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SJIR - Subharti Journal of Interdisciplinary Research
An Official Publication of Swami Vivekanand Subharti University



Vol. 1: Issue 1; Dec 2018

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Editorial

It is indeed a great pleasure for me that I have been assigned the honourable and mammoth task of starting the online journal for our prestigious Swami Vivekanand Subharti University. At the outset I would like to thank the Vice Chancellor and Management of our University who have shown faith in me by entrusting me with the privilege to serve as the Editor-in-Chief of the Subharti Journal of Interdisciplinary Research- An Official publication of Swami Vivekanand Swami University.

An enormous amount of hard work has been put in by the editorial team in giving a final shape to this inaugural issue of the online version of the journal. I sincerely hope that our hard work will have a titillating effect on the minds of the readers and followers too. The editorial team will bring about gradual changes in the near future for a successful indexation (ISSN no.) and more importantly try to incorporate new ideas, opinions and newer sections, for further progress of the journal. The journal will be a regular and timely publication which will have three issues in a year with issues in April, August and December.

The journal will aim to publish high-quality research and expert knowledge on topics that will ensure to further augment the day to day functionality. We will lay strong emphasis on interdisciplinary issues as we're conscious that many complex problems require multi-disciplinary solutions.

I would like to say an advance Thank you to all of you who are going to be with me in our journey to take the journal to a higher level.

On a positive note, I would like to extend an invitation to send the articles for publication in this journal. We look forward to welcoming your submissions.

Season's Greetings, Happy New Year and Happy Reading,

Dr Vijay Wadhwan

Editor-in-Chief

journal@subharti.org

Median Rhomboid Glossitis: Developmental anomaly or Acquired Disorder- A Review

Aakriti Maheshwari¹

1. Private Practitioner, Meerut

Abstract

Median Rhomboid Glossitis has remained as an enigma from the times immemorial and various researchers have argued over this entity being a developmental disorder or an acquired disorder of tongue. Over the years the terminology pertaining to median rhomboid glossitis has undergone many changes. The designated and common terminologies include Central papillary atrophy, Posterior lingual papillary atrophy and Posterior midline atrophic candidiasis. This review paper is an attempt to investigate the precise etiology, pathogenesis and treatment modalities of Median Rhomboid Glossitis.

Key Words: Median Rhomboid Glossitis, Tongue, Candidiasis

Address for Correspondence: Dr Aakriti Maheshwari, A 120- Ganga Nagar, Opp. Defence Colony, Mawana Road, Meerut-250001

Mail: aakritimaheshwari1995@gmail.com

Contact: +919634522199

Introduction:-

Median Rhomboid Glossitis has been considered as a developmental anomaly and in the recent years the focus has shifted on it being caused due to candida albicans, and majority of the patients responding to the antifungal agents. ⁽¹⁾

Median Rhomboid Glossitis has been classified under a broad heading of tongue diseases. Tongue diseases can be categorized as congenital and acquired. Some examples of congenital disorders include: Aglossia, ankyloglossia, hypoglossia, bifid tongue, microglossia, macroglossia etc. Some examples of acquired disorders include:-Vascular, Infective, Traumatic, Autoimmune, Inflammatory, Neurological, Neoplastic, Degenerative, Environmental, and unknown. ⁽¹⁾

Median Rhomboid Glossitis is an infective type of acquired disorder as the infective agent is C. Albicans which causes candidiasis and it is acquired later in life i.e after the birth of the child. Median Rhomboid Glossitis refers to a benign, ovoid/rhomboid mass that is situated in midline of the dorsum of the tongue just anterior to the V formed by the circumvallate papillae. It is an inflammatory lesion of the tongue, now believed to be secondary to candidiasis. This ovoid area is slightly raised from the rest of the tongue devoid of papillae. The elevated mass is often nodular and is occasionally fissured. ⁽²⁾

It is an uncommon condition, occurring with equal prevalence in males and females at any age

with slight male predilection. Most cases are not diagnosed until the middle age of the affected patient but the entity is present in childhood.

History :-

This condition is prevalent since 19th century and researchers are studying to know the root cause of it. Median Rhomboid Glossitis earlier was known to be a developmental anomaly rather than due to candida species. History reveals the condition was first described by Broeque & Pautrier in 1914, who reported 17 cases under the title "Glossite losangique midlane de la face dorsal de la langue".

