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To Study the Knowledge and Awareness about the Problems Faced by the Left and Right-Handed Dominant Individuals among Physiotherapy Practitioners and Students

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Tanvi M. Mehta

Final Year Physiotherapy Student.

Trupti Yadav

Associate Professor, HOD, Department of Oncologic Physiotherapy.

Vira Pansare

Final Year Physiotherapy Student.

Amrutkuvar Rayjade

Associate Professor, HOD, Department of Manual Therapy.

Dhirajkumar A. Mane

Statistician, Directorate of Research Krishna Institute of Medical Sciences "Deemed to be University", Karad-415539, Maharashtra, India.

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Abstract

Background: In India, when some children are still compelled to use their right hand, there are also dominances other than right that are increasing. Since modern society is becoming less conservative, the percentage of people being identified as a leftist or an ambidextrous will continue to scale with time. Hence Physiotherapists should know the problems that different dominances face, teach them correct hand ergonomics and efficient writing grips to prevent overuse injuries. Incorrect activities, if continuously performed, may turn into a habit of the future. Physiotherapists must also be aware of the separate devices/tools available for non-right-handed people.

Method: This study included 351 physiotherapy students and practitioners, 328 right and 23 left-handed who were given the "Varying Hand Dominance, Varying Problems" questionnaire. Data was collected over google forms and interpreted via the Instat application.

Result: The study shows that 40.5% of the people feel that they are not well-versed in the concept of dominance ($p=0.4664$). They were forced to change their dominance ($p=0.0029$). All left-handed and 73.8% of the right-handed had knowledge about the difficulty in positioning hands during manual therapy techniques which may be pertaining to the dominance of the physiotherapist. ($p=0.0001$). 74% of the left-handed and 92% of the right-handed had pain of varying intensity after prolonged writing ($p=0.0108$).

Conclusion: This study proves that enforcement of dominance by parents is still prevalent ($p=0.0029$). Nearly half the population in this study, lacks knowledge about the problems faced by different-handed individuals and are unaware about tools for different hand dominances.

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1. Introduction:

Hand dominance or hand preference refers to the hand which shows the best efficiency to perform a particular unimanual action ^[1] Hand preference emerges early in an infant's life, where genetics and environmental influences are believed to play a key role in development ^[2]. Some researchers have suggested hand preference in adulthood may be predicted by lateralized motor behavior in early gestation, comparing ultrasound observation of thumb sucking ^[3] and neonate palmar grasp reflex strength ^[4].

There are four types of hand dominances left, right, ambidextrous and ambilevous. Left-handed discrimination is still prevalent in many countries. Children are forced to change their dominance to right. It is thought of as rude to eat, pick up, or hand over things with your left hand. Even language shows that the left-handers have a bad reputation. In French "gauche" means left or clumsy. In English, the word "left" comes from the Anglo-Saxon word left meaning weak.

We live in a right-hander's world ^[5] most tools, utensils, office equipment, home appliances, clothes, medical instruments, sporting goods, weapons and public facilities are designed for people who are right-handed. Many left-handed people have to endure a certain amount of inconvenience, pain and difficulty in carrying out daily activities in such an environment. ^[6] ^[7]. Although left-handers have gotten accustomed to using right-handed devices, an underlying preference for objects that afford the dominant hand could remain. ^[8] The number of dominances other than right that is increasing with each age group is certainly due to modern society becoming less conservative. It is very likely that the overall percentage of people being identified as a leftist or an ambidextrous will continue to increase over time. ^[6]

2. Methodology:

India has a population of more than 125 billion people with a majority of right-handed-dominant. 10 to 12% i.e. more than 10 crores of this population is left-handed. ^[5] Thus the population of left-handed and ambidextrously-handed is large. The main

objective of this study was to make physiotherapists realize that dominance-related concepts along with correct hand ergonomics and efficient grips need attention. They must urge their patients to use the correct tools to prevent wrong and continuously performed activities that may put undue strain on the muscles and hamper a patient's performance. Such activities should not be allowed to turn into a habit that they carry with them in the future.

