themselves did not notice any notable variations by Wagenaar et al. [37]. Reassuring findings are also seen in studies on children conceived by ICSI. When Leunes et al monitored the cognitive and motor development of 8–10-year-old children, they discovered comparable outcomes to those of NC youngsters [38].

Infertility and Periodontitis

Periodontitis is characterized as an inflammatory condition affecting the tissues that support teeth, brought on by certain bacteria or clusters of certain bacteria, leading to gingival recession, periodontal pocket development, or both, and gradual degradation of the periodontal ligament and alveolar bone [39]. Eighty-five percent of women conceive regularly within a year, whereas just 10-15% of women struggle with infertility. Women receiving ovulation induction and receiving infertility therapy had their gingival inflammation levels measured and compared to those of non-users of these medications. It was discovered that women who took ovulation induction drugs for more than three menstrual cycles had greater levels of gingival inflammation, bleeding, and GCF while having similar plaque levels. GCF is a fluid that has been investigated as a possible marker for the advancement of

periodontitis since it includes enzymes and products of tissue destruction [40].

Attrition and IVF

The term "tooth atrophy" refers to the progressive and consistent loss of tooth structure brought on by normal mastication [41]. Bernal et al Numerous clinical and epidemiologic studies have examined incisal and occlusal tooth wear. In the deciduous dentition of Belgian children, there was 21% tooth wear in the molars and 41% in the incisors [42]. Kaufman et al found that 55 IVF children and 56 spontaneously conceived youngsters in our research did not have any maxillary incisor agenesis. The sum of the percentages is 35.94 and 36.60. Regarding all groupings, there is no statistically significant difference in the proportion of spontaneously conceived children vs IVF children. Next, we look at mandibular molars. 93.46% of IVF children and 90.84% of spontaneously conceived children had Score 0, 5.22% and 7.84% had Score [43].

Dental Aesthetic Index (DAI)

The World Health Organization (WHO) recommends the Dental Aesthetic Index (DAI) as one of the best tools for assessing the frequency and severity of malocclusion [44]. Any culture or community must be aware of the prevalence of malocclusion in order to take the appropriate preventative, interceptive, and remedial action. This information also shows the full scope of the impending problem [45]. The DAI scores look at the occlusal features of a permanent dentition to assess the prevalence rates of various malocclusion types. 29.48% and 30.28% of DAI scores had 26–30 DAI scores with clear abnormalities or mild malocclusion requiring no or minimal orthodontic treatment. malocclusion needing elective orthodontic treatment, 12.74% and 15.14% had severe malocclusion with 31–35 DAI ratings that required highly desired orthodontic treatment, and 7.57% and 9.56% had very severe/handicapping malocclusion with ≥36 DAI values [46].

Dental Aesthetic Index and IVF Children

Out of all the characteristics of malocclusion, research revealed that crowding was the one that occurred most frequently. The findings of other research conducted in Spain [47] and New Zealand [48] revealed almost the same frequency. 1.6% of participants in Madras, South India,[49] had maxillary diastema. There was a median diastema in the instances, and

the findings are not statistically significant. Research from Nigeria [50], Malaysia [51], and New Zealand [52] revealed a greater frequency of midline diastema. The group of children conceived through IVF and spontaneous conception showed 29.48% and 38.24% of 0 mm anterior maxillary irregularity (significant statistically), 64.94% and 52.58% of 1-2 mm anterior maxillary irregularity (significant statistically), and 5.57% and 9.16% of ≥3 mm anterior maxillary irregularity, respectively. According to research conducted in Canada [53] and Saudi Arabia [20], among IVF and spontaneously conceived offspring, 82.07% and 85.25% of the sample displayed a 0–3 mm maxillary overjet (statistically nonsignificant), whereas 17.92% and 14.74% exhibited maxillary overjet of less than 4 mm (statistically nonsignificant) [54].

Table 1: Distribution of the Orthodontic Treatment Need of IVF Children according to the DAI Scores. According to DAI Scores, Scores less than 25 does not require treatment, scores between 26-30 requires elective treatment such as restorations, orthodontic treatment and implant surgery.