In 1922 Arndt recorded 1 case and mentioned that 40 other cases of a similar nature had been observed by him in an eighteen month period at the skin clinic of University of Berlin. Then after a lot of investigations and researches in 1924, Lane reported a case and modified and shortened the original title to "Glossitis Rhombica Mediana". Then later Zimmerman reviewed the subject in 1928 on the basis of 29 cases which he had collected from literature up to that time. Akshier and Loos and Horbst each reported 1 case each in 1934. Till that time everyone believed that Median Rhomboid Glossitis was a developmental anomaly & not a candidal infection. ⁽³⁾

Historically this lesion was believed to be a developmental defect of tongue caused by failure of tuberculum impar to be covered by lateral processes of tongue. This was disproven when a study of 10,000

children were examined and no Median Rhomboid Glossitis lesions were found at all. Since then a consistent correlation with *C. Albicans* has been demonstrated. The studies are now conducted on the Median Rhomboid Glossitis to be a candidal infection and many have proved it to be true. ⁽¹⁾

Discussion :-

Median Rhomboid Glossitis is also known as Central Papillary Atrophy of the tongue or Glossal Central Papillary Atrophy".

Embryologically, the tongue is formed by two lateral processes (lingual tubercles) meeting in the midline and fusing above a central structure from the first and second branchial arches, the tuberculum impar. The posterior dorsal point of fusion is occasionally defective, leaving a rhomboid-shaped, smooth erythematous (reddish) mucosa lacking in papillae or taste buds. The papillae in this area undergo atrophy and the tongue appears smooth and flat. Thus Median Rhomboid Glossitis is a focal area of susceptibility to recurring or chronic atrophic candidiasis, prompting a recent shift towards the use of posterior midline atrophic candidiasis as a more appropriate and a diagnostic term. ⁽¹⁾

This term has certain difficulties; because not all cases show initial evidence of fungal infection and not all cases improve with anti fungal therapy. The erythematous clinical appearance is primarily due to absence of filiform papillae, rather than a local inflammatory changes as first suggested in 1914 by Broeque & Pautrier. The lesion is found in one of every 300-2000 adults, depending on the rigor of clinical examinations. It is seldom biopsied unless the red discolouration is confused with precancerous erythroplakia or its surface shows pronounced nodularity. ⁽³⁾

Median Rhomboid Glossitis was thought to be a developmental anomaly caused by failure of lingual tubercles to cover the tuberculum impar. In 1971, Baughman questioned this long held belief. He argued that if Median Rhomboid Glossitis is a developmental anomaly, it should have occurred more frequently in children. In 1975, Cooke found colonisation of the mucosa of the tongue by *C. Albicans*, in all the biopsies taken from 10 patients with Median Rhomboid Glossitis.

There appears to be a 3:1 male predilection. Those lesions with atrophic candidiasis, are usually more erythematous but some respond with excess keratin production, and therefore show a white surface change. Infected cases may also demonstrate a midline soft palate erythema in the area of routine contact with the underlying tongue involvement; this is commonly referred to as "Kissing Lesion". ⁽³⁾



Fig1: A typical appearance of a median rhomboid glossitis lesion on dorsal surface of tongue

This lesion occurs in <1% of the adult population. There is rarely soreness or pain associated with this oral condition. Apart from the appearance of the lesion there are usually no other signs or symptoms. The typical appearance of the lesion is an oval or rhomboid shaped area located in midline of the dorsal surface of the tongue, just in front of sulcus terminalis. The lesion is usually symmetric, well demarcated, erythematous and depapillated, which has a smooth, shiny surface. Less typically, the lesion may be hyperplastic or lobulated and exophytic. It is situated, anterior to the circumvallate papillae, at about the junction of the anterior 2/3rd and posterior 1/3rd of the tongue.

There may be candidal lesions at other sites in the mouth, which may lead to a diagnosis of chronic multifocal oral candidiasis. Sometimes an approximating erythematous lesion is present on the palate as the tongue, touches the palate frequently. The lesion is typically 2-3 cm in its longest dimension. Occasionally lesions are located somewhat anterior to the usual location. None have been reported posterior to circumvallate papillae. ⁽²⁾

Predisposing factors include smoking, denture wearing, use of corticosteroid sprays or inhalers and HIV infection. *Candida* species even in healthy people mainly colonises the posterior dorsal tongue. Median Rhomboid Glossitis is thought to be a type of chronic atrophic candidiasis. Microbial culture of the lesion usually shows *Candida* mixed with bacteria. ^(2,4)

