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# Prevalence of malocclusion and orthodontic treatment needs among 12–15-year-old schoolchildren of fishermen of Kutch coast, Gujarat, India

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## ABSTRACT

***Background:*** *Malocclusion is one of the most common dental problems in mankind. Planning orthodontic treatment as well as an interceptive approach within a public health system requires information on the prevalence of malocclusions.*

***Aim:*** *The aim of the study was to assess the prevalence of malocclusion and orthodontic treatment needs among 12–15-year-old schoolchildren of fishermen of Kutch coast, Gujarat, India.*

***Materials and methods:*** *A cross-sectional descriptive survey was conducted among 947 schoolchildren of fishermen of Kutch coast, Gujarat, India aged 12–15 years. The prevalence of malocclusion and orthodontic treatment needs was assessed using Dental Aesthetic Index. General information on demographic data was also recorded. A $\chi^2$ test, analysis of variance (ANOVA) and Sheffe's test were employed for statistical analysis.*

***Results:*** *Malocclusion and orthodontic treatment need was reported among 33.4% of the participants. Younger age group and female gender had significantly greater treatment need. Males and older age groups had significantly lesser prevalence of anterior crowding and largest anterior maxillary irregularity.*

***Conclusions:*** *Orthodontic treatment need among 33.4% calls for developing school based oral health promotion programmes for children with an inculcation of orthodontic treatment and educational programmes for parents (fishermen) addressing prevention and early interceptive treatment of malocclusion.*

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**Key words: child, fishermen, India, malocclusion, prevalence**

## INTRODUCTION

Occlusion is the relationship among all the components of masticatory system in their function, parafunction and dysfunction, whereas occlusion that is aesthetically and functionally not acceptable is referred to as malocclusion [1], in other terms, defined as an irregularity of the teeth or a malrelationship of the dental arches beyond the range of what is accepted as normal [2]. It is a manifestation of

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normal biological variability and is a continuum ranging from an ideal occlusion to considerable deviation from normal [3]. Moreover, it is not a single entity, but rather a collection of situations, each in itself constituting a problem [4]. The World Health Organisation (WHO) (1987) had included malocclusion under the heading of Handicapping Dentofacial Anomaly, defined as an anomaly which causes disfigurement or which impedes function, and requiring treatment "if the disfigurement or functional defect was likely to be an obstacle to the patient's physical or emotional well-being" [5].

Malocclusion does not pose a risk to life, however its implications mandates the need for treatment [6]. There is an increase in susceptibility to other diseases like periodontal disease and trauma, in addition to hampered oral functions like mastication, swallowing, and speech. A number of studies have demonstrated its impact on quality of life [7–9].

Since the early 1990's, when orthodontics became a recognised specialty of dental profession, much has been written on the incidence and/or prevalence of malocclusion in the different populations. A large number of studies depicting an anecdotal prevalence of malocclusion have been published [10].

Literature [11, 12] has revealed that the parent's occupation, directly or indirectly, influences child's oral health. Fishermen's children face prolonged working hours of parents who remain isolated from families for long period of time due to their occupation. This makes fishermen's children a vulnerable target population for oral health. Moreover, determination of malocclusion in childhood can facilitate prevention and furthermore, this knowledge might help to minimise or eliminate future treatment need. To the best of our knowledge, there are no studies in the literature reporting the prevalence of malocclusion among fishermen's children. Hence, this study was taken up to assess the prevalence of malocclusion and orthodontic treatment needs among 12–15-year-old schoolchildren of fishermen of Kutch coast, Gujarat, India.

## MATERIALS AND METHODS

### STUDY DESIGN AND STUDY POPULATION

A cross sectional descriptive survey was conducted from January 2010 to March 2011 among 12–15 year-old schoolchildren (whose parents were fishermen) of Udaipur, India. Children with mixed dentition, craniofacial anomalies (clefts and syndromes) and who were undergoing or had a history of orthodontic treatment were excluded.