• Participants

Physiotherapy students from the first, second, third, and fourth year, interns, and first and second MPTh along with physiotherapy practitioners of all age groups and genders were included. Participants who were not willing to be a part of the study were excluded.

• Procedure

The study involves a voluntary sample of 351 students studying physiotherapy and physiotherapy practitioners, both males and females. They were recruited via word of mouth. Volunteers were informed about the details of the study. First, the Dutch Handedness questionnaire [Edinburg's handedness questionnaire] was used for the participants to realize that hand dominance cannot be judged only by the hand that is used to perform the activity of writing. With this questionnaire one can determine the handedness of the participant and whether they were forced to change their hand dominance in their early childhood. This questionnaire measures the extent of your handedness ^[9]. The next step was to assess the knowledge and awareness among the participants regarding the problems faced by the left and right-handed dominant people. A self-designed, copyright questionnaire, developed in English was used. This questionnaire is called "Varying Dominance, Varying Problems Questionnaire. It consists of questions that tested the knowledge of dominance and its clinical application and questions that tests awareness about different tools available in the market for different-handed people. Here the individual had to respond with "Yes" or "No". Consent of the participants was taken and the questionnaire was circulated via google forms for data collection for a period of 1 month The study was conducted over a period of 4 months from June 2021 to September 2021. This questionnaire investigates if people were ever forced to change

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their dominance as a child, and whether the participants are capable of rehabilitating individuals with dominances other than right by laying down various concepts related to hand dominance like efficient and inefficient grips of writing, grip strength, writing style, hand ergonomics etc. Awareness was judged by asking about tools and devices that are available for different-handed people which they can buy and use according to their suitability and dominance.

• Statistical Analysis

With 5% of level of significance and 90% power the collected data of 351 participants was interpreted via the INSTAT application. Using contingency tables, the responses were entered to which Pearson Chi-square test was applied to each of the questions and their p-values were obtained. $P \leq 0.05$ was taken as statistically significant.

3. Results:

A total of 351 participants took part in this study and were asked to fill out a questionnaire. The demographic dataset is summarized in Table 1. Maximum participants lie in the age group of 21 to 24 years (56.4%). In this study the male to female ratio is 1:7. There are 23 left-handed dominant and 328 right-handed dominant individuals. 8 out of these 328 right-handed were forced to change their dominance to right while they were young. Hence the actual population of left-handed could have been 51. Table 2 gives a simplified version of responses obtained from the number of people who gave the response in "yes" and the number who gave "no". Table 3. Illustrates responses according to the dominance of the individuals participating. The reason for dividing the participants according to

their dominance was to know if the left-handed people had more knowledge or whether they were more aware of the different devices made especially available for them as compared to the right-handed dominant. But a good percentage of leftists weren't aware. From the first question, we can infer that out of the 23 left-handed people, 26.08% of them were forced to use their right hand but continued to stay as a leftist. Out of the 328 right-handed, 28 (8.5%) of them had a preference for left hand but were forced to change their dominance to right (their non-preferred hand), ($P=0.0029$). Hence 9.7% of participants were forced to change their dominance while they were young. Initially, 78.3% of the left-handed and 76.5% of the right-handed have said that they have knowledge about the importance of knowing dominance ($P=0.8666$) but in the last question when asked if they were well-versed with the concept of dominance, out of the 78.3% only 65.2% of the left-handed dominant people agreed. Similarly, 59.1% of the people understood the concept of dominance well but previously 76.5% of the right-handed had said that they have knowledge about the importance of knowing dominance ($P=0.4664$). Hence there were more people who felt that it was important to know the dominance of the patient but even a lesser number were actually well-versed with that concept. 74% of the left-handed and 92% of the right-handed had pain of varying intensity after prolonged writing ($p=0.0108$). There were 53 individuals who had pain at the intensity of 5 on Numerical Rating Scale for pain and 30 individuals whose pain intensity was above 7.^[10] All left-handed physiotherapists in the study said that they have difficulty in positioning their hands in manual therapy techniques which may be pertaining to their dominance. 73.8% of the right-handed population felt the same. ($P=0.0001$)