Current thinking holds true that Median Rhomboid Glossitis is a chronic infection, since *Candida Albicans* can be seen on smears of material culture from lesions. Prior to biopsy, the clinician should be certain that the midline lesion does not represent a lingual thyroid, as it may be the only thyroid tissue present in the patient's body. Differential diagnosis includes: Gumma of tertiary syphilis, the Granuloma of tuberculosis, deep fungal infections, erythroplakia, geographic tongue and granular cell tumor. ⁽¹⁾

Histologically, Median Rhomboid Glossitis shows a smooth or nodular surface covered by atrophic stratified squamous epithelium overlying a moderately fibrosed stroma with somewhat dilated capillaries. A mild to moderately intense chronic inflammatory cell infiltrate may be seen within subepithelial and deeper fibrovascular tissues. Chronic candida infection may result in excess surface keratin or extreme elongation of rete processes and premature keratin production with individual cells or as epithelial pearls deep in the processes. Silver staining for fungus will often reveal candida hyphae and spores in superficial layers of the epithelium.⁽³⁾

The pseudoepitheliomatous hyperplasia may be quite pronounced and the tangential cutting of a specimen may result in the artifactual appearance of cut rete processes as unconnected islands of squamous epithelium, leading to mistaken diagnosis of well differentiated squamous cell carcinoma. Because of this difficulty, it is recommended that the patient be treated with topical antifungals prior to biopsy of a suspected Median Rhomboid Glossitis.^(3,5)

Treatment :-

No treatment is necessary for Median Rhomboid Glossitis, but nodular cases are often removed for microscopic evaluation. Recurrence after removal is not expected, although those cases with pseudoepitheliomatous hyperplasia should be followed closely for at least a year after biopsy to be certain of the benign diagnosis. If medications are necessary, anti-fungal rinses such as nystatin or using anti-fungal tablets, is effective to kill bacteria and reduce symptoms. Also to decrease the inflammation, corticosteroid paste can be prescribed. The lesion resolves quickly and completely and does not recur. Good oral hygiene at home may also reduce the risk of micro-organisms growth in the mouth.⁽¹⁾

Conclusion:-

Median Rhomboid Glossitis still gives rise to questions concerning its importance and etiology. We believe that Median Rhomboid Glossitis is a form of oral candidiasis. The etiologic factors for oral candidiasis suggested are almost same as Median Rhomboid Glossitis. So it should be treated as an infective disorder rather than a developmental disorder.

Conflict of Interest: None

Financial Support & Sponsorship: None

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How to Cite this article: Maheshwari A, Median Rhomboid Glossitis: Developmental anomaly or Acquired Disorder - A Review. *Subharti J of Interdisciplinary Research* 2018; Vol. 1: Issue 1, 1-3

Short-term effect of lower limb neural stretch versus pelvic traction along with spinal extension exercises on pain and disability in patients with lower back pain with radiculopathy: A randomized clinical trial

Sumit Raghav¹, Anshika Singh¹, R.K.Meena², Dr. Gaurav Pratap Tyagi³, Kapil Rastogi¹

1. Assistant Professor, 2. Professor & Principal, 3. Tutor/ Clinical Physiotherapist, Subharti College of Physiotherapy, Meerut, 250005

Abstract

Background: Low back pain with radiculopathy is a common condition among the musculoskeletal disorders. This problem is characterized by compression or inflammation and injury to spinal nerve and nerve root in lower back region. There are various Physiotherapy approaches towards in managing this problem. Traction or pelvic traction is a choice of treatment in managing such problems. Many previous data supports that the traction is helpful in reducing symptoms which evoked from this condition. On the other hand, many empirical data purports that neural stretch is a good choice of treatment in reducing symptoms in patients with low back pain with radiculopathy. The purpose of this study is to know the comparative effect of pelvic traction versus neural stretch in patients with low back pain with radiculopathy. **Material and Method:** The study was a randomized controlled trial with a sample of 30 subjects, 17 were female, 13 were male, and all subjects were assigned according to criteria (inclusion & exclusion) and carried out at physiotherapy OPD of CSS Hospital, Meerut. The subjects were equally divided into two groups such as group A (15 subjects, 9 male and 6 female), Group B (15 subjects, 4 male and 11 female). Pain and disability was assessed by using VAS and ODI questionnaire respectively. The subjects were reassessed at 3 weeks after completion of intervention. **Statistical Analysis:** All analysis was obtained using SPSS version 20.0. Demo graphic data of the patients including pain and disability were summarized. The dependent variables for the statistical analysis were VAS and ODI score. A base line data was taken and analyze. Paired and unpaired t-test was used in this study. A level of significance 5% was used to determine the statistical significance. **Results:** On measurement of Mean, Standard Deviation, t-test value and p-value, the results showed that there was significant difference in pain and disability with their VAS and ODI score ($p=0.000$) respectively. **Conclusion:** Study concluded that the difference from 1st to 21th day in VAS & goniometry score which shows that neural stretch is more effective than pelvic traction in order to decrease pain and disability in patients with low back pain with radiculopathy.