### OFFICIAL PERMISSION, ETHICAL CLEARANCE AND INFORMED CONSENT

The study protocol was reviewed by the Institutional Review Board and was granted ethical clearance. An official permission was obtained from the District Education Officer, District Education Office [Primary and middle; Secondary], Kutch. A written informed consent was obtained from the parents of all the children who fulfilled the eligibility criteria and were willing to participate in the survey.

### TRAINING AND CALIBRATION (RELIABILITY OF THE INDEX USED)

Before the commencement of the study, training and intra examiner calibration was done on 20 schoolchildren in the Department of Public Health Dentistry, Pacific Dental College and Hospital. The intra examiner reliability for Dental Aesthetic Index (DAI) was assessed using Kappa statistics, which was found to be 90%.

### VALIDITY OF THE INDEX USED

The gold standard of orthodontic treatment need was determined by 3 professors who are experts in the area of orthodontics with at least 10 years of clinical experience. They examined the 20 schoolchildren separately. Each children was coded as "no need for orthodontic treatment", "elective orthodontic treatment" or "orthodontic treatment required" based on the clinical evaluation of each one. Where there was disagreement in the assessment by the professors, there was a discussion to reach a consensus.

The DAI scores and degrees of treatment need as determined by the examiner on the same 20 schoolchildren were regrouped in a dichotomous manner as follows: "without treatment needs" and "in need of treatment". The DAI scores were dichotomised as "no need for treatment" (DAI < 25) and "in need of treatment" (DAI > 25). In the same way, the gold standard evaluation was dichotomised as follows: "without treatment needs" and "in need of treatment". The latter category included "elective orthodontic treatment" and "orthodontic treatment required".

### PROFORMA DETAILS

A survey proforma designed with the help of WHO Oral Health Assessment form (1997) [13] consisted of two sections: (1) General information: demographic data including name, age, gender and name and address of the school; (2) Clinical parameter: DAI [13].

### PILOT SURVEY

A pilot study was carried out among 70 children, 12–15-year-old children from 2 schools to determine the feasibility of the study. Depending on the prevalence of malocclusion obtained (30%), 95% confidence level and 10% allowable error, the minimum sample size was determined to be 933.

### SAMPLING DESIGN

Multi-stage random sampling was employed to select the study population. Kutch coast is divided into 4 zones. From

each zone, one district was randomly selected and from each selected district, 2 villages were randomly selected. All the 12–15-year-old children (whose parents were fishermen) in all the schools of selected villages were included in the study.

## METHODOLOGY

Data was collected by single examiner. The examiner visited the schools on predetermined dates according to schedule. Eligible children were identified as per above specified sampling design and given informed consent forms to get them signed from their parents/guardians who were also notified by the school teachers on request of the investigator. A total of 947 subjects aged 12–15 years, whose parent/guardians had given a written informed consent, were examined. The general information and the clinical examination findings were recorded. The examination for malocclusion was made according to the DAI as described in WHO Oral Health Survey Basic Methods (1997) [13]. To reduce the examiner's bias (diagnostic criteria maintenance), duplicate examination was conducted on 5% (n = 45) of the population during the course of the study. There were 3 differences in the DAI where the error was 1 mm in all of them, resulting in error rate of 0.7462%, which was disregarded (error smaller than 1.00%).

## STATISTICAL ANALYSIS

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 11.5 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations. The $\chi^2$ was used for comparisons of malocclusion prevalence between different age and gender groups. Analysis of variance (ANOVA) along with Scheffe's test was used for comparison of mean DAI scores between the various age groups and the changes in DAI scores. 't' test was used for comparing the mean DAI scores between gender groups. For all tests, confidence interval and p-value were set at 95% and ≤ 0.05 respectively.

**Table 1.** Distribution of study subjects by age and gender

| Age [years] | Gender | | Total |
|---|---|---|---|
| | Male | Female | |
| 12 | 134 (14.1%) | 109 (11.5%) | 243 (25.7%) |
| 13 | 130 (13.6%) | 109 (11.5%) | 239 (25.2%) |
| 14 | 129 (13.6%) | 103 (10.9%) | 232 (24.5%) |
| 15 | 133 (14.1%) | 100 (10.6%) | 233 (24.6%) |
| Total | 526 (55.6%) | 421 (44.4%) | 947 (100%) |

# RESULTS

## DISTRIBUTION OF STUDY SUBJECTS

A total of 957 children, 526 (54.9%) males and 421 (45.1%) females, participated in the survey (Table 1).

