Original Article

A study on the evaluation of bite force, prosthetic and nutritional status in adult cleft patients in Kolkata

Alak Kumar Bera, Samiran Das, Jayanta Bhattacharyya, Sayan Majumdar, Saumitra Ghosh, Preeti Goel

Department of Prosthodontics and Crown and Bridge, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India

Abstract

Context: Altered orofacial morphology and poor dental status affects the dietary intake of cleft patient, making susceptible to nutritional imbalance. Oral health care planning for this population is impossible without the evaluation of stomatognathic functional status as well as prosthetic and nutritional status and need.

Aims: The aim of this study was to evaluate prosthetic status and prosthetic treatment need, bite force and nutritional status, in adult cleft patients and to compare them with the adult noncleft population of similar definition.

Settings and Design: Cleft ($n = 250$) and noncleft ($n = 250$) individuals of either sex, aged 18 years or above, excluding severe medically compromised and differently abled, were examined and individual biteforce was measured after obtaining written consent and ethical clearance from the two institutions in Kolkata.

Subjects and Methods: A "raw data sheet" was prepared according to the parameters of the "Oral Health Surveys: Basic methods," World Health Organization (1997) for evaluation of prosthetic status and need, dentition status and Mini-Nutritional Assessment, Nestlé (1994) for the evaluation nutritional status. A Gnathodynamometer was used to record bite force.

Statistical Analysis Used: Statistical analysis was performed using SPSS 20.0.1, Graph Pad Prism version 5, Student's *t*-test, and Chi-square test.

Results: The mean bite force of frontal area in cleft group (3.4356 ± 0.9457 kgf) was found to be significantly lower ($P < 0.0001$) than in noncleft (22.8749 ± 5.3644 kgf) group. The difference of mean bite force in the right side (2.4576 ± 0.6131 kgf) and left side (1.2708 ± 0.1036 kgf) in cleft group was found to be statistically significant ($P < 0.0001$). Prosthetic need in maxillary arch was found to be significantly (χ^2: 490.0000; $P < 0.0001$) higher in cleft than in noncleft group. Nutritional status was observed to be significantly (χ^2: 179.4049; $P < 0.0001$) higher "at risk" in cleft than in noncleft group.

Conclusions: Lack of adequate Government concern leading to significantly higher prosthetic need and lower prosthetic status, hence lower bite force resulting lower nutritional status in adult cleft patients in Kolkata.

Keywords: Adult cleft lip and palate, bite force, gnathodynamometer, nutritional status, prosthetic status and need

Address for correspondence: Dr. Alak Kumar Bera, Department of Prosthodontics and Crown and Bridge, Guru Nanak Institute of Dental Sciences Research, Panihati, Kolkata - 700 114, West Bengal, India.
E-mail: dra_bera@yahoo.com

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INTRODUCTION

Cleft of the lip and palate are commonly encountered congenital anomalies and often result in severe functional deficiency on the patient's chewing ability, appearance, and ability to speak.[1] It is estimated that between 28,000 and 35,000 children are born with clefts in India each year, or about 1 out of every 500–800 live births.[2] The numbers have been slowly improving, but until recently, only one-third of the new Indian cleft cases were corrected each year, and only half of those cases were treated by a trained surgeon.[3] Often, this disparity is a result of social and economic factors that prevent people from knowing about available cleft care options and demanding proper cleft care.[4] As a result, there is a backlog of about 1 million untreated clefts in India.[3]

The growth of facial bones in a cleft lip and palate patient is uniquely affected due to the failure of fusion of bones and matrix. As a result, there is severe functional deficiency of the stomatognathic system. The relationship of maximum voluntary bite force and the masticatory system is well documented and indicate the functional status of stomatognathic system.[5] The bite force has been used as a clinical indicator of masticatory performance in the past two decades. Gnathodynamometers and force transducers are some of the devices used for the evaluation of bite force.[6] It has been reported that children with clefts of the lip and palate and with isolated cleft palate were significantly shorter than their unaffected peers. Males with these defects were also thinner than normal based on an average standard deviation scores for body mass indices.[7] Children with cleft lip and/or cleft palate are at high risk of dental caries leading to tooth loss.[8] Hence, it is expected that these children are going to suffer from the same problems in their adult life if the preventive measures are not taken aggressively.

