



# RELATIONSHIP OF GRIP AND PINCH STRENGTH TO BODY MASS INDEX AMONG DENTAL PROFESSIONALS - CROSS SECTIONAL STUDY

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## ABSTRACT

**Aim:** To determine the relationship of grip and pinch strength to body mass index among dental professionals.

**Methodology:** In this cross sectional study total number of 150 dental professionals, aged 22 to 40 years, who fulfilled selection criteria, were recruited through Purposive sampling. Participant's height, weight, body mass index, grip strength, lateral pinch strength, Pad to Pad pinch strength and Tip to Tip pinch strength were then assessed. All measurements were taken by using standardized procedures. The data collected was analyzed by using Pearson's correlation test.

**Results:** The inferential statistics had shown that there was a significant positive correlation between body mass index and grip strength with correlation coefficient (r) value of 0.233 (p = 0.004), body mass index and lateral pinch strength with of r value 0.259 (p value = 0.01), body mass index and pad to pad pinch strength with r value of 0.209 (p value = 0.05), body mass index and tip to tip pinch strength with r value of 0.169 (p value = 0.05).

**Conclusion:** The study shows that there is a significant weak positive correlation between body mass index and Grip strength, body mass index and lateral pinch strength, body mass index and pad to pad pinch strength & body mass index and tip to tip pinch strength.

**Key Words:** Body Mass Index, Grip strength, Lateral pinch strength, Pad to Pad pinch strength, Tip to Tip pinch strength

## INTRODUCTION

Grip and pinch strength of dental professionals have been focused in numerous studies worldwide. The prevalence of work-related upper extremity Musculo-Skeletal Disorders are increased among dentists and dental hygienists than other professionals.<sup>1</sup> As the work area of dentists is narrow, dental treatment is performed in a very inflexible work posture,<sup>2</sup> so they are more prone for Musculo-Skeletal Disorders even from early stage of their career.<sup>3</sup> One of the factors associated with the high prevalence of upper extremity Musculo-Skeletal Disorders among dental practitioners is the repeated high pinch force applied during periodontal scaling<sup>4</sup>. Over-use and extreme range of motion of certain muscle groups and joints are caused by repeated identical or similar motions, which are performed over a period of time can eventually lead to muscular fatigue which in turn affects the grip and pinch strength.<sup>5</sup>

Hand strength evaluation has been identified as an important factor in predicting Musculo-Skeletal Disorders, the grip strength and pinch strength are considered to be an objective outcome measures.<sup>6</sup> Grip and pinch are measures of the hand muscles strength<sup>7, 8</sup> Pinch grip strength has been used as indices of strength in hand therapy assessments.<sup>9</sup> The grip strength and pinch strength was reported to be higher in dominant hand.<sup>10</sup>

Body mass in adults can be classified using body mass index, which is a simple index of weight-for-height, With the increase in body mass index grading, the health risk may be differ among different population.<sup>11, 12</sup> Research has shown that individuals fall into overweight or obese categories has higher chances of experiencing health problems.<sup>13</sup> body mass index is one of the key factors in the development of musculoskeletal dysfunction, that may vary among different professionals.

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Received: 08.10.2016

Revised: 17.10.2016

Accepted: 29.10.2016

Singh A, Prohit B reported that Obesity was observed in third-year (22.4%), final-year (16.3%) students, interns (20.4%) and faculty members (40.8%).<sup>14</sup>Ibegbu Augustine Oseloka et.al stated that body mass index have positive correlation with grip strength among Nigerian students.<sup>15</sup>T Kamarul, TS Ahmad stated that grip strength was positively correlated with hand dominance, gender, occupation, height, and weight, but not with body mass index.<sup>16</sup>Also, Angelica Soares et.al concluded that there was no association between grip strength and body mass index in general population.<sup>17</sup>

Disparity exists in the literature over the relationship between hand grip strength and body mass index in different professionals, some researchers claiming a positive relationship between grip strength and body mass index in all age groups, while other researchers found no relationship<sup>18-21</sup>. Especially in dental profession there are lacks of studies in finding the relationship between body mass index with grip and pinch strength. Hence, this study aims to find the correlation between grip and pinch strength with body mass index among dental professionals.