## DISTRIBUTION OF DAI COMPONENTS BY AGE AND GENDER

The proportion of children with crowding was significantly highest among 12 years age group (p = 0.000). A significant association (p = 0.000) of incisal segment crowding with gender was revealed with males portraying a greater prevalence of 1 segment (31.7%) and 2 segments crowding (18.5%) than females: 1 (18.4%) segment crowding, 2 (9.2%) segments crowding. More than half of the children (54.2%) showed no maxillary irregularity. Only 6.4% had largest anterior maxillary irregularity of ≥ 3 mm. Statistically significant differences among the age groups (p = 0.000) showed a declining pattern of irregularity from 12 years towards 15 years. A significantly higher proportion of males revealed largest anterior maxillary irregularity with the distribution of 45.4% and 7.9% children among 1–2 mm and ≥ 3 mm irregularity groups, respectively (p = 0.000). Females exhibited 31.7% and 4.6% children with 1–2 mm and ≥ 3 mm irregularity, respectively. A little more than one fourth of the study population exhibited mandibular irregularity with 27.4% and 0.9% children falling in the groups of 1–2 mm and ≥ 3 mm largest anterior mandibular irregularity, respectively. Out of total 887 study subjects, majority (49%) possessed anterior maxillary overjet between 2 to 3 mm. Anterior mandibular overjet was evident in only 2.1% of the total children examined. Open bite was ostensible in 2.5% of the total children. Among all, 86.1% had normal molar relation, 7.1% had half cusp deviation and 6.8% had full cusp deviation (Tables 2, 3).

## DISTRIBUTION OF DAI SCORES BY AGE AND GENDER

The overall mean DAI score of the study population was 22.06 ± 5.623 which kept reducing significantly by age (p = 0.000) with a score of 23.47 ± 5.624, 22.62 ± 5.669, 21.76 ± 5.511 and 20.32 ± 5.216 among 12-, 13-, 14- and 15-years age group, respectively. Females portrayed a significantly lower mean DAI score (20.99 ± 5.355) than males (22.91 ± 5.689) with p = 0.000 (Table 4).

Table 5 explains a significant difference in the DAI score and orthodontic treatment needs among the study population by age (p = 0.039) and gender (p = 0.000). Of the whole population, 33.3% subjects had malocclusion and required orthodontic treatment. Age wise distribution showed a statistically significant decrease (p = 0.039) in the severity of DAI score from 12 to 15 years age group. Signi-

