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Hand Gripping Assessment in Female Nail Artist: A Cross-Sectional Study

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ABSTRACT

Background: Nail artists are exposed to various ergonomic stressors due to repetitive hand movements, which may affect their hand grip strength and pinch strength. This study aims to assess these parameters in female nail artists to understand the potential occupational impacts on hand function.

Materials and Methods: A cross-sectional study was conducted involving 100 female nail artists aged 18-35 years, working in various nail salons in Surat. The Jamar hand dynamometer and Jamar pinch meter were used to measure hand grip strength and pinch strength in both dominant and non-dominant hands. Data were collected from September 2023 to March 2024 using convenient sampling.

Results: The study participants had a mean age distribution with 23% in the 18-23 age group, 63% in the 24-29 age group, and 14% in the 30-35 age group. Statistical analysis using SPSS software revealed significant differences in cylindrical grip strength between the dominant and non-dominant hands. There was also a notable relationship in pulp-to-pulp pinch strength.

Conclusion: The study found no significant difference in hand grip strength and pinch strength in female nail artists compared to normal individuals. However, the findings suggest that prolonged exposure to repetitive hand movements may lead to overuse injuries and muscle weakness, affecting their ability to perform certain tasks.

Keywords: Hand Grip Strength, Pinch Strength, Nail Artists, Jamar Dynamometer, Occupational Health, Ergonomic Stressors

INTRODUCTION

The prevalence of work-related musculoskeletal disorders (WMSD) has considerably increased in the beauty industry over time as beauticians execute the everyday duties listed below, which call for fine finger, pinch, grip, and wrist motions. Numerous terms, including cumulative trauma disorders (CTDs), repetitive strain injury (RSI), repetitive motion injury (RMI), and occupational overuse disorders (OODs), are used to explain the problem of WMSDs. The beauty business performs a variety of tasks in various roles in beauty salons. Workers who are exposed to manual work in uncommon or limited postures, repetitive and static work, and vibration have been found to have a high prevalence of WMSDs. A high prevalence of hand/wrist complaints has

been found in studies, primarily as a result of excessive exposure to physical risk factors (job involving extended sitting and demanding body postures). Additionally, "manual handling of vibrating tools" while hunched over can burden various parts.[1]

Greater job opportunities are anticipated in the future years as the number of salons and employees grows as well. Due to the low entrance barriers which include a lack of education and skill-related qualifications, short-term training, flexible work schedules, little financial pressure, and a minimal requirement for English proficiency immigrants have been particularly drawn to the nail salon industries. [4] Manicures and pedicures are frequently performed by nail technicians. Cleaning and disinfecting instruments and the workspace, setting up the workspace, cleaning, cutting, filing, and polishing fingernails, massaging the hands and feet, and using different nail treatments, such as polishes, lacquers, and powder formulations are some examples of these chores.[5]

Over the past four decades, artificial nail extensions have grown in popularity, especially since the introduction of methyl methacrylate acrylic resin to the manufacturing process. Methyl methacrylate monomer (MMA) has been linked to skin and respiratory allergies as well as being known to irritate the skin, eyes, and respiratory tract.[2] The risks that nail technicians may encounter at work include ergonomic and safety risks as well as chemical, biological, and physical risks. The work requires repetitive and precise hand, wrist, and arm motions in addition to long durations of sitting, bending, and holding awkward postures.[5]

The hands are a vital body part that are used in practically all daily activities. The performance of the hands when performing a task requires a variety of abilities, including grasp, muscle strength, movement, touch feedback, and motor coordination. Dexterity and handgrip strength are essential measurements that indicate hand function because they are the capacity to handle objects.[6] The term "hand gripping" refers to the position of the hands when holding or grasping objects firmly and securely, as well as the weight of the objects you can hold in your hands. The hand and forearm muscles play a significant role in grip strength, providing the hand with tremendous strength when a person needs to squeeze or hold something.[8]