## MATERIALS AND METHODS

This study was conducted among dental professionals aged 22 to 40 years with a sample size of 150. Purposive sampling method was used. The participants who fulfilled the selection criteria were included in the study. Prior to the participation, the study was explained and written informed consent was obtained from each of them. Ethical clearance was obtained from University ethics committee. The inclusion criteria: healthy dental professionals who are practicing at least for 1 year, males and females between 22 to 40 years of age with full functional range of motions of upper limb and neck. Exclusion criteria were participants with MSD, a history of recent surgery, any neurological disorder and any systemic illness.

A standardized weighing machine was used to measure the weight of each Participant. The height was measured by using a stadiometer. Body Mass Index was calculated for each participant by using the formula  $\text{Body Mass Index} = \frac{\text{Weight(Kg)}}{\text{Height(m)}^2}$

## METHODS

Grip strength was measured by using a Jamar Dynamometer (figure 1), lateral pinch (figure 2), pad to pad (figure 3) and tip to tip (figure 4) pinch strengths were measured by using a pinch gauge. The standardized functional positions were used.<sup>22-25</sup> Participants were asked to Grip/pinch with his/her dominant hand; other end of the pinch gauge was hold by the investigator. Explanation was given to squeeze the dy-

namometer and press the pinch gauge. Then, they were allowed to familiarize themselves with the instrument by a sub-maximal practice trial. Finally, they were asked to squeeze/pinch the handle of dynamometer/pinch gauge as strong as possible and measurement was taken (in Kg). The same was repeated for 3 times, allowing a 10 seconds rest between the measurements.<sup>23</sup> Average of 3 measurements was calculated and documented.

## STATISTICAL ANALYSIS

The collected data was analyzed using SPSS version 22. Descriptive Statistics was produced for Age, Gender, Hand dominance, body mass index, grip strength, lateral pinch, and pad to pad and tip to tip pinch strength distribution. The Pearson's Correlation test was used to check the relationship between body mass index and grip strength, lateral pinch, pad to pad and tip to tip,  $P < 0.05$  is considered to be significant.

## RESULTS

Results show there is a significant positive correlation between body mass index and grip strength with correlation coefficient (r) equal to 0.233 ( $p = 0.004$ ) (refer Table 3 and graph 1). There is a significant positive correlation between body mass index and lateral pinch strength with  $r = 0.259$  ( $p = 0.01$ ) (refer Table 4 and graph 2). There is a significant positive correlation between the body mass index and pad to pad pinch strength with  $r = 0.209$  ( $p = 0.05$ ) (Table 5 and graph 3). There is a significant positive correlation between the body mass index and tip to tip pinch strength with  $r = 0.169$  ( $p = 0.05$ ) (refer Table 6 and graph 4)

## DISCUSSION

Descriptive statistics shows that participants between 23 to 40 years old (male - 47.33%, female- 52.77%) were participated in the study. Both right and left dominance were included in the study, while comparing the percentage of right and left dominance, it is observed that 93.33 are right dominant individuals.

The inferential statistical value in correlating body mass index with grip strength shows that there was a significant positive correlation but it was weak ( $r$  value = 0.233). Similar findings were observed in a study "systematic exploring the relationship between hand grip strength and body mass index in healthy general population" by Kun-Hsi Liao.<sup>26</sup> Ibegbu Augustine Oseloka also concluded that there is a positive correlation between hand grip strength and body mass index in Nigerian college students.<sup>16</sup>

When correlating body mass index with lateral pinch strength, pad to pad pinch strength, and tip to tip pinch strength, the results showed that there were significant positive correlations but it was weak ( $r$  value = 0.259, 0.29, 0.169 respectively). Study results agree with the findings of Tsuyoshi Tajika et al, which showed that there was significant weak positive correlation of body mass index with lateral pinch and tip to tip pinch strengths but pad to pad pinch strength was not significant.<sup>27</sup> Ehsanollah Habibi et al who conducted a study on hand grip and pinch strength concluded that there was a significant positive relationship between body mass index and pinch strength.<sup>28</sup>

The positive correlation between body mass index with grip strength and pinch strength observed in this study may have occurred due to the reason that the subjects involved in the study were young adults and falls more in normal and overweight category (64.67% and 21.33%). The existence of greater percentage of lean body mass in normal and overweight individuals compared to the underweight and obese (7.3% and 6.67%) individuals may be influenced to perform handgrip and pinch in a better way. This is agreed by the study done by Duangporn Thong-Ngam et al. stated that subjects with normal body mass index had significantly higher hand grip strength than overweight and obese group.<sup>29</sup> The result of Smrithi shetty et al. revealed that the Body Mass Index of underweight category has less grip strength compared to normal and overweight category among young adults.<sup>30</sup>

It is a known fact that dental professionals use more of hand grip and pinch activities with different stressful positions that may keep stress on the musculoskeletal system which in turn leads to repeated fatigue of small hand muscles resulting in less hand grip and pinch strength,<sup>31</sup> this may be a reason for weak correlation. However, further studies comparing dental professionals with general population is needed.