**Table 2.** Distribution of Dental Aesthetic Index (DAI) components among study subjects by gender

| DAI components | Males (n = 526) | Females (n = 421) | Total (n = 947) | P |
|---|---|---|---|---|
| **Missing anterior teeth (total)** | 54 (10.3%) | 39 (9.3%) | 93 (10.5%) | 0.168 |
| No teeth missing | 472 (89.7%) | 382 (90.7%) | 854 (89.5%) | |
| One teeth missing | 18 (3.4%) | 7 (1.7%) | 25 (2.8%) | |
| Two teeth missing | 35 (6.7%) | 32 (7.6%) | 67 (7.6%) | |
| Three teeth missing | 1 (0.2%) | 0 (0%) | 1 (0.1%) | |
| **Incisal segment crowding (total)** | 259 (49.2%) | 128 (30.4%) | 387 (40.2%) | 0.003* |
| No crowding | 267 (50.8%) | 293 (69.6%) | 560 (59.8%) | |
| One segment | 162 (30.8%) | 82 (19.5%) | 244 (25.8%) | |
| Two segment | 97 (18.4%) | 46 (10.9%) | 143 (14.4%) | |
| **Incisal segment spacing (total)** | 160 (30.4%) | 106 (25.2%) | 266 (27.1%) | 0.12 |
| No spacing | 366 (69.6%) | 315 (74.8%) | 681 (72.8%) | |
| One segment | 124 (23.6%) | 80 (19%) | 204 (21.6%) | |
| Two segment | 36 (6.8%) | 26 (6.2%) | 62 (5.5%) | |
| **Midline diastema (total)** | 126 (23.9%) | 30 (7.1%) | 156 (15.3%) | 0.22 |
| No diastema | 400 (76%) | 391 (92.9%) | 791 (84.7%) | |
| 1 mm | 66 (12.5%) | 15 (3.6%) | 81 (8.2%) | |
| 2 mm | 35 (6.6%) | 6 (1.4%) | 41 (4.2%) | |
| 3 mm | 25 (4.7%) | 9 (2.1%) | 34 (2.9%) | |
| **Largest anterior maxillary irregularity (total)** | 284 (53.9%) | 152 (36.1%) | 436 (45.7%) | 0.05* |
| No irregularity | 242 (46%) | 269 (63.9%) | 511 (54.2%) | |
| 1–2 mm | 235 (44.7%) | 129 (30.6%) | 364 (39.3%) | |
| ≥ 3 mm | 49 (9.3%) | 23 (5.5%) | 72 (6.4%) | |
| **Largest anterior mandibular irregularity (total)** | 161 (30.6%) | 105 (24.9%) | 266 (28.3%) | 0.06 |
| No irregularity | 365 (69.4%) | 316 (75.1%) | 681 (71.7%) | |
| 1–2 mm | 150 (28.5%) | 101 (23.9%) | 251 (27.4%) | |
| ≥ 3 mm | 11 (2.1%) | 4 (0.9%) | 15 (0.9%) | |
| **Anterior maxillary overjet** | | | | 0.124 |
| 0 mm | 13 (2.5%) | 7 (1.6%) | 20 (1.4%) | |
| 1 mm | 188 (35.7%) | 140 (33.3%) | 328 (36.1%) | |
| 2–3 mm | 250 (47.5%) | 220 (52.3%) | 470 (49%) | |
| ≥ 4 mm | 70 (13.3%) | 52 (12.4%) | 122 (12.7%) | |
| **Anterior mandibular overjet** | | | | 0.42 |
| 0 mm | 513 (97.5%) | 415 (98.5%) | 928 (97.9%) | |
| ≥ 1 mm | 13 (2.5%) | 6 (1.5%) | 19 (2.1%) | |
| **Vertical anterior openbite** | | | | 0.98 |
| 0 mm | 514 (97.7%) | 411 (97.6%) | 925 (97.7%) | |
| ≥ 1 mm | 12 (2.3%) | 10 (2.4%) | 22 (2.3%) | |
| **Anteroposterior molar relation (total: half + full cusp)** | 81 (15.4%) | 56 (13.3%) | 137 (14.4%) | 0.65 |
| Normal | 445 (84%) | 365 (86.7%) | 810 (85.5%) | |
| Half cusp | 43 (8.2%) | 26 (6.2%) | 69 (7.3%) | |
| Full cusp | 38 (7.2%) | 30 (7.1%) | 68 (7.2%) | |

Test used: $\chi^2$ (*p ≤ 0.05)

