

# Prospective Cohort Study for Discectomy for Herniated Lumbar Disc in Resource Limited Hospital in Rural and Urban City: Loupe Vs Microscope

Ankitkumar Arunbhai Desai<sup>1</sup>, Siddharth Patel<sup>1</sup>, Kamlesh Jain<sup>1</sup>, Keyur Buddhdev<sup>1</sup>,  
Shubhdeepsingh Chugh<sup>1</sup>

## Abstract

**Introduction:** In resource limited hospital in rural and urban city where microscopes are not readily available, I hypothesize that if properly used, good magnifying loupes could offer comparable results to the microscope in relieving radiculopathy which is the primary goal of discectomy.

**Material and Methods:** Prospective cohort study was conducted on 49 single level lumbar disc prolapsed patients with radicular leg pain between January 2017 and March 2021. The microscope was used in 15 patients (29.9%) and loupe in 34 cases (70.1%). Pre-operative assessment clinical examination with spine assessment. Surgical indications included failure of at least 6 weeks medical, physio treatment, pain or progressive neurological deficits. Micro lumbar discectomy was done in all patients. Per-and post operative parameters recorded included: length of the incision, operative time, blood loss, the presence of a wound drain, length of hospital stay, leg and back pain before discharge and in follow up visits and complications. visual analogue scale (VAS) used as a tool.

**Results:** The demographic, clinical characteristic, radiological characteristics and surgical technique were similar and comparable ( $p>0.05$ ). The mean length of the incision was 2.5 cm for the microscope group and 3 to 3.5 cm for the loupes group ( $P$  value = 0.0007). There wasn't any statistically significant difference in both groups as regard the blood loss ( $p=1$ ), complication rate and length of hospital stay ( $p=0.21$ ). There wasn't any statistically significant difference in both groups as regard the blood loss ( $p=1$ ), complication rate and length of hospital stay ( $p=0.21$ ). There wasn't any statistically significant difference in VAS score for leg pain ( $p=0.32$ ) and low back pain ( $p=0.46$ ). Radicular pain recurred in equal proportion in both groups ( $p=0.17$ ). After 3-month post-operative there was VAS of ( $p=0.32$ ) in which there were 32 (92.6%) in group of loupe and 13 (86.2%) in group of microscope.

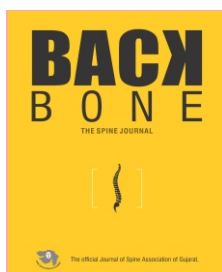
**Conclusion:** Operative microscope and loupes are both justifiable alternative device in lumbar micro discectomy since both have similar and comparable outcome. In rural n urban city hospitals with less resources & less access to microscopes and other minimally invasive equipment such as the endoscope, MLD system or tubular with proven safety and effectiveness over macro discectomy, loupes are safe and effective tools for in lumbar discectomy. Operating Microscopes is more surgeon friendly as it's gives good viewing angle without or less Work-related Musculoskeletal Disorders (WMSD).

**Keywords:** Microdiscectomy, Loupe, Microscope, Work-related Musculoskeletal Disorders (WMSD) Rapid Upper Limb

## Introduction

In Lumbar spine discectomy with decompression relieves pressure on the nerve by the cause of prolapsed disc result

would be improvement of symptoms and early regain of function [1-5]. Loupes and the microscopes are two most common magnification and illumination tools which were used in discectomy [1, 6-8]. In developed countries, microscopic discectomy [9] is the standard technique performed via small incision, significantly less tissue trauma, muscle dissection and bony destruction and conserving posterior ligamentous complex through dissection [10] with proven effectiveness over open macro discectomy [9, 11]. In resource limited regions & hospitals, micro lumbar



<sup>1</sup>Department of Orthopaedics, Haria L.G. Rotary Hospital, Vapi, Gujarat, India.