The size of the hands is a physiological component of grip strength, among many other physiological parameters. In general, someone with a large hand and long fingers will be stronger than someone with a smaller hand and shorter fingers. The level of grip strength is greatly influenced by forearm strength. As with hand size**,** body weight has a direct correlation with grip strength compared to someone who is thin and light weight. Another physiological component of grip strength is dexterity. The dominant hand, or the hand Favored for most daily activities, is the hand that has the strongest grip for the majority of the population.[8] A straightforward yet effective predictor of future disease, death, and disability in persons of all ages not just the elderly is grip strength. [7]

The main objective of the current study was to determine the current working population's health and safety concerns in the nail salon business. The initial goal of this poll was to find interested employers for focus groups that would help with the creation of training for their personnel. This study's objective is to gather data to disseminate throughout the public health and nail salon communities in order to advance the creation of training and educational materials for these populations that are easy to grasp. [3]

Although there are several devices that can test hand grip strength in a clinical context, none are as popular as the Jamar dynamometer. Since its invented by bechtol in 1954, the Jamar gadget has been regarded as the most reliable tool for assessing grip strength. The Jamar has proven to be dependable for clinical application when used with conventional positioning and

instructions. The American Society of Hand Therapists advises using the Jamar to gauge grip strength while evaluating patients with a range of upper extremity issues, as lateral epicondylitis, stroke, rheumatoid arthritis, carpal tunnel syndrome, neuromuscular disorder, and so forth.[9]

Pinch meter is widely used instrument for assessing pinch strength. With precision grip, thumb and fingers are used. Palm may or may not be involved. The intrinsic muscle plays vital roles in precision handling. Thumb is essential for precision grip because it provide stability and control of direction to the grip.[10]

MATERIALS & METHODS

Material:

- Pen
- Paper
- Jamar hand dynamometer
- Jamar pinch meter

Study setting:

Various nail salon setups situated in Surat district.

Study Population:

Nail artist

Study Duration:

From September 2023 to March 2023

Study Design:

Cross-sectional study

Sampling Method:

Convenient sampling

Sample Size:

N=100

Inclusion criteria

- Younger individuals between the age group of 18-35 years.
- Only Female participants will be included in the study.
- The Participant those who are willing to participate into study.
- Population currently working in different nail salon in Surat district.
- Subjects who are working for more than 4-5 hours per day.

Exclusion criteria

- Subjects < 18 year of age and >35 year of age will be excluded.
- An individual with wrist or hand arthritis will be excluded.
- An Individual previously diagnosed with any nerve related pathology or injury in wrist or hand will be excluded. (Past 1 Year)
- An individual with previous hand surgery will be excluded. (Past 1 Year)

DATA COLLECTION PROCEDURE:

Permission will be taken from nail artists of various nail salon of Surat district. Those who will be willing to participate will be included in the Study according to inclusion and exclusion criteria and will be evaluated using outcome measures. Hand grip strength and pinch strength will be evaluated using Jamar dynamometer and Jamar pinch meter. The collected data will be analysed using SPSS software.

OUTCOME:

Hand grip: (1) Power grip (2) Precision handling

OUTCOME:

1. **Jamar hand dynamometer:**

Although other instruments to measure hand grip strength are available in the clinical setting, none is as widely used as the Jamar dynamometer. Developed by Bechtol, the Jamar device has been considered the most acceptable de- vice for measuring grip strength since 1954. The Jamar is a relatively simple, inexpensive test instrument that measures grip force through a closed hydraulic system. Compression of the Jamar's handle is transduced in pounds per square inch. The resultant force is then reported on an Analog out- put meter. The Jamar, when used with standard positioning and instructions, has been shown to be reliable for clinical use. The Jamar is recommended by the American Society of Hand therapists for measuring grip strength in the assessment of patients with diverse upper extremity disorders.[9]

Image no 01. Jamar hand dynamometer

2. Jamar pinch meter:

Pinch meter helps to determine the strength of pinches i.e. pad to pad, tip to tip and lateral pinch. Studies have been shown excellent reliability and validity.