Poor dental status negatively affects the dietary intake thereby nutritional status of cleft lip and/or cleft palate patient, making susceptible to the ill effects of nutritional imbalance. Oral health care planning for this needy section of the society becomes impossible without evaluation of treatment needs regarding prosthetic and nutritional status.

The objective of the present study was to evaluate prosthetic and nutritional status, bite force and prosthetic treatment need in the adult cleft lip and/or cleft palate patients and compare these with the adult noncleft population of similar definition.

SUBJECTS AND METHODS

A "raw data sheet" was prepared to facilitate data recording, by combining two instruments [Figure 1]. "Oral Health Assessment Form" of the World Health Organization (WHO,1997) and Mini Nutritional Assessment form, Nestlé (1994) for the evaluation of dentition status, prosthetic status, prosthetic need, and nutritional status, respectively.[9,10] Occupation was classified according to Kuppuswamy socioeconomic scale.[11] A table was included in the final raw data sheet to facilitate the recording of data generated from Gnathodynamometric studies. Gnathodynamometer used in this study was designed, developed by the authors with necessary technical help from SG International, Kolkata and calibrated from National Test House, Kolkata, India [Figures 2 and 3]. It is made up of the load cell and a digitizing unit, which can measure 0-150 kg bite force and has a precision of 0.020Kg with a confidence interval of 95% [Figure 4].

After obtaining the ethical clearance from the respective institution's ethics committee and individual written consent, 500 cleft lip and/or cleft palate (n = 250) and noncleft (n = 250) participants of either sex, aged 18 years or above except severe medically compromised, differently abled and having temporomandibular disorder, were examined. The healthy noncleft participants had a full set of normal dentition.

The raw data sheet numbering 001–250 was used for noncleft participants, whereas 251–500 were used for cleft lip and/or cleft palate participants.

As per the recommendation of the WHO protocol for infection control, armamentariums used for the study were sterilized. Examiner and data recorder were prepared themselves as per the WHO guidelines.[9]

The clinical examination and measurements were made with the patient comfortably seated in a chair with high backrest.[9] The data were recorded in three parts. The 1st part recorded dentition status, prosthetic status and need. In the 2nd part, data obtained from the Gnathodynamometric analysis was recorded [Figure 5]. The participants were asked to bite on the steel sensor tip which was disinfected with 77° Isopropyl alcohol and wrapped by a disposable plastic shield. The highest value for each bite was recorded. The measurement was accomplished three times at each position; with a 30 s interval between measurements to avoid muscular fatigue. The bite force was quantified (in kg force) in the molar region bilaterally and in the anterior region at points where the subject feels comfortable to exert the maximum strength.[12] In the 3rd part, nutritional status was recorded. Weight was measured without shoes and heavy outer clothing, using a reliable set of scale with the subject standing on the platform. Height (cm) was measured

A STUDY ON THE EVALUATION OF BITE FORCE, PROSTHETIC AND NUTRITIONAL STATUS, IN ADULT CLEFT PATIENTS IN KOLKATA.

RAW DATA SHEET

Serial No: ____ Date of examination: ____

Last name: ____ First name: ____

Sex: ____ 1=Male, 2=Female

Age: At last birthday ____

Weight, Kg: ____ Height,cm: ____

Contact No: ____

Occupation:(as per Kuppuswamy socioeconomic scale) ____

Occupation	
Profession	10
Semiprofessional	6
Clerical, shopowner, farmer	5
Skilled worker	4
Semiskilled worker	3
Unskilled worker	2
Unemployed	1

Habit:(as per WHO oral health questionnaire for adults,1=no,6=yes) ____

H/O Present Illness: ____

Past Medical History: ____

Standard codes: No abnormality detected = 0

Oral Health Assessment

Type of cleft ____

As per WHO oral health assessment form 1997

Standard codes: Not recorded/not carried out/not applicable = 9

Group	Type of cleft
1	Repaired cleft lip
2	Unrepaired cleft lip
3	Repaired cleft palate
4	Unrepaired cleft palate
5	Repaired cleft lip and palate
6	Unrepaired cleft lip and palate

Oral Mucosa:

Condition
0=No abnormal condition
1=Malignant tumor
2=Leukoplakia
3=Lichen planus
4=Ulceration
5=Acute necrotizing gingivitis
6=Candidiasis
7=Abscess
8=Othercondition (specify if possible)……
9=Not recorded