### Address of correspondence :

Dr. Ankitkumar Arunbhai Desai,  
Consultant Spine Surgeon, Department of Orthopaedics,  
Haria L.G. Rotary Hospital, Vapi, Gujarat, India.  
E-mail: dr.ankitdesai85@gmail.com

Submitted: 29/07/2022; Reviewed: 18/08/2022; Accepted: 21/01/2023; Published: 10/04/2023

Back Bone: The Spine Journal (The Official Journal Of "Spine Association of Gujarat") | Available on [www.backbonejournal.com](http://www.backbonejournal.com) | DOI: <https://doi.org/10.13107/bbj.2023.v04i01.054>  
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial-Share Alike 4.0 License (<http://creativecommons.org/licenses/by-nc-sa/4.0>)  
which allows others to remix, tweak, and build upon the work non-commercially as long as appropriate credit is given and the new creation are licensed under the identical terms.

discectomy with the use of loupes for illumination/magnification is prevalent as only 70% of surgeons in an advanced setting admitting using the microscope in one research survey [12]. For the purposes of being more surgeon friendly i.e., comfortability, providing better visualization and a comparatively better tool the microscope is favorable as per non-concurrent cohort found in English & French literature research papers [13]. Other authors are confirming visualization advantages & the facilitate the use of the microscope but argued that it does not improve the final results when compared to macro discectomy in longer period of follow ups [8, 14].

## Patients and methods

### Study Design:

Prospective cohort study on 49 patients having a single level lumbar disc prolapse with a radicular leg pain. Our preference was to use the microscope (“gold standard”) unless it was not available when we used loupes (Intervention group). The microscope (Zeiss OPMI pico) was used in 15 (29.9%) and loupe (ZEISS EyeMagproF 4X) in 34 cases (70.1%). All the operations were undertaken between January 2017 and September March 2021.

### Inclusion Criteria:

The indication for surgery was failure of medical treatment for at least six to eight weeks (Table 1) six patients who had earlier surgery (under six weeks) due to intractable pain & neuro weakness.

### Exclusion Criteria:

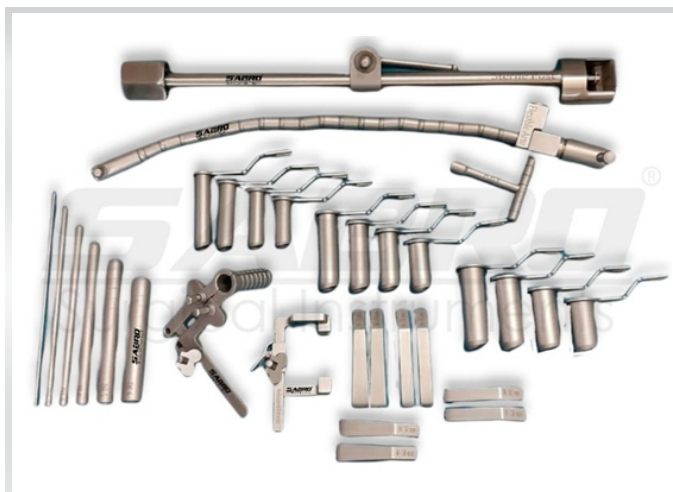
We excluded patients with multiple level disc disease, Previous surgery, multilevel canal stenosis, when there is need for fusion due to instability (Table 1).

**Table 1: Inclusion and Exclusion Criteria**

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>• Single level disc disease</li> <li>• Failed medical &amp; physio treatment</li> <li>• No previous lumbar surgery</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple level disc disease</li> <li>• Previous surgery</li> <li>• multilevel canal stenosis</li> <li>• When there is need for fusion due to instability</li> </ul>

### Pre-operative assessment:

All patients underwent a thorough clinical examination with spine assessment. The social, demographic data and medical history had been recorded by us. The radicular pain & its duration with disturbances in activity were noted its severity assessed by using the visual Analogue Scale (VAS) [15].



**Figure 1: Tubular Retractor System**

### Surgical technique

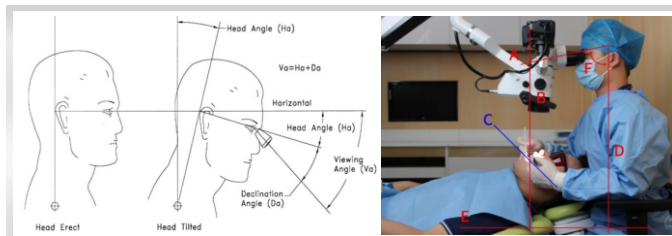
We operated on all patients under general anaesthesia. All patients received prophylactic antibiotics with the induction of anaesthesia. Patients were positioned prone using bolsters with protection of pressure areas. All aseptic precaution was taken before draping a patient. Erector spinae block given before incision. We marked the incision under the guidance of image intensifier (C-ARM) We used Tubular retractor system (Figure 1) and MLD SYSTEM (Figure 2) retractor in all cases. We used fluoroscopy (C-ARM) for the level marking and incision direction as per the disc fragment migration in all cases. Per-operative parameters recorded which includes length of the incision, operative time, blood loss, the presence of a wound drain, and complications of surgery.