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Tables

Table 1: Demographic Details of the individuals

Age(years)	16-20	132(37.6%)	Left	10 (2.8%)
			Right	122 (34.8%)
	21-24	198(56.4%)	Left	11 (3.1%)
			Right	187 (53.2%)
	25 and above	21(6%)	Left	2 (0.6%)
			Right	19 (5.4%)
Gender	Female	310 (88.3%)	Left	20 (86.9%)
			Right	290 (88.4%)
	Male	41 (11.7%)	Left	3 (13%)
			Right	38 (11.6%)
Which hand do you use for writing?	Left			23 (6.6%)
	Right			320 (91.2%)
	Was forced to change the dominance to right.			8 (2.3%)

Table 1 shows the different age groups and genders that are part of the study and the number of left and right handed individuals in each of the group. It also shows the hand preferred by the participants to write and if they were originally leftist and were force to change their preference to right.

Table 2: Frequency and percentage of the responses to knowledge and awareness

Questions	Yes		No	
	n	%	n	%
Forced to change your dominant hand.	34	9.7	317	90.3
Importance of knowing the dominance of a patient.	269	76.6	82	23.4
Problems faced by the opposite dominance.	206	58.7	145	41.3
Various objects used in daily life for different dominant handed.	280	79.8	71	20.2
Various kitchen tools available different dominant handed.	225	64.1	126	35.9
Architectural changes needed to be made for different dominant handed.	216	61.5	135	38.5
Various writing materials available for different dominant handed.	154	43.9	197	56.1
Availability of these tools/materials in the market.	117	33.3	234	66.7

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Pain/discomfort after prolonged writing.	319	90.9	32	9.1
Efficient and inefficient grips.	236	67.2	115	32.8
Types of efficient writing grip.	246	70.1	105	29.9
Types of inefficient writing grips.	198	56.4	153	43.6
Dominance and its impact on grip strength.	300	85.5	51	14.5
Dominance and its impact on writing style.	293	83.5	58	16.5
Setting protocols of the patient.	238	67.8	113	32.2
Advising ergonomics to the patient.	254	72.4	97	27.6
Designing physiotherapy tools.	295	84	56	16
Setting up/designing a physiotherapy department.	288	82.1	63	17.9
Positioning of the hands in manual techniques.	265	75.5	86	24.5
Clarity of concept of dominance.	209	59.5	142	40.5

Table 2 illustrates the number of responses with their percentage in “Yes” and “No” that gives an overall review.

Table 3: Responses are segregated into left and right handed dominance with their P-values and Chi square values.						
Questions	Left handed dominance (23)		Right handed dominance (328)		P value	Chi square value
	YES	NO	YES	NO		
Forced to change your dominant hand.	6 (26.08%)	17 (73.9%)	28 (8.5%)	300 (91.5%)	0.0029*	8.866
Importance of knowing the dominance of a patient.	18 (78.3%)	5 (21.7%)	251 (76.5%)	77 (23.5%)	0.8666	0.02823
Problems faced by the opposite dominance.	16 (69.6%)	7 (30.4%)	190 (57.9%)	138 (42.1%)	0.1051	2.626