Location
0=Vermilion border
1=Commissures
2=Lips
3=Sulci
4=Buccal mucosa
5=Floor of the mouth
6=Tongue
7=Hard and/or soft palate
8=Alveolar ridges/gingiva
9=Not recorded

Figure 1: Raw data sheet

DENTITION STATUS

As per WHO oral health assessment form 1997

(Teeth marked according to FDI system)

Status
0=Sound
1=Decayed
2=Filled, with decay
3=Filled, no decay
4=Missing, as a result of caries
5=Missing, any other reason
6=Fissure sealant
7=Bridge abutment, special crown or veneer/implant
8=Unerupted tooth,(crown)/unexposed root
T=Trauma (fracture)
9=Not recorded

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

Prosthetic status and Prosthetic need

As per WHO oral health assessment form 1997

Prosthetic Status

Upper	Lower

0=No prosthesis
1=Bridge
2=More than one bridge
3=Partial denture
4=Both bridge(s) and partial denture(s)
5=Full removable denture
9=Not recorded

Prosthetic Need

Upper	Lower

0=No prosthesis needed
1=Need for one-unit prosthesis
2=Need for multi-unit prosthesis
3=Need for a combination of one- and/or multi-unit prostheses
4=Need for full prosthesis (replacement of all teeth)
9= Not recorded

Figure 1: Contd...

Table for recording the data obtained from the Gnathodynamometric study:

Test number	Frontal area Kgf	Left molars Kgf	Right molars Kgf
1			
2			
3			
Mean			

Mini Nutritional Assessment

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?

0 = severe decrease in food intake ☐
1 = moderate decrease in food intake ☐
2 = no decrease in food intake ☐

B Weight loss during the last 3 months

0 = weight loss greater than 3 kg (6.6 lbs) ☐
1 = does not know ☐
2 = weight loss between 1 and 3 kg (2.2 and 6.6 lbs) ☐
3 = no weight loss ☐

C Mobility

0 = bed or chair bound ☐
1 = able to get out of bed / chair but does not go out ☐
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?

0 = yes ☐
2 = no ☐

Figure 1: Contd...

E Neuropsychological problems

0 = severe dementia or depression ☐
1 = mild dementia ☐
2 = no psychological problems ☐

F1 Body Mass Index (BMI) (=weight in kg) / (height in m2)

0 = BMI less than 19 ☐
1 = BMI 19 to less than 21 ☐
2 = BMI 21 to less than 23 ☐
3 = BMI 23 or greater ☐

Weight (in Kg)	Height (in Meter)	BMI

If BMI is not available, replace question F1 with question F2.Do not answer question F2 if question F1 is already completed.

F2 Calf circumference (CC) in cm

0 = CC less than 31
3 = CC 31 or greater

Screening score: ☐
(max. 14 points)

12-14 points: Normal nutritional status	**8-11 points:** At risk of malnutrition	**0-7 points:** Malnourished

DIETARY ASSESSMENT

J. How many full meals does the patient eat daily?

0=1 meal
1=2 meals
2=3 meals ☐

K. Selected consumption markers for protein intake

At least one serving of dairy products (milk, cheese, yoghurt) per day yes/no
Two or more servings of legumes or eggs per week yes/ no

Figure 1: Contd...

Meat, fish or poultry every day yes/no

0.0 = if 0 or 1 ye

0.5 = if 2 yes

1.0 = if 3 yes

L. Consumes two or more servings of fruit or vegetables per day?

0 = no

1 = yes

M. How much fluid (water, juice, coffee, tea, milk...) is consumed per day?

0.0 = less than 3 cups

0.5 = 3 to 5 cups

1.0 = more than 5 cups

N. Mode of feeding

0= unable to eat without assistance

1= self-fed with some difficulty

2= self-fed without any problem

Mid-arm circumference (MAC) in cm

0.0 = MAC less than 21

0.5 = MAC 21 to 22

1.0 = MAC greater than 22

Calf circumference (CC) in cm

0 = CC less than 31

1 = CC 31 or greater

Figure 1: Contd...

without shoes using a stadiometer with the subject standing barefoot with heels together, arms at the side, legs straight, shoulders relaxed and in Frankfort horizontal plane and with the heels, scapulae and head against the vertical backdrop. Mid arm circumference was measured at the mid-point between the acromial surface of the scapula and the olecranon process of the elbow on the back of the arm. For measurement of calf circumference, the tape was wrapped around the calf at the widest part and the measurement was recorded. Statistical analysis of recorded data was performed using SPSS 20.0.1 (IBM Corporation, New York City, New York, United States), Graph Pad Prism version 5, Student's *t*-test, and Chi-square test.