### Postoperative care and assessment

Patients were mobilized on the same day. Routine NSAID were provided to patients postoperatively. Instructions were provided to the patients wound care & life style medication explain accordingly. Wounds care explain properly to patients. Back and leg pain score on the visual analogue score (VAS) before discharge and in their followup visit. Collected data included length of stay and post-operative complications.



**Figure 2: MLD System**



**Figure 3:** Different viewing angle with Work-related Musculoskeletal Disorders (WMSD) Rapid Upper Limb Assessment (RULA)

### Statistical Methodology

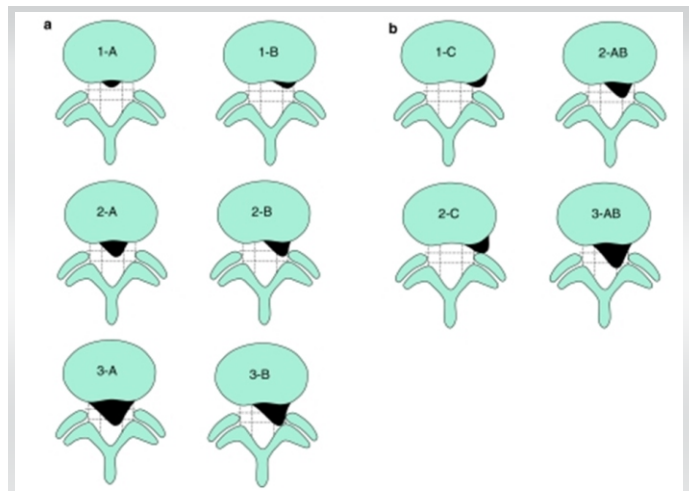
Chi-square tests and analyses of variance were used to compare the cases between the two treatment groups. Age, pain severity, duration of symptoms, were analysed as a discrete variable while sex, disc level, location and size were categorized. The main outcome measure was pain intensity at 3 months after surgery. Secondary outcome measures were: viewing angle in microscope & loupe for Work-related Musculoskeletal Disorders (WMSD) Rapid Upper Limb Assessment (RULA) (Figure 3) in treating surgeon, length of the incision, operative time, blood loss, the presence of a wound drain, complications of surgery and length of hospital stay.

### Results

49 patients underwent a single level lumbar microdiscectomy procedure for lumbar radicular symptoms in the five-year study period. 34 patients (70.1%) were operated using loupes and 15 patients (29.9%) using the surgical microscope. Mean age  $\pm$  Standard Deviation (SD) was  $39.5 \pm 9.4$  years (range 22-64).

There wasn't any statistically significant difference in the age ( $p$ -value= 0.56) nor sex ( $p$ -value= 0.48) for both treatment groups making them comparable as regard these demographic parameters (Table 2).

There wasn't any statistically significant difference in the baseline clinical features for both treatment groups making them comparable (Table 3). All the patients had low back pain and radicular pain. For both groups, the mean back pain VAS was 5.0 ( $p$ -value= 0.97) and leg pain severity score was 8.3 ( $p$ -value= 0.82). 5.5 months for the loupe group and 5 months for



**Figure 4:** MSU Classification For Herniated Disc

the microscope group with a  $p$ -value = 0.9 was the mean duration of pre-operative symptoms.

Most of the operated levels in both groups were L5/S1 and L4/5. Using the MSU Classification [16] for the grading of herniated disc size, there wasn't any statistically significant difference for both treatment ( $p$ -value=0.63) likewise for disc location ( $p$ -value=0.56). There wasn't also any statistically significant difference in the laterality of the disc (disc side) ( $p$ -value=0.17) and degree of disc generation using Pfirrmann's grading [17] ( $p$ =0.88), thus, both groups were comparable radiologically (Table 4).

### Outcome

Accordance to surgical technique, the mean length of the incision was 2.1 cm for the microscope group and 2.8 cm for the loupes group.

Although the difference was highly statistically significant ( $P$  value = 0.0007), the mean difference was only 0.7 cm. Patients of the "loupe" group had unilateral muscle separation, they also underwent more bilateral muscle separation than the "microscope" group. ( $P$ -value=0.011).