Image no (2) Jamar pinch meter

RESULT

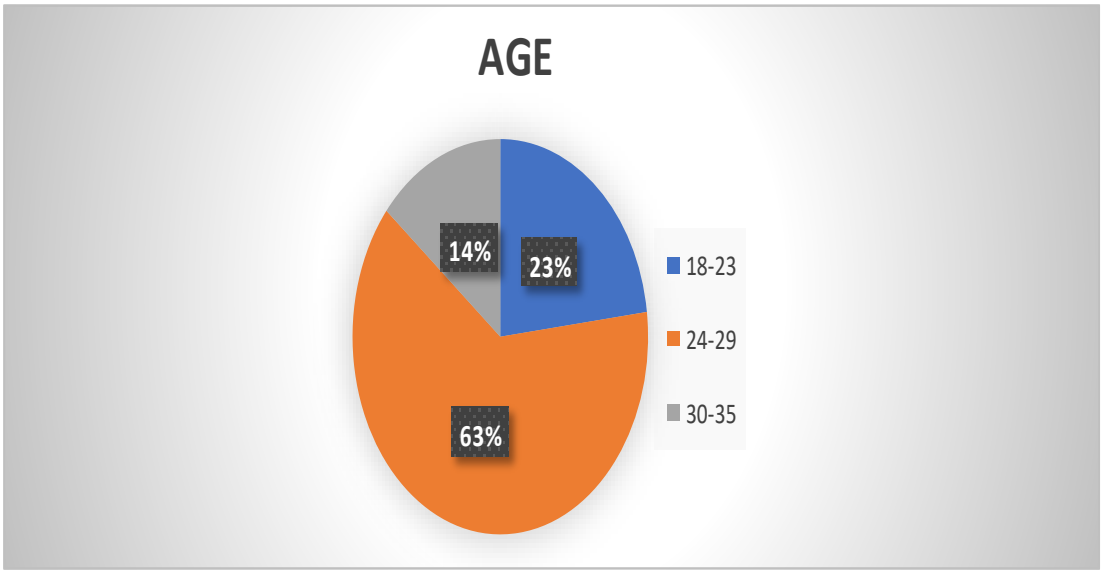
The study consisted of 100 female nail technicians in Surat. Among them 23% were in age group of 18-23, 63% in age group of 24-29 and 14% in age of 30-35. The working hours were more than 4-5 hour. There is significant relation in pulp-to-pulp pinch, cylindrical grip is statistically significant.

A total of 100 subjects were included in the study. Statistical analysis was done using IBM SPSS 2.0 software version. Normality of the study was tested using Shapiro-Wilk test. The Data was distributed normally and analyzed to find out significance within the sample.

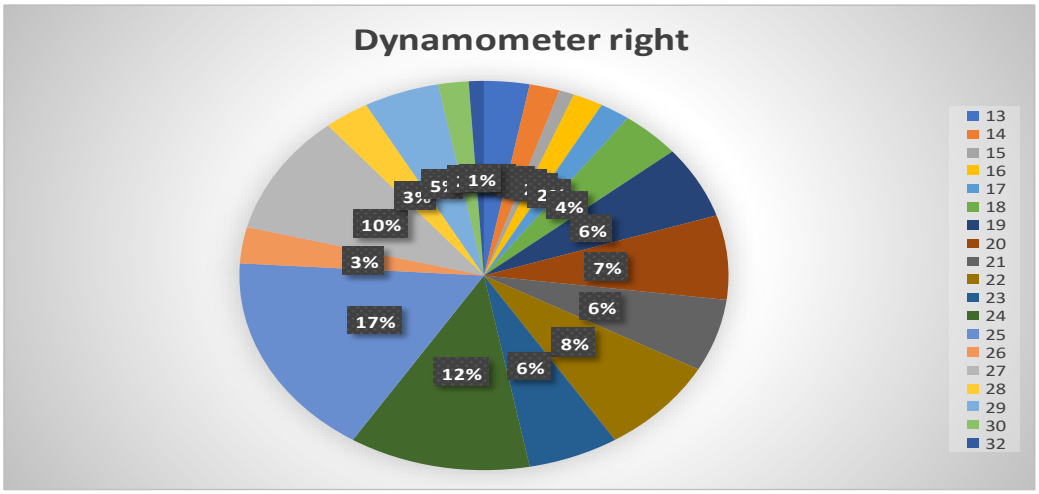
	Shapiro-Wilk		
	Statistic	**Statistic**	**Statistic**
Work experience	0.922	100	0.000
Dynamometer Right	0.975	100	0.055
Dynamometer Left	0.994	100	0.925
Pinchmeter Right	0.851	100	0.000
Pinchmeter Left	0.720	100	0.000