RESULTS

The mean age (mean ± standard deviation) of cleft group patients was 38.6120 ± 10.6619 years with a range of 19.00–55.00 years and the median age was 39.00 years as against the noncleft group, which were 25.0370 ± 3.9563 years 18.00–58.00 years and 25.00 years, respectively.

In the cleft group, 70% were male and 30% were female which closely follows the normal gender distribution in cleft lip and/or cleft palate patients. Unemployed and unskilled workers were more prevalent in the cleft group, whereas clerical and semi-professionals were more in the noncleft group. Oral habits were significantly more prevalent in cleft group than in noncleft group.

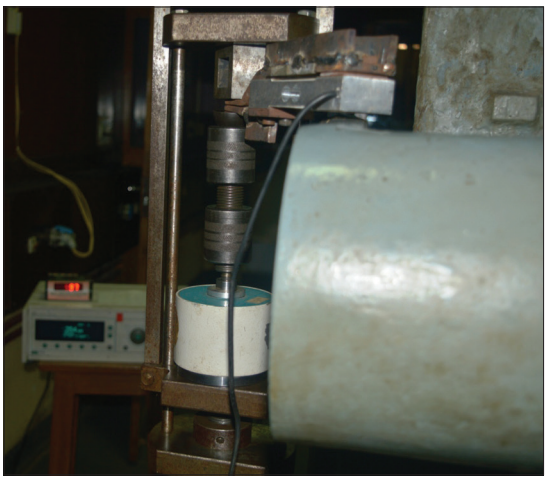

Figure 2: Standardization of Gnathodynamometer and load cell in the permanent lab of National Test House, Government of India

The number of prosthetic restorations (fixed partial dentures and crowns) was found to be significantly (χ^2: 26.6835; $P < 0.0001$) higher in number in noncleft group than in cleft group in mandibular arch [Table 1]. Prosthetic restorations in noncleft group were found to be significantly (χ^2: 41.3976; $P < 0.0001$) higher in number than cleft group in maxillary arch [Table 1]. Prosthetic need (one or multi-unit bridge) in maxillary arch was found to be significantly (χ^2: 490.0000; $P < 0.0001$) higher in cleft than in noncleft group [Table 1]. Prosthetic need (one or multi-unit bridge) in mandibular arch was significantly (χ^2: 123.9256; $P < 0.0001$) higher in cleft than in noncleft group [Table 1].

Nutritional status was observed to be significantly (χ^2: 179.4049; $P < 0.0001$) higher "at risk" in cleft than in noncleft group [Table 2]. The incidence of malnutrition was observed to be significantly higher in cleft than in noncleft group [Table 2].

The mean bite force in frontal area in cleft group (3.4356 ± 0.9457 kgf) was significantly lower ($P < 0.0001$) than in noncleft (22.8749 ± 5.3644 kgf) group [Table 3]. The mean bite force (11.6270 ± 1.5753 kgf) in left side in cleft group was found to be significantly lower ($P < 0.0001$) than in non-cleft (44.2505 ± 11.9190 kgf) group [Table 3]. The mean bite force (14.0847 ± 1.8632 kgf) in right side in cleft group was found to be significantly lower ($P < 0.0001$) than in non-cleft (44.3062 ± 11.6586 kgf) group [Table 3]. The difference of mean bite force in right side and left side in cleft group (2.4576 ± 0.6131 kgf and 1.2708 ±0.1036 kgf respectively) was statistically significant (p<0.0001) where as in non-cleft group it was statistically not significant [Table 3].