**Table 3.** Distribution of Dental Aesthetic Index (DAI) components among study subjects by age

| DAI components | 12 years (n = 243) | 13 years (n = 239) | 14 years (n = 232) | 15 years (n = 233) | Total (n = 947) | P |
|---|---|---|---|---|---|---|
| **Missing anterior teeth (total)** | 39 (16.1%) | 33 (13.8%) | 24 (10.3%) | 17 (7.3%) | 113 (11.9%) | 0.023 |
| No teeth missing | 204 (83.9%) | 206 (86.2%) | 208 (89.7%) | 216 (92.7%) | 834 (88.1%) | |
| One teeth missing | 13 (5.3%) | 10 (4.2%) | 6 (2.6%) | 8 (3.4%) | 37 (3.9%) | |
| Two teeth missing | 26 (10.7%) | 22 (9.2%) | 18 (7.8%) | 9 (3.9%) | 75 (7.9%) | |
| Three teeth missing | 0 (0%) | 1 (0.4%) | 0 (0%) | 0 (0%) | 1 (0.1%) | |
| **Incisal segment crowding (total)** | 118 (48.5%) | 111 (46.4%) | 91 (39.2%) | 57 (24.5%) | 377 (39.8%) | 0.04* |
| No crowding | 125 (51.4%) | 128 (53.6%) | 141 (60.8%) | 176 (75.5%) | 570 (60.2%) | |
| One segment | 75 (30.8%) | 64 (26.8%) | 62 (26.7%) | 40 (17.2%) | 241 (25.4%) | |
| Two segment | 43 (17.7%) | 47 (19.6%) | 29 (12.5%) | 17 (7.3%) | 136 (14.4%) | |
| **Incisal segment spacing (total)** | 78 (32.1%) | 71 (29.7%) | 57 (24.6%) | 55 (23.6%) | 261 (27.5%) | 0.41 |
| No spacing | 165 (67.9%) | 168 (70.3%) | 175 (75.4%) | 178 (76.4%) | 686 (72.4%) | |
| One segment | 61 (25.1%) | 54 (22.6%) | 44 (18.9%) | 45 (19.3%) | 204 (21.5%) | |
| Two segment | 17 (6.9%) | 17 (7.1%) | 13 (5.6%) | 10 (4.3%) | 57 (6.0%) | |
| **Midline diastema (total)** | 46 (18.9%) | 43 (17.9%) | 39 (16.8%) | 28 (12.0%) | 156 (16.5%) | 0.667 |
| No diastema | 197 (81.1%) | 196 (82%) | 193 (83.2%) | 205 (87.9%) | 791 (83.5%) | |
| 1 mm | 23 (9.7%) | 24 (10.0%) | 22 (9.4%) | 12 (5.2%) | 81 (8.6%) | |
| 2 mm | 16 (6.5%) | 10 (4.2%) | 8 (3.4%) | 11 (4.7%) | 45 (4.8%) | |
| 3 mm | 7 (2.9%) | 9 (3.8%) | 9 (3.9%) | 5 (2.1%) | 30 (3.2%) | |
| **Largest anterior maxillary irregularity (total)** | 145 (59.7%) | 121 (50.6%) | 102 (43.9%) | 58 (24.9%) | 426 (44.9%) | 0.034* |
| No irregularity | 98 (40.3%) | 118 (49.4%) | 130 (56.0%) | 175 (75.4%) | 521 (55.0%) | |
| 1–2 mm | 122 (50.2%) | 107 (44.8%) | 86 (37.1%) | 46 (19.8%) | 361 (38.1%) | |
| ≥ 3 mm | 23 (9.5%) | 14 (5.9%) | 16 (6.9%) | 12 (5.2%) | 65 (6.9%) | |
| **Largest anterior mandibular irregularity (total)** | 70 (28.8%) | 73 (30.5%) | 62 (26.7%) | 56 (24.0%) | 261 (27.6%) | 0.78 |
| No irregularity | 173 (71.2%) | 166 (69.5%) | 170 (73.3%) | 177 (75.9%) | 686 (72.4%) | |
| 1–2 mm | 70 (28.8%) | 69 (28.9%) | 58 (25%) | 53 (22.7%) | 250 (26.4%) | |
| ≥ 3 mm | 0 (0%) | 4 (1.7%) | 4 (1.7%) | 3 (1.3%) | 11 (1.2%) | |
| **Anterior maxillary overjet** | | | | | | 0.323 |
| 0 mm | 2 (0.8%) | 4 (1.7%) | 1 (0.4%) | 5 (21.4%) | 12 (1.3%) | |
| 1 mm | 83 (34.2%) | 80 (33.5%) | 80 (34.5%) | 88 (37.8%) | 331 (34.9%) | |
| 2–3 mm | 121 (49.8%) | 125 (13.2%) | 124 (53.4%) | 105 (45.1%) | 475 (50.2%) | |
| ≥ 4 mm | 35 (14.4%) | 26 (10.9%) | 26 (11.2%) | 34 (14.6%) | 121 (12.8%) | |
| **Anterior mandibular overjet** | | | | | | 0.67 |
| 0 mm | 235 (96.7%) | 228 (95.4%) | 227 (97.8%) | 226 (96.9%) | 916 (96.7%) | |
| ≥ 1 mm | 8 (3.3%) | 11 (4.6%) | 5 (2.2%) | 7 (3.0%) | 31 (3.3%) | |
| **Vertical anterior openbite** | | | | | | 0.976 |
| 0 mm | 233 (95.9%) | 229 (95.8%) | 226 (97.4%) | 225 (96.6%) | 913 (96.4%) | |
| ≥ 1 mm | 10 (4.1%) | 10 (4.2%) | 6 (2.6%) | 8 (3.4%) | 34 (3.6%) | |
| **Anteroposterior molar relation (total: half + full cusp)** | 35 (14.4%) | 40 (16.7%) | 41 (17.7%) | 31 (13.3%) | 147 (15.5%) | 0.68 |
| Normal | 208 (85.6%) | 199 (83.2%) | 191 (82.3%) | 202 (86.7%) | 800 (84.5%) | |
| Half cusp | 17 (6.9%) | 18 (7.5%) | 24 (10.3%) | 16 (6.9%) | 75 (7.9%) | |
| Full cusp | 18 (7.4%) | 22 (9.2%) | 17 (7.3%) | 15 (6.4%) | 72 (7.6%) | |