Age	Frequency
18-23	23
24-29	63
30-35	14

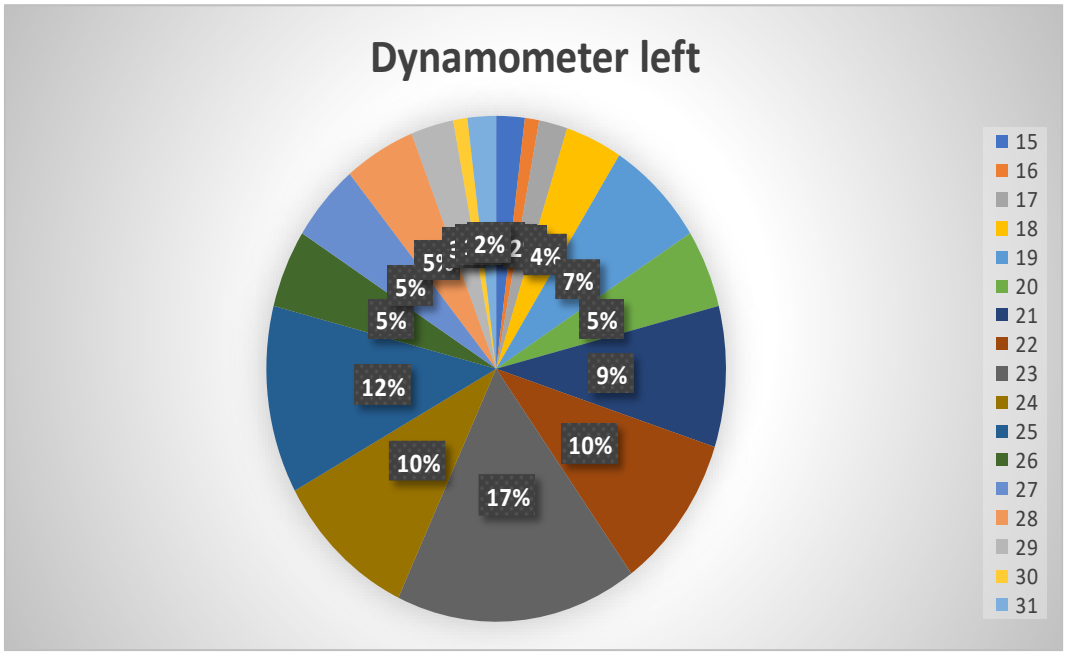
Table 01 Age Group



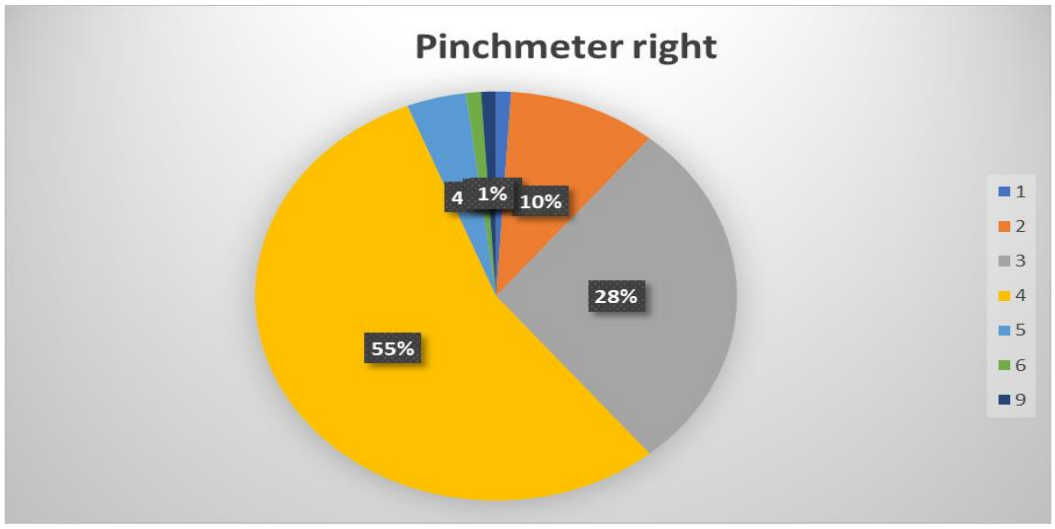
Dynamometer Right	
	Frequency
13	3
14	2
15	1
16	2
17	2
18	4
19	6
20	7
21	6
22	8
23	6
24	12
25	17
26	3
27	10
28	3
29	5
30	2
32	1