### LIMITATION

Though we planned to include the participants from 22 to 40 years old, except very few many above 30 years were unwilling to participate in the study.

### CONCLUSION

The study shows that there is a significantly weak positive correlation of body mass index with grip strength and pinch strength. So body mass index may be considered as an influential variable in determining the grip strength and pinch strength, which is an essential component of dental clinical performance.

### ACKNOWLEDGEMENT

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed. Authors are also grateful to Yenepoya University for permitting the smooth conduct of the study.

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**Table 1: Descriptive statistics: Gender and hand dominance distribution.**

Variable (n=150)		Frequency (%)
Gender	Male	71 (47.33)
	Female	79 (52.67)
Hand Dominance	Right	145 (93.33)
	Left	5 (6.67)

**Table 2: Descriptive statistics of Age, Body Mass Index, Grip Strength, Lateral Pinch, Pad to Pad and Tip to Tip pinch strength.**

Variables (n=150)	Minimum	Maximum	Mean	Standard Deviation	
Age (Year)	23	40	26.05	2.95	
Body Mass Index Score	16.40	34.72	23.3	3.79	
Grip Strength (Kg)	6.60	49.30	25.08	7.47	
Pinch Strength (Kg)	Lateral Pinch	2.80	13.50	5.99	1.96
	Pad to Pad	2.00	11.80	4.42	1.59
	Tip to Tip	0.60	6.50	2.77	1.17

**Table 3: Inferential statistics of correlation between Body Mass Index and Grip Strength**

Variable (n=15U)	Mean (Standard Deviation)	Correlation coefficient "r"	p value
Body Mass Index	23.33(3.79)	0.233	0.004
Grip Strength	25.07(7.47)		

**Table 4: Inferential statistics of correlation between Body Mass Index and Lateral Pinch strength**

Variable (n=15U)	Mean (SD)	Correlation coefficient "r"	p value
Body Mass Index	23.33 (3.79)	0.259	0.01
Lateral Pinch strength	5.99 (1.96)		

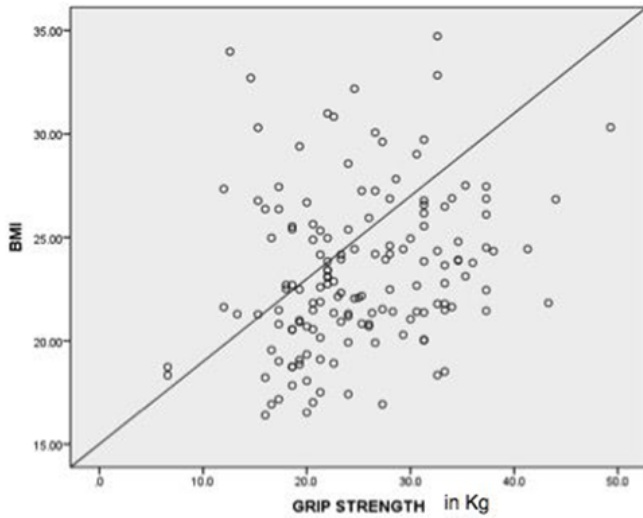
**Table 5: Inferential statistics of correlation between Body Mass Index and Pad to Pad pinch strength**

Variable (n=150)	Mean (Standard deviation)	Correlation coefficient "r"	p Value
Body Mass Index	23.33 (3.79)	0.209	0.05
Pad to Pad pinch strength	4.42 (1.59)		