Test used: $\chi^2$ test (*p ≤ 0.05)

**Table 4.** Mean Dental Aesthetic Index (DAI) score among study subjects by age and gender

| Age [years] | Gender | Mean DAI score ± standard deviation |
|---|---|---|
| 12 | Male 134 (14.1%) | 25.1 ± 4.51 |
| | Female 109 (11.5%) | 21.9 ± 4.82 |
| | Total 243 (25.7%) | 23.51 ± 4.66 |
| 13 | Male 130 (13.6%) | 22.21 ± 5.88 |
| | Female 109 (11.5%) | 21.87 ± 4.9 |
| | Total 239 (25.2%) | 22.99 ± 5.4 |
| 14 | Male 129 (13.6%) | 21.16 ± 6.77 |
| | Female 103 (10.9%) | 21.11 ± 5.11 |
| | Total 232 (24.5%) | 21.82 ± 5.89 |
| 15 | Male 133 (14.1%) | 20.93 ± 6.89 |
| | Female 100 (10.6%) | 18.99 ± 3.44 |
| | Total 233 (24.6%) | 19.94 ± 5.11 |
| Total | Male 526 (55.6%) | 22.89 ± 5.48 |
| | Female 421 (44.4%) | 20.78 ± 4.53 |
| | Total 947 (100%) | 22.15 ± 6.23 |

Tests used: One way ANOVA, Post hoc Scheffe's test, t-test

One way ANOVA: p = 0.000 (for age comparison)

Post hoc Scheffe's test: 12 vs. 14*, 12 vs. 15*, 13 vs. 15* (*p < 0.05)

t-test: p = 0.000 (for gender comparison)

ficant variance (p = 0.000) by gender was also ascertained with higher percentage of male children unfolding definite malocclusion requiring elective treatment 29.6%, severe malocclusion requiring highly desirable treatment (6.7%) and very severe or handicapping malocclusion requiring mandatory orthodontic treatment than females. Elective treatment need: 19.9%, highly desirable treatment need: 6.1% and mandatory orthodontic treatment need: 0.3%.

## DISCUSSION

The present cross sectional descriptive study was conducted to assess the prevalence of malocclusion and orthodontic treatment needs among 12–15-year-old schoolchildren of fishermen of Kutch coast, Gujarat, India using DAI. The study covered an age group in which orthodontic clinics are most sought after due to the emergence of clinical situations that involve alterations in the arches and faces. This is a period when many professional interventions can be made, leading to numerous benefits for these individuals [14].