As the complication rate, hospital stay ( $p$ = 0.21), extent of bony work ( $p$ = 0.09), blood loss ( $p$ = 1), duration of surgery

**Table 2:** Patient baseline demographic data

Patients' Baseline Demographic Data				
	Total	Microscope	Loupe	P-Value
Variable	49	15	34	
AGE/Years Mean( $\pm$ SD)	39.49 $\pm$ 9.36	38.65 $\pm$ 10.79	39.85 $\pm$ 8.74	0.56*
SEX				
Male	32	10	22	0.48**
Female	17	05	12	

\*\*Pearson chi2  
\* t-test for equal variances

**Table 3:** Baseline Clinical data

Patients' Baseline Clinical Data				
	Total	Microscope	Loupe	P-Value
Variable	49	15	34	
Low Back Pain Severity Mean VAS $\pm$ SD		5.0 $\pm$ 1.8	5.0 $\pm$ 1.7	0.96*
Radicular Pain Severity Mean VAS $\pm$ SD	8.3 $\pm$ 1.3	8.3 $\pm$ 1.2	8.3 $\pm$ 1.4	0.82*
Straight Leg Raising Yes (SRL<60)= n (%)		12(79.31)	31 (92.65)	0.06†
No= n (%)		3(20.67)	3 (7.35)	
Duration of symptoms /months Median (P25, P75)	5(3 to 9)	5 (3 to 9)	5 (3 to 9)	0.90**

\* Two-sample t test with equal variances, †Fisher's Exact Test \*\*Two-sample Wilcoxon rank-sum (Mann-Whitney) test



**Table 4:** Baseline Radiological Data

Patients' Baseline Radiological Data				
Variable	TOTAL	MICROSCOPE	LOUPE	P-VALUE
Variable	49	15	34	
Disc Level				
L5-S1		7(51%)	16(48%)	0.092†
L4-L5		5(34%)	16(48%)	
L3-L4 + L2-L3 + L1-L2		3(15%)	2(4%)	
Disc Size				
I		2(14)	3(7)	0.63†
II		9(58)	20(60)	
III		4(28)	11(33)	
Disc Location				
A		1(7)	1(3)	0.56†
AB		6(45)	20(58)	
ABC		1(3)	1(4)	
B		5(34)	10(30)	
BC		1(7)	1(3)	
C		1(4)	1(2)	

†Fisher's Exact Test

( $p=0.85$ ), and technique of discectomy ( $p=0.18$ ) both the groups didn't show any significant statistical difference. (Table 5)

The median follow up period was similar in both groups ( $p=0.19$ ). For low back pain ( $p=0.46$ ) and leg pain ( $p=0.32$ ) the VAS didn't show any statistical difference massively. Radicular pain recurred in equal proportion in both groups ( $p=0.17$ ) (Table 6). Median leg pain dropped from 9 to 0 [25 cases (86.2%) with 3 months post-op VAS=0] and from 8 to 0 [63 cases (92.6%) with 3 months post-op VAS=0] on the visual analogue score for the microscope and loupes groups respectively at three months following surgery.

## Discussion

In resource limited regions & hospitals where microscopes are not available, we hypothesize that if properly used, Loupes for magnification could give comparable & satisfactory results to the microscope in relieving leg pain which is the only goal of

**Table 5:** Surgical Technique and Operative Outcome

Variable	Total	Microscope	loupe	P-value
Variable	49	15	34	
Length of Skin Incision (cm): Mean±SD	2.1±0.50	2.8±1.1		0.0007*
Muscle Separation				
Unilateral	35	13	22	0.011†
Bilateral		142	12	
Bony Work				
Fenestration	39	15	24	0.09†
Laminectomy		10	2	
Technique of Discectomy				
Classical Discectomy				
Bony Decompression without discectomy				
Duration of operation (minutes): Mean ±SD	44	13	36	0.18†
Volume of blood loss (cm)				
>100cc		5	1	0.85*
≤100 cc		84.3±19.0	85.3±24	
Unintended Durotomy=Yes n (%)				
CSF Leak=Yes n (%)				
Infection (Superficial) =Yes n (%)				
Length of Hospital Stay/days: Mean±SD				
		0	1	1†
		13	35	
	3	1	2	0.63†
	3	1	2	0.63†
	2	2		0.56†
	1.7±0.7	1.4±1.1		0.21*
†Fisher's Exact Test	‡Two-sample Wilcoxon rank-sum (Mann-Whitney) test			
* t-test for equal variances	**Pearson chi2			