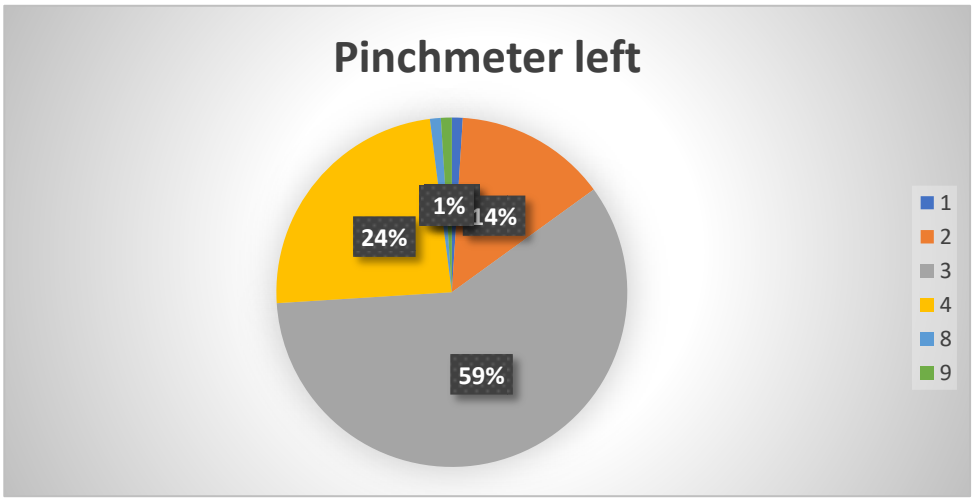
Dynamometer left	
	Frequency
15	2
16	1
17	2
18	4
19	7
20	5
21	9
22	10
23	17
24	10
25	12
26	5
27	5
28	5
29	3
30	1
31	2



Pinch meter right	
	Frequency
1	1
2	10
3	28
4	55
5	4
6	1
9	1



Pinch meter left	
	Frequency
1	1
2	14
3	59
4	24
8	1
9	1



DISCUSSION

The word Ergonomics in simple terms can be defined as the study of work. It helps to fit the job to the worker instead of fitting the worker to a job. Such a study deals with study of people at work, in terms of equipment design, workplace layout, the working environment, safety, productivity, and training, which in turn affects the physiology, biomechanics, psychology, anthropometry and kinesiology. Ergonomics helps in determining the risk and to initiate strategies to control work related musculoskeletal disorders. WRMSDs occur when there is an imbalance between physical capabilities of the worker and physical requirements of the job. Damage to a worker's body leading to MSDs can occur due to prolonged exposure to ergonomic risk factors. In beauticians the common risk factors could be repetition of movements; awkward postures, or unsupported positions, static postures, or maintained for long periods of time, Motion, such as increased speed or acceleration when bending and twisting, can body; Compression, from grasping sharp edges like tool handles, can concentrate force on small areas of the body, Inadequate recovery time due to overtime, lack of breaks, and failure to vary tasks; Excessive vibration, usually from vibrating tools. One of the most frequently affected areas is the arms, mainly the wrist and fingers that can lead to tendon disorders such as tendinitis, tenosynovitis, De Quervain's disease, trigger finger, and carpal tunnel syndrome, Raynaud's syndrome, etc. [1]