Table 1: Association between prosthetic status and need in maxillary and mandibular arch in cleft and noncleft group

	Prosthetic status in mandibular arch		Prosthetic status in maxillary arch		Prosthetic need in maxillary arch		Prosthetic need in mandibular arch	
	Cleft	Noncleft	Cleft	Noncleft	Cleft	Noncleft	Cleft	Noncleft
0	246	228	240	194	0	247	149	249
1	0	18	7	52	15	3	7	0
2	0	4	3	2	66	0	4	0
3	4	0	0	2	165	0	0	0
4					4	0	0	0
χ^2	26.6835		41.3976		490.0000		123.9256	
P	<0.0001		<0.0001		<0.0001		<0.0001	

Prosthetic status, 0=No prosthesis, 1=Bridge, 2=More than one bridge, 3=Partial denture. Prosthetic need: 0=No prosthesis needed, 1=Need for one-unit prosthesis, 2=Need for multi-unit prosthesis, 3=Need for one- and/or multi-unit prostheses, 4=Need for full prosthesis (replacement of all teeth)

The effect of prosthodontic interventions on the other parameters has also been studied [Table 4]. The bite force and nutritional status were significantly (χ^2: 127.8440, $P < 0.01$) lower in nonintervention group than the intervention group, whereas the prosthetic need was higher though both group had significantly lower values for the same parameters than the control group.

DISCUSSION

The difference of mean age in the two groups was not statistically significant, which implies that both groups had participants of similar age.

According to Singh and Ward, Government of India does not have any national policy which considers cleft as a deformity and therefore, there are no programs developed specific for either the treatment or rehabilitation (socioeconomic, prosthodontic, etc.,) of cleft lip and cleft palate patients which explain the higher prevalence of lower socioeconomic status in this group.[3,17]

The present study was also carried out to find out the association of prosthetic status in maxillary and mandibular arch in two groups [Table 1]. A significantly higher number of the prosthesis (crowns, fixed partial dentures) were found in noncleft group than in cleft group. Murthy in her study mentioned that lower socioeconomic status, lack of education, awareness were more common in cleft.[14] Gopalakrishna and Agrawal found that there is a lack of interdisciplinary approach in the majority of the cleft care centers, and hence, there is a need for better interaction among the specialists.[15,16] Ward in his study found that many cleft lip and cleft palate patients fail to access the cleft care facilities provided by private or Government organizations.[17] He also mentioned that Government of India's insurance schemes and projects are not perfect and that many needy cleft families are still not benefitted. Furthermore, Government of India's insurance schemes and projects do not cover all types of interventions a cleft patient needs especially prosthodontic interventions.[16,18-20] Poor prosthetic status in the maxillary and mandibular arch of cleft lip and /or cleft palate patients can be due to their low socioeconomic status, lack of awareness, and inadequate Government concern.[3,13,17]

The significance of the association between prosthetic need in maxillary and mandibular arch in two groups was observed in this study [Table 1]. The prosthetic need was found to be significantly higher in cleft than in noncleft group. Zhu *et al*. found that the number of teeth and their position are not only affected by cleft(s) but also the carious involvement of the teeth leading to teeth loss are also common.[8] Holt *et al*. found that the incidence of dental caries in cleft lip and/or cleft palate group was significantly high.[21] Singh found that cleft lip and/or cleft palate patients are one of the most disadvantaged group.[3] Not only due to low socioeconomic status but also there are several other reasons like lack of motivation and awareness, which explain why their missing or lost teeth are not replaced.[16] Mutthineni *et al*. found, another leading cause of teeth loss in cleft lip and/or cleft palate group is periodontal breakdown due to difficulty in maintaining oral hygiene.[22] Furthermore, malposed teeth cause hindrance in oral hygiene maintenance.[22]

Nutritional status "at risk" was significantly higher in cleft than in noncleft group [Table 2]. This significance is in agreement with the study conducted by Chakraborty *et al*.[23] Overall, monthly family income was positively correlated with Body Mass Index (BMI) and mean weight. According to the WHO Working Group (1986) a representative average value of 25 ± 2.5 kg/m^2, in an industrialized country can be considered an indicator of normal nutritional status. In this study, BMI of <19 was scored as zero according to Mini Nutrition Assessment, Nestlé (1994) and it was found that in cleft group individuals a lower socioeconomic status and a nutritional status "at risk" were most frequent.[24]