Search of literature revealed no studies on the prevalence of malocclusion among schoolchildren of fishermen. Hence the comparisons are made with other populations.

One or more missing anterior teeth were evident among 11.9% of the study population which is higher than those reported in other studies among Spanish and Nigerian [15, 16] schoolchildren. Furthermore, in the present study 38.9% of children presented crowding of teeth which is higher than that evidenced among Brazilian and Tanzanian schoolchildren [2, 17]. Age related decrease in crowding portrayed in the present study confirms the findings of previous studies [18, 19]. Females had lower prevalence of crowding than males in the present study. This finding corroborates the results obtained by Danaei et al. (2007) [20] and Rwakatema et al. (2007) [21]. Prevalence of spacing and midline diastema in the present study was almost double than that observed among 13–15-year-old North Jordanian children [22]. The next parameter under space is the largest anterior maxillary irregularity which may occur with or without crowding. More than 3 mm largest anterior maxillary irregularity was conferred among 6.4% of the study participants which is greater than those obtained by Esa et al. [23] and Rwakatema et al. [21] in 2001 and 2007, respectively. An increase in frequency of maxillary irregularity showed a significant increase with age in the present study as reported by Estioko et al. (1994) [24]. Males were affected more by maxillary irregularity than females which is analogous to findings among Iranians [20]. The prevalence of largest anterior mandibular irregularity and increased overjet coincided with previous literature [16, 22]. Proportion of subjects with anterior mandibular overjet (3.3%) in the present study was higher than other studies [23, 25]. In the present study, 3.6% of schoolchildren of fishermen presented with vertical anterior openbite which were observed to be higher than that reported by Hill (1992) [25] among Glasgow children and Esa et al. (2001) [23] among Malaysians. Deviations from normal relation were observed in 15.5% of the subjects which was higher than previous studies [26, 27].

The present study population portrayed a greater orthodontic treatment need (33.4%) than that observed among 12–18-year-old Brazilians [19], 12–15-year-old Iranians [20], 12–15-year-old [27] and 12–14-year-old [28] South Indian populations. It could be attributed to the high level of premature tooth extractions in children, no concern being shown for the maintenance of space, and to extensive untreated caries lesions [29] of schoolchildren of fishermen. This in turn may be due to the prolonged working hours of fishermen, lower socioeconomic status and lower level of literacy. Another reason of high prevalence of malocclusion in the present study as compared to other populations may be the consanguineous marriage practice among the fishermen population which might lead to various craniofacial abnormalities [30].

Age related decrease in mean DAI scores and orthodontic treatment need demonstrated in the present study is analogous to that observed among Victorians [24].