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Various objects used in daily life for different dominant handed.	16 (69.6%)	7 (30.4%)	264(80.5%)	64 (19.5%)	0.1416	2.160
Various kitchen tools available different dominant handed.	15 (65.2%)	8 (34.8%)	210 (64%)	118 (36%)	0.8825	0.02182
Architectural changes needed to be made for different dominant handed.	14 (60.9%)	9 (39.1%)	202 (61.6%)	126 (38.4%)	0.8845	0.02112
Various writing materials available for different dominant handed.	13 (56.5%)	10 (43.5%)	141 (43%)	187 (57%)	0.0897	2.880
Availability of these tools/materials in the market.	5 (21.7%)	18 (78.3%)	112 (34.1%)	216 (65.9%)	0.0832	3.001
Pain/discomfort after prolonged writing.	17 (74%)	6 (26%)	302 (92%)	26 (7.9%)	0.0108*	6.503
Efficient and inefficient grips.	17 (73.9%)	6 (26.1%)	219 (66.8%)	109 (33.2%)	0.3522	0.8655
Types of efficient writing grip.	18 (78.3%)	5 (21.7%)	228 (69.5%)	100 (30.5%)	0.1999	1.643
Types of inefficient writing grips.	13 (56.5%)	10 (43.5%)	185 (56.4%)	143 (43.6%)	1.000	0
Dominance and its impact on grip strength.	20 (86.9%)	3 (13%)	280 (85.4%)	48 (14.6%)	0.8385	0.04153
Dominance and its impact on writing style.(Slopes and strokes of the letters)	19 (82.6%)	4 (17.4%)	274 (83.5%)	54 (16.5%)	1.000	0
Setting protocols of the patient.	15 (65.2%)	8 (34.8%)	223 (68%)	105 (32%)	0.7645	0.08978

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Advising ergonomics to the patient.	14 (60.9%)	9 (39.1%)	240 (73.2%)	88 (26.8%)	0.0981	2.736
Designing physiotherapy tools according to dominance.	19 (82.6%)	4 (17.4%)	276 (84.1%)	52 (15.9%)	0.8489	0.03629
Setting up/designing a physiotherapy department.	18 (78.3%)	5 (21.7%)	270 (82.3%)	58 (17.7%)	0.5959	0.2813
Positioning of the hands in manual techniques.	23 (100%)	0 (0%)	242 (73.8%)	86 (26.2%)	0.0001*	27.630
Clarity of concept of dominance.	15 (65.2%)	8 (34.8%)	194 (59.1%)	134 (40.9%)	0.4664	0.5306

4. Discussion:

It has been shown that approximately 90% of the population shows a preference for the right hand, with the other 10% preferring the left hand. ^[5] But one needs to scrutinize these values and obtain more accurate data that covers a large portion of the world. A physiotherapist must know about the problems a patient may face during rehabilitation. E.g. if an injury/trauma occurs to the dominant hand, especially if they are leftist, will the patient's dominance affect the prognosis? Would certain changes have to be made in the treatment plan because of the activities performed differently by that dominance? Will the injured hand be able to do activities in the same manner as the pre-injury status?

More studies can be carried out in the health profession itself, to see if different dominances have issues with using tools that may not be designed for their dominance or because of poor grip strength. ^[11] ^[12] ^[13] Physiotherapists with greater work experience can be assessed for their grip strength with respect to their dominance ^[14] they can also be assessed for pain while performing a manual therapy technique.

In this study, left-handed individuals knew how difficult it is to position their hands during manual therapy, therefore there is a possibility that they may themselves be facing an issue. Hence awareness can be made among the teaching staff for the same and further research can be carried out in this field. A study revealed that work-related musculoskeletal disorders are common in physiotherapists, where manual therapy techniques accounted for 58.6%. But this study doesn't differentiate patients according to their dominance to understand which dominance is more prone to get affected. ^[15]

Many tools that are easily available in daily life are meant for right-handed. ^[7] Left-handed pens have a special hooked tip that allows lefties to see what they are writing, which prevents smudging, hooking of their wrists or tilting their body or the book and write. ^[12] Pen grips that designed to achieve an efficient grip, calligraphy and fountain pens designed in a way that their tip opens on the left side, rulers, sharpeners, paper cutters and spiral binded books are examples of left-handed stationery