Key words: Neural Stretch, Pelvic Traction, VAS (Visual Analogue Scale), ODI (Oswestry Disability Index), LBP (Low Back Pain).

Address for Correspondence: Dr. Sumit Raghav, Assistant Professor, Subharti College of Physiotherapy, Meerut, U P. 250005

Mail – drsumitraghav@gmail.com

Contact: +918476079698

Introduction:-

Low back pain with radiculopathy is a common condition among the musculoskeletal disorders. This problem is characterized by compression or inflammation and injury to spinal nerve and nerve root in lower back region. It is often caused by occurrence of pathology in intervertebral disc such as disc prolapse or disc herniation¹.

In lumbar radiculopathy, pain travels from lower back region to lower extremity till to leg or foot. This is caused due to damage in lower spine, ranging from upper lumbar region to lower lumbar region and sacral region of spine². This problem caused by compression on nerve roots which exist from the different level of spinal segment. Tingling sensation, radiating pain, numbness and other special nature associated with pain³. This condition may be arising from any part of spine but lower spine or lumbar region is more susceptible for this problem⁴. Lower

back pain with or without radiculopathy is very common in general population. On the other hand, low back pain with radiculopathy has been reported with an incidence of 3% to 5%⁵.

The disc related origin of lumbar radiculopathy is around 2% out of a 12.9% incidence of low back pain complaints with working population 11% due to lumbar radiculopathy⁶.

The prevalence of lumbosacral radiculopathy has been situated from 9.9% to 25%. Risk factors for radiculopathy are activities that place an excessive or repetitive load on the spine. Patients involved in heavy labor or contact sports are more prone to develop radiculopathy than those with a more sedentary lifestyle⁷.

Firstly, this problem may be managed with conservative treatment. There are various Physiotherapy approaches towards in managing this problem. Traction or pelvic traction is a choice of treatment in managing such problems. Many previous data supports that the traction is helpful in reducing symptoms which evoked from this condition.

On the other hand, neural stretch is also an option to treat such problem. Many empirical data purports that neural stretch is a good choice of treatment in reducing symptoms in patients with low back pain with radiculopathy. The purpose of this study is to know the comparative effect of pelvic traction versus neural stretch in patients with low back pain with radiculopathy.

Objectives

1. To find out the effect of pelvic traction on pain and disability in patients with low back pain with radiculopathy.
2. To find out the effect of neural stretch on pain and disability in patients with low back pain with radiculopathy.
3. To find out the effect of pelvic traction versus neural stretch on pain and disability in patients with low back pain with radiculopathy.

Hypothesis

Null Hypothesis [H₀]

There will be no significant difference between the effectiveness of pelvic traction along with spinal extension exercises versus neural stretch in reducing pain and disability in patients with low back pain and radiculopathy.

Alternative Hypothesis [H₁]

There will be significant difference between the effectiveness of pelvic traction along with spinal extension exercises versus neural stretch in reducing

pain and disability in patients with low back pain and radiculopathy.

Materials And Method

The study was a randomized controlled trial with a sample of 30 subjects, 19 were female, 11 were male, and all subjects were assigned according to criteria (inclusion & exclusion) and carried out at physiotherapy OPD of CSS Hospital, Meerut. The subjects were equally divided into two groups such as group A (15 subjects, 9 male and 6 female), Group B (15 subjects, 4 male and 11 female). Pain and disability was assessed by using VAS and ODI questionnaire respectively. The subjects were reassessed at 3 weeks after completion of intervention.

Outcome Measures

Visual Analogue Scale (VAS)

The visual analog scale is one of the most basic pain measurement tools. It consists of a 10 cm line. The clinician can measure the place on the line and convert into it a score between 0 to 10 where 0 is no pain and 10 is bad as it could be⁸.