A study by Hatch *et al*. found that bite force was a key determinant of masticatory performance.[25] Bite force has been shown to be affected by some physiological and morphological variables such as craniofacial morphology, age, gender, periodontal support of the teeth, height and body weight, temporomandibular disorders, pain, and dental status.[25] Height, body weight, craniofacial morphology, periodontal support of the teeth, and dental status has been found to be affected in cleft lip and cleft palate patients.[8,21,22,25]

Mean maximum voluntary bite force in the frontal area of the cleft group was found to be significantly lower than in noncleft group [Table 3]. Miyaura *et al*. found that the number of teeth is most important to maintain biting ability.[26] The number of maxillary anterior teeth is reduced due to dental caries, partial anodontia, and periodontal cause.[8,22] Zhu *et al*. found that anterior teeth of cleft group individuals were frequently affected by dental caries.[8] Meşe found that many cleft patients with the affected alveolar ridge, presented with either congenital absence of the permanent maxillary lateral incisor or is present in a rudimentary form.[27] The maxillary central incisors are often hypoplastic with short roots and severely malposed.[27]

Form No : NTH/SL/F/5

सत्यमेव जयते

भारत सरकार
Government of India

राष्ट्रीय परीक्षण शाला (पूर्वी क्षेत्र)
National Test House (Eastern Region)

ब्लॉक – सी पी, सेक्टर – V, साल्ट लेक सीटी, कोलकाता – 700 091
Block-CP, Sector-V, Salt Lake City, Kolkata - 700 091

केलिब्रेशन प्रमाण-पत्र
CALIBRATION CERTIFICATE

केलिब्रेशन प्रमाण पत्र सं. Calibration Certificate No	NTH(ER)/CAL(M)/2016/00160	जारी होने की तिथि Date of Issue	30/11/2016
केलिब्रेशन की तिथि Date of Calibration	अगला केलिब्रेशन का बकाया Next Calibration due on	पृष्ठ Page	पृष्ठों की संख्या No of Pages
22/11/2016	NA	1	2

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पंजिका सं. एवं दिनांक Register No & Date	00160/NTH(ER)/CAL(M)/04/10/2016
नमुना प्राप्ति की तिथि Date of Receipt of Sample	03/10/2016
केलिब्रेशन के अंतर्गत सामग्री का विवरण Description of Sample for Calibration	Load cell of Gnathodynamometer, Marking: 29, Rated load 150 kg, Precision 0.02 kg, no 71, Indicator Mfg by Shree Gopal International.
माप-क्रम एवं विभाजन Scales & Divisions	Capacity 150 kg, (Calibrated upto 25 kg), L.C.005 kg.
व्यापक्त प्रणाली का महत्मान Identification of the method used	Generally of the lines of IS 1828(part1)/2015.
पर्यावरणी अवस्था Environmental Conditions	Temp: 25 oC.
व्यापक्त मुख्य मानक/ उपकरण Major Standards/Equipments used	Standard dead weights.
केलिब्रेशन स्थल Site of Calibration	Permanent Lab.
मापन कार्यों का अनुमार्गन Traceability of measurements	NPL/New Delhi vide calibration certificate no. 13011215/D.01/C-340 dt. 14.03.2013 & WI/Feb/13/055 dt. 10.02.2013.
केलिब्रेशन स्टिकर पर रा.प.शा का महत्मान चिह्न NTH Identification Mark on Calibration Sticker	61289

Calibrated By	Checked By	Approved By
Projjwal Banerjee	Angad Verma	Debashis Bhattacharyya
SA(Mechanical)	Scientist-SB(Mechanical)	Scientist-SD(Mechanical)

Figure 3: Standardization certificate of Gnathodynamometer and load cell

The status of each anterior tooth was also examined; their data were tabulated and statistically analyzed in this study [Table 5]. About 62% of anterior teeth were found to be carious and 39% of upper permanent left lateral incisor was found to be missing which made it difficult for the cleft group individuals to bite a hard object which is reflected in the values that were recorded [Table 3]. These values are found to agree with the findings of Sipert *et al*.[12]

The mean bite force of the right and left side in the cleft group was significantly lower than in noncleft group [Table 3]. The values are in agreement with the previous study conducted by Sipert *et al*.[12] Significantly lower bite force in cleft patients is attributable to fewer number of teeth. The lower prosthetic status and higher prosthetic need of the cleft patients might also be responsible for this significantly lower amount of bite force.