**Table 6:** Follow up and Outcome of Pain

Variable n	Total	Microscope	Loupe	P-Value
Variable n	49	15	34	
Follow Up duration/months:				0.19‡
• Median (P25, P75)		6 (5 11)	5 (4 5)	
Immediate Post-op Severity of radicular pain:				
• Median (P25, P75)		0 (0 1)	0 (0 0)	0.62‡
• (min max)		(0 4)	(0 8)	
Severity of radicular pain at 3 months:				0.32‡
• Median (P25, P75)		0 (0 0)	0 (0 0)	
• (min max)		(0 9)	(0 6)	
Change in Severity of radicular pain (VAS pre-op- VAS at 3 months )				
• Median (P25, P75)		8 (8 7)	8 (8 9)	0.92‡
• (min max)		(1 10)	(1 10)	
Severity of low back pain at 3 months:				0.46‡
• Median (P25, P75)		2 (0 2)	1 (1 2)	
• (min max)		(0 6)	(0 6)	
Recurrence of sciatica=Yes n(%)	13	6 (46.8)	7 (53.2)	0.17†

†Fisher's Exact Test \* t-test for equal variances ‡Two-sample Wilcoxon rank-sum (Mann-Whitney) test

discectomy. We prefer for the use of the loupe in resource limited hospitals for easy access and visualization of the operating field, portability, easy to equipped, no maintenance fees and freedom to operate and comfort which may decrease operating times. Smaller magnification does not mean poor quality as there is no documented minimum threshold of magnification for optimal safe discectomy and that of the Loupes are enough for effectiveness and safe discectomy. Although WHO has proposed regarding viewing angle in microscope & loupe for Work-related Musculoskeletal Disorders (WMSD) Rapid Upper Limb Assessment (RULA) in surgeons. Considering the final RULA score, which provides the risk estimation for WMSD, we found that, for naked eye and medical loupes interventions there is a high risk, confirming the results in, while, for the surgical microscope, the total risk is classified just as 'low'. Estimate the risk of WMSD for different visual aids, pointing out that using the surgical microscope is less fatiguing than medical loupes and the naked eye [14].

Microscopic discectomy is the standard treatment [10, 18] for herniated lumbar disc with proven effectiveness and safety. However loupes are routinely used when the microscope is unavailable and open discectomy is not uncommon especially in developing countries. In 2009 Canadian national survey by Cenic and Kachur regarding the tool used by neurosurgeons for lumbar disc surgery; results revealed that 70% of responding surgeons routinely used the microscope and just less than 20% used loupes for magnification during lumbar disc surgery [12]. To the best of our knowledge, there is only one paper in the French and English literature comparing lumbar discectomy utilizing the loupes and the operating microscope with results in favour of the microscope with significantly better outcome, less complications and earlier return to function but non-significant difference in patient satisfaction and visual analogue score [13].

In resource limited settings where microscopes are not readily

available for the previously mentioned reasons, magnifying loupes offers comparable results to microdiscectomy and could be a more effective and safer alternative than open (naked eye) macro discectomy since the microscope has been proven to be superior to the latter [8, 14].

The baseline sociodemographic, clinical and radiological characteristics were similar in both treatment groups limiting bias and contribution to them for comparison (Table 2, 3 & 4).

“Expertise bias” is a major problem with the assessment of “tools” in surgery [16]. This wasn’t a major confounder in our study since both tools (loupes and microscope) were used by me as surgeons. Only patients requiring a single-level discectomy or decompression were included to reduce bias.

The mean length of the incision was statistically longer for loupes (2.8 cm) than for the microscope group (2.1 cm) ( $P=0.0007$ ), the standardized mean difference was only 0.7 cm. Even though there is a significant difference in the extent of muscle separation, more patients of the “loupe” group had bilateral muscle separation as well as unilateral muscle separation than the “microscope” group ( $p\text{-value}=0.011$ ).

In maximum cases, we used fluoroscopy and tailored the incision site according to the direction of the prolapsed disc, which reduces the incision length and avoiding muscle dissection or wound extension.