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products. 56.1% of the people weren't aware of the different stationery. The primary difference between left and right-handed scissors is the way the blades are connected. With a standard pair of open scissors, the blade on the right side goes up and the blade on the left side goes down. It doesn't matter if you turn the scissors over, or change the contour of the handles; the position remains the same. The left-handed scissor is the exact opposite. This means the blade on the right sits on the bottom. The bicycle ring, the computer mouse should be present on the dominant side. Many study desks have no elbow support on the left side but research says that typing desks should be designed in a way, where both the hands are given armrest and wrist support.^[16] Wrong school desks could be one of the factors why 90.9% of the participants said that they experience pain with prolonged writing whereas supported desks improves your handwriting, decreases pain caused because of awkward sitting and improves ergonomics.^[17] When a left-handed uses a right-handed vegetable peeler the blade goes upside down making it difficult to peel. A study describes how right-sided knives have serrations on a different side and if used by the left-handed will be inconvenient and dangerous because they are forced to cut at an improper angle.^[18] The graphics on mugs and measuring glass/cups show measurements printed on the opposite side if a left-handed were to hold. The cupboards, doors and refrigerators should have their handles/knobs placed on the dominant side. Important keys on the video-game controller are placed on the right side. Left-handed watches/Dextro watches can be comfortably worn on the right wrist whose crowns are on the left at 9'o'clock position. 83.5 % of the people agreed that writing style can differ with dominance. A significant difference was observed in left handed and right handed writing and was concluded that left-handed writers makes strokes in right-to-left direction and the slope of letters has an inclination in backward direction whereas right-handed writers makes strokes in left-to-right direction and the inclination of slope was in forward direction. For direction of stroke in letters having cross bar like t, f, A, E, F has a degree of variation in their formation were observed among the left-handed and right-handed writer. It was assumed that the left-handed writer makes the horizontal stroke in Right-to-Left direction in contrast to the right-handed writer who writes in left to right direction.^[19] 82.6% of the left-

handed and 84.1% of the right-handed had knowledge about applying dominance while designing splints, equipment for different-handed people. A study stated that the left-handed tend to use their left hands more with force-required motions than with accuracy-required motions, while ambidextrous and right-handed people use their right hands more with accuracy-required motions than with force-required motions^[6] This knowledge can be helpful while designing. The Vancouver school system issues 2 page brochures on left handed writers to primary teachers in 1954, emphasizing correct positioning of paper, and warning against conversion. This kind of awareness if given among teachers can go a long way in students having better posture and developing efficient grips^[20] There are many reasons for majority of population experiencing pain. ($p=0.0108$). The participants may not be using tools made for their dominance, they may not have an efficient writing grip or may not be following sound ergonomics.

Limitations-The gender distribution is poor. Subjects above the age of 25 are fewer as compared to other age groups, hence there is less population of physiotherapists with more years of work experience. No Ambidextrous or ambilevous categories of dominances were considered in the study.

The authors have no conflicts of interest.

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6. Conclusion:

The study was a genuine endeavor to test the knowledge and awareness about dominance and to contribute towards a better understanding of handedness. This study may lead to a tolerant attitude towards the left minority, to which the

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author herself belongs. We had assumed that the left-handed would be more aware of the existing devices in the market as they may have faced issues at some point of time in their life, be it in school or in daily life. But the study shows that 40.5% of the people still feel that they are not well versed with the concept of dominance. ($p=0.4664$) out of which there are 39.8% of left and 40.9% of right handed dominant. 74% of the left handed and 92% of the right handed had pain of varying intensity after prolonged writing ($p=0.0108$).

We aim that this study can help the physiotherapy and other academic staff to understand how dominance needs to be implemented while making treatment protocols, teaching manual therapy techniques and ergonomics. Lastly this study can help parents and educational institutions to take steps in the teaching children to write with efficient grips and provide infrastructural facilities comfortable for all kinds of handedness.

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