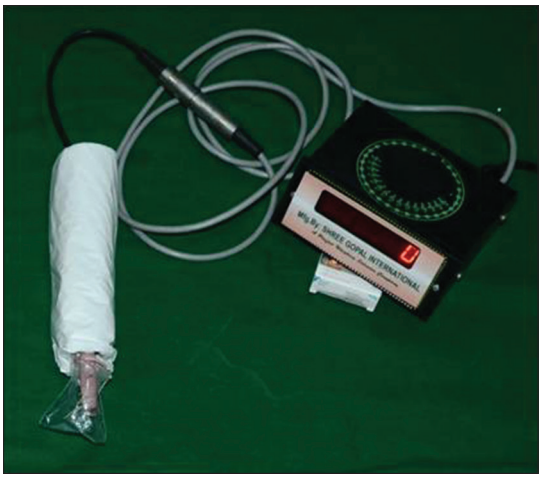

Figure 4: Gnathodynamometer

Figure 5: Measurement of bite force

Table 2: Association of nutritional status in between cleft and noncleft group

	Group		
Nutritional status	Cleft (*n*=250)	Noncleft (*n*=250)	Total
Malnourished	13	2	15
Normal	40	189	229
At risk	197	59	256
Total	250	250	500
χ^2		179.4049	
P		<0.0001	

Nutritional status: Malnourished=0-7points, At risk=8-11points, Normal=12-14points

The significance of the difference between the mean bite force of the right and left side in the two groups was observed in this study [Table 3]. There are several factors identified which affect the number of functional tooth unit present in the left side of maxilla in cleft patients.[26] Left 2nd premolars and left permanent lateral incisors are frequently missing in the cleft group.[28] Second, the molars of the left side are most frequently lost due to dental caries.[29] Third, commonest cleft encountered is a unilateral cleft palate affecting left side.[4] Shapira *et al*. explained this phenomenon as: in the early stages of development, the embryo receives a somewhat greater supply of blood, due to the higher blood pressure from the right internal carotid artery, which is in a more direct line of blood flow than the left side.[30] Fourth, periodontal break down most commonly occurs near the cleft.[22] The oral hygiene maintenance is also a difficult task at the cleft side because of the patient's oronasal communication.[22] Rintala found that the side of the cleft is associated with ipsilateral handedness.[31] Patients with unilateral cleft palate affecting left side were left handed and faced difficulty in oral hygiene maintenance in left side. In the present study, about 16% of upper left premolars were found to be missing in cleft group individuals [Table 6]. 26%–36% of molars were found to be missing in the left side of cleft group individuals, where as in the right side, it was 8%–13%. Out of 250 cleft patients, 103 were unilateral cleft palate affecting left side. The findings mentioned above may explain the statistically significant difference of biteforce between left and right side in cleft group. The findings of our study are in contrast to Calderon *et al*. who did not found difference in bite force between the right and left side in the cleft individuals.[32]

The reason for significantly lower bite force of both prosthodontic nonintervention and intervention cleft than noncleft group [Table 4] can be explained with the help of the study conducted by Suzuki *et al*. where they showed that only surgical and orthodontic correction cannot make significant improvement in functional loading capacity (bite force) unless and otherwise the adequate number of teeth from both sides of the cleft are splinted with appropriate prosthodontic intervention(s).[33] According to Bavbek *et al*. a multi-unit fixed partial dentures acts as a massive body to distribute the bite force among the supporting abutments, thereby contributing to restoring functional loading (bite force) capacity although such type of prosthodontic interventions were not found in the cleft group in this study except few temporary Removable Partial Dentures.[34]

CONCLUSIONS

Due to inadequate Government concern and lack of national policy for complete treatment and rehabilitation of adult cleft participants; their prosthetic, nutritional status, and bite force were significantly lower though prosthetic need was significantly higher than adult noncleft participants. Well planned and designed prosthodontic intervention is an urgent need of adult cleft participants in Kolkata.