In study, we found no statistically significant difference between both groups in terms of extent of bony work, technique of discectomy, operative time, blood loss, length of hospital stay (Table 5). Kumar et al [13] found a longer operative time with the microscope and related it to be due to time needed to drape the microscope; in our study we found the converse. Our mean length of hospital stay was longer for the microscope group results similar to those of Kumar et al [13]. We didn’t assess the functional outcome, life quality & patient satisfaction, which I think would have provided more useful overall information of post-operative status [13] as Kumar et al.

## Conclusion

Operative microscope and loupes are both justifiable alternative device in lumbar micro discectomy since both have similar and comparable outcome. In rural & urban city hospitals with less resources & less access to microscopes and other minimally invasive equipment such as the endoscope, MLD system or tubular with proven safety and effectiveness over macrodiscectomy, loupes are safe and effective tools for in lumbar discectomy. Operating Microscopes is more surgeon friendly as it gives good viewing angle without or less Work-related Musculoskeletal Disorders (WMSD) [14].

## References

- [1]. Abou-Zeid A, Palmer J, Gnanalingham K. Day case lumbar discectomy--viable option in the UK? *Br J Neurosurg* 28:320-3, 2014.
- [2]. Pearson AM, Blood EA, Frymoyer JW, Herkowitz H, Abdu WA, Woodward R, et al. SPORT lumbar intervertebral disk herniation and back pain: does treatment, location, or morphology matter? *Spine* 15;33:428-35, 2008.
- [3]. Peul WC, van den Hout WB, Brand R, Thomeer RT, Koes BW. Prolonged conservative care versus early surgery in patients with sciatica caused by lumbar disc herniation: two year results of a randomised controlled trial. *BMJ* 14; 336:1355-8, 2008.
- [4]. Rothoerl RD, Woertgen C, Brawanski A. When should conservative treatment for lumbar disc herniation be ceased and surgery considered? *Neurosurg Rev* 25:162-5, 2002.
- [5]. Schoenfeld AJ, Weiner BK. Treatment of lumbar disc herniation: Evidence-based practice. *Int J Gen Med* 3:209-14, 2010.
- [6]. Koebe CJ, Maroon JC, Abula A, El-Kadi H, Bost J. Lumbar microdiscectomy: a historical perspective and current technical considerations. *Neurosurg Focus* 15; 13:E4, 2002.
- [7]. Newsome RJ, May S, Chiverton N, Cole AA. A prospective, randomised trial of immediate exercise following lumbar microdiscectomy: a preliminary study. *Physiotherapy* 95: 273-9, 2009.
- [8]. Tureyen K. One-level one-sided lumbar disc surgery with and without microscopic assistance: 1- year outcome in 114 consecutive patients. *J Neurosurg* 99: S247-50, 2003.
- [9]. Rasouli MR, Rahimi-Movaghar V, Shokraneh F, Moradi-Lakeh M, Chou R. Minimally invasive discectomy versus microdiscectomy/open discectomy for symptomatic lumbar disc herniation. *Cochrane Database Syst Rev* 9:CD010328, 2014.
- [10]. Riesenburger RI, David CA. Lumbar microdiscectomy and microendoscopic discectomy. *Minim Invasive Ther Allied Technol* 15:267-70, 2006.
- [11]. Schick U, Dohnert J, Richter A, Konig A, Vitzthum HE. Microendoscopic lumbar discectomy versus open surgery: an intraoperative EMG study. *Eur Spine J* 11:20-6, 2002.
- [12]. Cenic A, Kachur E. Lumbar discectomy: a national survey of neurosurgeons and literature review. *Can J Neurol Sci* 36:196-200, 2009.
- [13]. Kumar SS, Mourkus H, Farrar G, Yellu S, Bommireddy R. Magnifying loupes versus microscope for microdiscectomy and microdecompression. *J Spinal Disord Tech* 25: E235-39, 2012.
- [14]. Alberto Pispero, Marco Marcon, Carlo Ghezzi et al. Posture Assessment in Dentistry for Different Visual Aids Using 2D Markers. *Sensors* 2021, 21(22), 7717.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL  
Source of Support: NIL

#### How to Cite this Article

Desai AA, Patel S, Jain K, Buddhdev K, Chugh S | Prospective Cohort Study for Discectomy for Herniated Lumbar Disc in Resource Limited Hospital in Rural and Urban City : Loupe Vs Microscope | Back Bone: The Spine Journal | April 2023-September 2023; 4(1): 14-19 | <https://doi.org/10.13107/bbj.2023.v04i01.054>