An investigation into the potential health concerns associated with beauty therapy practices that involve massage and spray tanning treatments revealed that beauty therapists used longer, non-neutral movements during massage treatments. Among them, non-neutral neck/trunk postures accounted for 90%, and non-neutral wrist postures for 64%. According to the REBA study, 73% of the trunk, 75% of the neck, 81% of the shoulder, and 68% of the wrist positions were deemed to be non-neutral. Later on in the job, non-neutral postures have an adverse effect on beauticians and might result in injuries. A study on symptoms associated with work in hairdressers showed controls (6%) reported current pain, more hairdressers (30%) reported wrist and hand pain than controls (14%), and (19%) reported having experienced hand or wrist pain in the week prior. A much higher percentage of hairdressers believed that this pain was related to their jobs. [4] Musculoskeletal disorders associated with the workplace, such as De Quervain's tendinitis, tennis elbow, carpal tunnel syndrome (CTS), etc., can result in pain that impairs one's ability to perform their job and weakens their hands and wrists. [1]

Numerous factors can impact grip strength, and certain research have been conducted to

investigate these effects. Strength of muscles is among these elements. The strength of the resulting grip is largely dependent on the interaction of different muscle groups and the synergistic action of the flexor and extensor muscles. The strength of the grip can be affected by a variety of circumstances, such as weariness, hand dominance, time of day, age, nutritional status, pain, patient compliance, and the existence of amputations, restricted motion, pain, and sensory loss. [14]

As previously reported, our study shows a significant prevalence of hand/wrist complaints, primarily due to high exposure to physical risk factors (work at extended sitting and demanding body postures). The prevalence of musculoskeletal problems in different body sites was found to be significantly correlated with self-reported physical risk factors such as extended sitting, using vibrating instruments, reaching far, and adopting awkward body positions. It must be underlined that substantial interrelationships are expected within variables, given the nature of cosmetologists' activity. For instance, "prolonged sitting" could stand in for laborious tasks requiring the flexion and extension of the wrists and hands. Similarly, "manual handling of vibrating tools" can mean that they must operate with their trunk bent far forward, which could result in a non-neutral neck position that puts strain on the vertebrae and muscles of the neck. This emphasizes how important it is to do a comprehensive ergonomic examination of the cosmetology practice activities that can result in musculoskeletal diseases. [15]

Hand dynamometer

The number of techniques and instruments have been used to measure hand grip strength, but many of have questionable reliability and validity. Jamar hand dynamometer was used as “gold standard” for the study because it has been supported by numerous studies. [9]

To measurement method was suggested by the American society of hand therapists (ASHT), in a seated position, rotate the shoulder joint inwards, bends elbow joint at 90 degrees, keep the forearm in neutral position and extend the wrist at 0-30 degree. The right- and left-hand measure 3 times in the same way and the average values was measured. The average value of right side was 23.35kg and the left side was 23.58kg.

Hand pinch meter

Pinch meter helps to determine the strength of pinches i.e. pad to pad, tip to tip and lateral pinch. The thumb is essential for pinch grips because it provides stability, power to grip and it also resists the pressure of the objects held in between it the fingers. Its loss can affect hand function greatly. The loss of hand function affects about 40%-50% hand function. [10]

Nail artist require pinch grip for various activity such as filing nails, holding art brush, sticking nail tips etc. and many more. Reduced strength pinches may affect these activities on a larger scale. Due to current use of index and thumb they are more prone to CTD’s injury, leading to weak muscles which cause inability to perform pad to Pad pinch with full strength.

CONCLUSION

In nail artist there is no significant difference in hand grip strength and pinch strength compared to normal individual. But evidence suggest that overuse injuries or repetitive strain injuries overtime have adverse effect on wrist and fingers which leads to muscle weakness and leading to inability to perform certain tasks.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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