Table 3: Distribution of mean bite force (in kgf) of frontal area, right and left side in cleft and non-cleft group

	Group	Number	Mean±SD	Minimum	Maximum	Median	*P*
Bite force in frontal area	Cleft	250	3.4356±0.9457	0.3020	5.3100	3.4117	<0.0001
	Noncleft	250	22.8749±5.3644	14.2940	42.5400	22.9537	
Bite force in left side	Cleft	250	11.6270±1.5753	8.3670	14.6130	11.4707	<0.0001
	Noncleft	250	44.2505±11.9190	24.5213	71.4710	45.5822	
Bite force of right side	Cleft	250	14.0847±1.8632	10.4040	16.5473	14.4143	<0.0001
	Noncleft	250	44.3062±11.6586	24.4577	71.4250	44.2590	
Cleft	Right side	250	2.4576±0.6131	0.0390	4.0740	2.0370	<0.0001
	Left side	250	1.2708±0.1036	0.0040	8.0790	0.3920	
Noncleft	Right side	250	1.2608±0.1131	0.0090	8.0640	0.0370	0.0601
	Left side	250	1.2708±0.1036	0.0040	8.0790	0.3920	

Table 4: Effect of prosthetic intervention (prosthetic status) on prosthetic need, bite force and nutritional status

Group	n	Prosthetic status	Prosthetic need	Bite force	Nutritional status	*P*
Case subgroup 1	10	1.300	1.100	5.320	12	<0.01
Case subgroup 2	240	0.000	3.500	3.201	8	
Control	250	0.132	0.001	22.870	13	

Case subgroup 1= Who had prosthetic restoration, Case subgroup 2= Who had no prosthetic restoration, Control= Noncleft group

Table 5: Comparison of anterior teeth status in maxillary and mandibular arch in cleft group

Maxillary anterior teeth							
Teeth status	13	12	11	21	22	23	*P*
0	186	196	205	139	166	187	0.002
1	15	18	45	32	30	30	0.3001
2	0	15	0	54	0	0	0.1001
3	29	10	0	0	0	0	0.6001
4	20	4	0	25	24	33	<0.0001
5	0	4	0	0	30	0	<0001
7	0	3	0	0	0	0	0.3628
Mandibular anterior teeth							
Teeth status	43	42	41	31	32	33	*P*
0	186	62	205	213	216	187	0.0030
1	5	1	4	2	3	3	0.2001
2	0	0	0	0	0	0	0.1001
3	2	1	0	02	01	01	0.6001
4	2	4	0	5	4	3	0.5001
5	0	03	11	9	4	0	0.4001
7	0	4	0	0	0	0	0.3628

Dentition status WHO 1997: 0=Sound, 1=Decayed, 2=Filled, with decay, 3=Filled, no decay, 4=Missing, as a result of caries, 5=Missing, any other reason, 6=Fissure sealant, 7=Bridge abutment, special crown or veneer/implant, 8=Unerupted tooth, (crown)/unexposed root, T=Trauma (fracture), 9=Not recorded

Table 6: Comparison of posterior teeth status between the right and left side in maxillary and mandibular arch in cleft group

Maxillary arch									
Teeth status	17	16	15	14	24	25	26	27	*P*
0	175	116	181	185	203	56	86	103	0.00014
1	25	38	52	31	32	54	56	61	0.13888
2	0	51	3	0	15	50	13	14	<0.0001
3	0	30	0	0	0	25	50	0	
4	50	15	14	34	0	24	40	73	0.0232
5	0	0	0	0	0	41	5	0	<0.0001
7	0	0	0	0	0	0	0	0	
Mandibular arch									
Teeth status	47	46	45	44	34	35	36	37	*P*
0	213	179	205	213	216	187	141	226	0.0700
1	15	21	45	32	30	30	28	20	0.3001
2	0	5	0	0	0	0	0	0	0.1001
3	2	1	0	0	0	0	0	0	0.6001
4	20	40	0	5	4	33	74	4	<0.0001
5	0	0	0	0	0	0	0	0	
7	0	4	0	0	0	0	7	0	0.3628

Dentition status WHO 1997: 0=Sound, 1=Decayed, 2=Filled, with decay, 3=Filled, no decay, 4=Missing, as a result of caries, 5=Missing, any other reason, 6=Fissure sealant, 7=Bridge abutment, special crown or veneer/implant, 8=Unerupted tooth,(crown)/unexposed root, T=Trauma (fracture), 9=Not recorded

Clinical significance

The results of this study could be regarded as a guideline for future planning and policy making so as to improve dental awareness and oral health of adult cleft lip and cleft palate individuals.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There no conflicts of interest.

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