Sr. No.	DAI Scores	Treatment need	Severity Levels
1	≤25	No or slight need of treatment	Normal or minor
2	26-30	Elective treatment	Definite malocclusion
3	31-35	Treatment highly desirable	Severe malocclusion
4	≤36	Mandatory treatment	Very severe/ handicapping malocclusion

Table 2: Dental Aesthetic Index (DAI) parameters. The Dental Aesthetic Index (DAI), adopted by the World Health Organization, evaluates 10 occlusal characteristics: overjet, negative overjet, tooth loss, diastema, anterior open bite, anterior crowding, anterior diastema, width of the anterior irregularities (mandible and maxilla) and antero-posterior spring relationship.

Sr. No.	Parameter	Finding

1	Crowding in the anterior segment	0 – no segment crowded 1 – one segment crowded 2 – two segments crowded
2	Spacing in the incisal segment	0 1 2
3	Largest anterior irregularity in maxilla (mm)	0 1-2 =3
4	Largest anterior irregularity in mandible (mm)	0 1-2 =3
5	Anterior mandibular overjet (mm)	>0
6	Anterior open bite (mm)	>0
7	Antero posterior molar relation 0 – normal 1-1/2 cusp 2-one full cusp	>0

IVF Children and Developing Flaws in the Primary Dentition

Dental caries formation, dentinal sensitivity, dentofacial deformities, and cosmetic issues can all be predisposed by enamel developmental disorders [55]. The prevalence rates of enamel developmental abnormalities in these studies show a large deal of heterogeneity. When Kar et al [56] looked at D.D.E. in both the IVF and spontaneously conceived groups, they found no statistically significant difference in either group. The outcome could indicate that children born through IVF and children conceived naturally are similar. Additionally, it was discovered that the developmental abnormalities in the prevalence of enamel developmental abnormalities in IVF offspring was found to be 7.18%. Racial disparities and the variety of methodological approaches used might be the cause of the observed variances in the results [57].

IVF Children and Oral Habit

Hand sucking is among the most prevalent repeated behaviours throughout the infancy stage [58]. The behaviour is referred to as detrimental oral habit producing dentoalveolar

and/or skeletal deformation if it has an impact on the development of orofacial structure. Bhayya [59] reported that 38% of infants born spontaneously had an oral habit. Karl had corroborated this discovery. Furthermore, a statistically significant proportion of IVF offspring in his study had dental habits. Kar et al., [60] found that thumb sucking was much more common in kids born through IVF. Handkerchief biting was also shown to be considerably more common in IVF offspring in the same research. In his research, Onyeaso et al., [61] found that finger sucking was most common. Kar et al., [62] has also corroborated this result. The same study by Karl also discovered that there were greater cases of nail biting in IVF children.

IVF Children and Temporomandibular Joint Disorders

One of the most used and intricate joints in the human body is the TMJ [63]. It is thought to be a bi-condylar, very mobile, sensitive joint that performs many roles at once. Although it has long been believed that this joint (TMJ) dysfunction exclusively affects adults, several investigations have shown that youngsters can have the same frequency of signs and symptoms as adults [64]. The incidence of TMJ dysfunction in children and adolescents was shown to vary between 6% and 68% in several studies. Research found that the prevalence of symptoms in children associated with TMJ issues ranged from 22% to 68%. The IVF children showed the similar pattern, with 17.39%, 17.77%, and 32.60%, respectively [65].

Conclusion

This review found that comparing the dental state of ART children to that of NC children reveals a dearth of information. The information on future children's ART procedures which may or may not be connected to the children's oral health condition will be helpful to both future parents and medical professionals. This evaluation encourages the researcher to expand the scope of their longitudinal study by allowing for the inclusion of other criteria that might be used to collect data on a broader scale about IVF children. There is potential for a more thorough investigation with other criteria, which might aid the researcher in learning more about the oral health of IVF offspring. Based on such data, particular guidelines might be developed to stimulate and innovate future research in this uncharted area.

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Authors Contribution

All authors are contributing in the manuscript rough draft writing, revision and to prepare the final draft of manuscript and cross ponding authors is responsible for the concept generation of study design and its implementation.

Conflict of interest statement

Authors declare they do not have any conflict of interest.

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