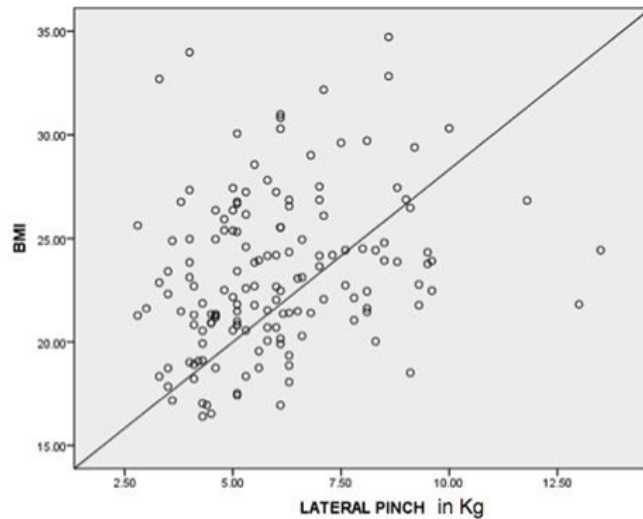


**Table 6: Inferential statistics of correlation between Body Mass Index and Tip To tip pinch strength**

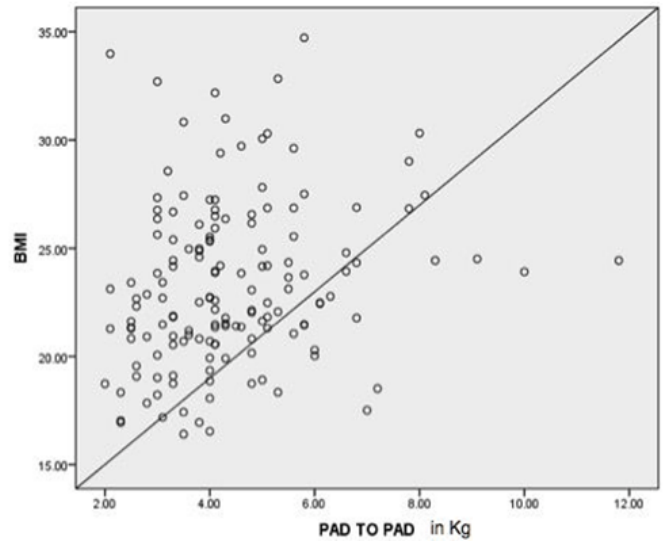
Variable (n=150)	Mean (Standard deviation)	Correlation coefficient "r"	p Value
Body Mass Index	23.33 (3.79)	0.169	0.05
Tip to Tip pinch strength	2.77 (1.17)		



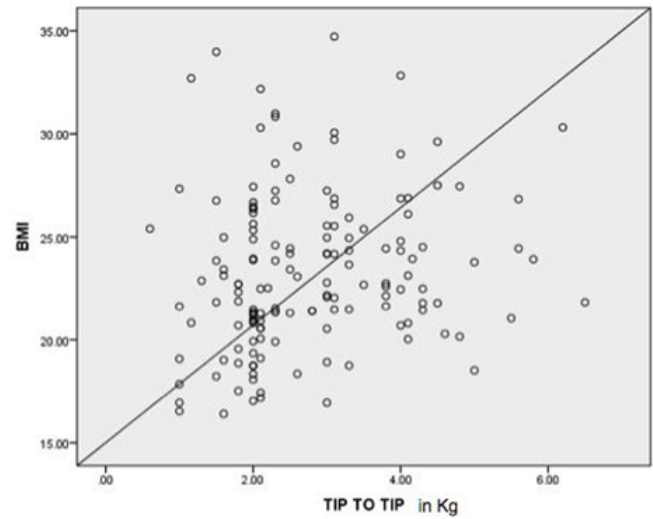
**Graph 1:** Scatter plot of correlation between body mass index and grip strength



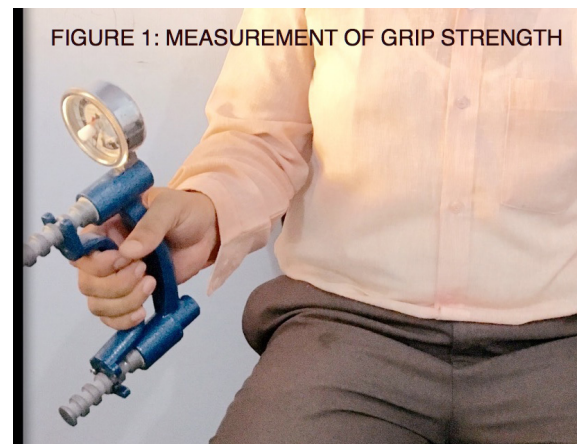
**Graph 2:** Scatter plot of correlation between body mass index and lateral pinch strength



**Graph 3:** Scatter plot of correlation between body mass index and pad to pad pinch strength



**Graph 4:** Scatter plot of correlation between body mass index and tip to tip pinch strength



**FIGURE 1: MEASUREMENT OF GRIP STRENGTH**