**Table 5.** Dental Aesthetic Index (DAI) scores and orthodontic treatment needs among study subjects by age and gender

| Age [years] | Gender | DAI score and orthodontic treatment needs | | | | |
|---|---|---|---|---|---|---|
| | | No abnormality or minor malocclusion | Definite malocclusion | Severe malocclusion | Very severe or handicapping malocclusion | Total |
| | | No/slight need | Elective treatment | Highly desirable | Mandatory treatment | |
| 12 | Male 134 (14.1%) | 75 (55.9%) | 37 (27.6%) | 16 (11.9%) | 6 (4.5%) | 59 (44.0%) |
| | Female 109 (11.5%) | 68 (62.4%) | 32 (29.4%) | 6 (5.5%) | 3 (2.8%) | 41 (37.6%) |
| | Total 243 (25.7%) | 143 (58.8%) | 69 (28.4%) | 22 (9.1%) | 9 (3.7%) | 100 (41.2%) |
| 13 | Male 130 (13.6%) | 80 (61.5%) | 41 (31.5%) | 5 (3.8%) | 4 (3.1%) | 50 (38.5%) |
| | Female 109 (11.5%) | 77 (70.6%) | 21 (19.3%) | 11 (10.1%) | 0 (0%) | 32 (29.4%) |
| | Total 239 (25.2%) | 157 (65.7%) | 62 (25.9%) | 16 (6.7%) | 4 (1.7%) | 82 (34.3%) |
| 14 | Male 129 (13.6%) | 82 (63.5%) | 33 (25.6%) | 8 (6.2%) | 6 (4.7%) | 47 (36.4%) |
| | Female 103 (10.9%) | 80 (77.7%) | 18 (17.4%) | 5 (4.9%) | 0 (0%) | 23 (22.3%) |
| | Total 232 (24.5%) | 162 (69.8%) | 51 (21.9%) | 13 (5.6%) | 6 (2.6%) | 70 (30.2%) |
| 15 | Male 133 (14.1%) | 89 (66.9%) | 40 (30.1%) | 4 (3%) | 0 (0%) | 44 (33.1%) |
| | Female 100 (10.6%) | 80 (80%) | 14 (14%) | 6 (6%) | 0 (0%) | 20 (20%) |
| | Total 233 (24.6%) | 169 (72.5%) | 54 (23.2%) | 10 (4.3%) | 0 (0%) | 64 (27.8%) |
| Total | Male 526 (55.6%) | 326 (61.9%) | 151 (28.7%) | 33 (6.3%) | 16 (3.0%) | 200 (38.0%) |
| | Female 421 (44.4%) | 305 (72.4%) | 85 (20.2%) | 28 (6.7%) | 3 (0.7%) | 116 (27.6%) |
| | Total 947 (100%) | 631 (66.6%) | 236 (24.9%) | 61 (6.4%) | 19 (2.0%) | 316 (33.4%) |

Test used: $\chi^2$ test, p-value for age group = 0.048, p-value for gender groups = 0.000

According to Knutson a plausible explanation to this could be that the temporary malocclusions are corrected with age because the child outgrows deforming habits and dental relationships are returned to normal [24].

The present study depicted a higher demand for orthodontic treatment among males than females implying that there are more girls than boys with a normal occlusion which is in conformity with the results obtained for 12–15-year-old Iranians [20] and 12-year-old South Africans [31]. The reason for this is not understood, but it might be related to the fact that male growth starts later and does not reach maximum at the age range of the study population [32]. Besides, due to aesthetic reasons girls show a greater interest in orthodontic correction than boys and in present study, population undergoing orthodontic treatment or who have already undergone orthodontic treatment had been excluded which may account for lesser treatment need among females.

The present epidemiological survey assessed the orthodontic treatment priorities among schoolchildren of fishermen and is the first study of its kind. This necessitates more extensive multicentre surveys involving larger sample from the rural and urban areas of India and abroad to provide a better baseline for this vulnerable population. Specific aspects such as distribution of dental professionals and adaptation of available human and material resources will require further studies.

## CONCLUSIONS

The prevalence of malocclusion and orthodontic treatment needs among schoolchildren of fishermen of Kutch coast, Gujarat India was found to be 33.4%. The prevalence was greater among older than younger children and also among males than females. Further studies in different geographic areas are warranted. Manpower and resource considerations, available and required, needs further research. Based on the results, following recommendations can be given:

— Considering the environmental aspects implicated in the institution of malocclusion, some of which can be prevented, such as prolonged retention or premature loss of deciduous teeth and prolonged oral habits; intensification of dental health education of schoolchildren and their parents increasing awareness concentrating on preventive aspects and routine dental check-ups is strongly recommended which may help to avoid the need for costly treatments in the future. Moreover, steps should first be taken to educate the population on the

benefits of interception before a community screening programme could make a worthwhile contribution to satisfying the treatment needs of the community.

— Preventive and interceptive orthodontic programs must be implemented early, with the goal of keeping the balance of orofacial development and/or re-establishing the normality of growth patterns.

— Comprehensive orthodontic services delivering appropriate and efficient treatment to meet the treatment needs are desirable.

— Subsidised dental care by Government would encourage uptake of orthodontic services in the community and financial assistance from Non-Governmental Organisations may help in the provision of services to the needy population.

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