Oswestry Disability Index (ODI)

Oswestry disability index is a good functional scale because it deals with activity of daily living and therefore is based on the patient response and concerns affecting daily life. It is the most commonly used functional back scale. The disability index is calculated by dividing the total score (each section is worth from 0 -5). The 6 statements are scored from 0-5 with the first statement scoring 0 through to the last at 5⁹.

Test Procedure

Visual analogue scale (VAS)

VAS attempt to represent measurement quantities in terms of a straight line placed horizontally or vertically on paper. The endpoints of the line are labeled with descriptive or numeric terms to anchor the extremes of the scale and provide a frame of reference for any point in the continuum between intervals between the endpoints to assists the individual in grading responses. Commonly the entire visual analog line is 10 cm long. The patient is asked to bisect the line at a point representing self-reported position on the scale. The patient score is then obtained by measuring from the zero mark to the mark bisecting the scale.

Oswestry Disability Index (ODI)

Oswestry disability index is used to assess the patients subjective range of perceived disability related to his/her functional limitation, e.g., work status, difficulty in activity of daily living. The higher score show more perceived disability. Using the test at the initial visit helps the examiner understand the patient perception of how his/her back pain is affected his or her life. The higher score is indicative of the need for the more intensive treatment such as spinal manipulative therapy and education to help the patient understand the lower likelihood of disability related to back pain. It can be calculated by dividing the total score (0 -5) by no. of section answered and multiplied by 100.

Limitation Of Study

- Research is done only among particular age group
- Only disability and pain are measured.
- It is a short duration study.

Variables Pain and Disability

Study Design This is a randomized clinical trial.

Inclusion Criteria

- Age group between 20-40 yrs.
- Both Male and female
- Subjects with low back pain with radiculopathy

Exclusion Criteria

- History of fracture in the lumbar spine
- History of recent spinal or abdominal surgery
- Any skin allergy
- Allergy to moist heat pack
- Any rheumatic disease like RA, Ankylosing spondylitis etc.
- Gynecological causes
- Congenital cause like scoliosis, spondylolisthesis

Instrumentation

- Couch
- Stationary (Pen, Pencil)
- Goniometer (Universal type full circle goniometer)
- Consent Form

Procedure

After getting their informed consent, the subjects were randomly assigned and allocated in three groups. Subjects for research purpose were selected according to inclusion and exclusion criteria.

According to VAS score and ODI score, the data of pain and disability was collected and table of selected variants was prepared and sorting of data was done. The patients in the experimental groups, group A and B subjects followed moist heat pack (MHP), neural stretch and pelvic traction along with spinal extension exercises respectively. In both Groups, the subjects were advised to perform hot water fomentation and home-based ROM exercises program of the lower back region.

In group A, the neural stretch technique was implemented with three sets of ten repetitions on each treatment occasion for a period of 6 days/ week. In this group, the adjustable couch was used to treat the patients effectively. During neural stretch, position of the patients was confirmed on the basis of requirement.

In group B, the pelvic traction was implicated after the calculation of body weight. On the basis of previous empirical data, 1/3rd of body weight was usually implemented during pelvic traction. During pelvic traction, the position of the patient was supine lying with both hip and knee joint flexion 90^o rests on the stool which was situated under the thigh and leg. Pelvic traction was applied to the patient followed by 10 sec hold with 5 sec rest time for 15 minutes. This was implemented for 6 days/ week.

Data Analysis

All analysis was obtained using SPSS version 20.0. Demo graphic data of the patients including pain and disability were summarized. The dependent variables for the statistical analysis were VAS and ODI score. A base line data was taken and analyze. Paired and unpaired **t-test was** used in this study. A level of significance **5%** was used to determine the statistical significance.

Results

Table:-1, Showing comparison of VAS score between group A and group B

Groups	Time Period	Mean	SD	SEM
Group A	Pre	4.02	1.24	0.23
	Post	0.81	0.78	0.17
Group B	Pre	4.64	1.29	0.23
	Post	1.27	1.06	0.19

Table 1 shows an improvement in VAS score in both groups. It is evident that VAS mean score is highly improved in group A.

Table:-2, Showing comparison of ODI score between group A and group B

Groups	Time Period	Mean	SD	SEM
Group A	Pre	44.02	13.76	2.36
	Post	7.83	3.78	0.72
Group B	Pre	41.36	12.03	2.14
	Post	17.56	7.34	1.97

Table 2 shows that there is an improvement in ODI score in both groups. It is evident that ODI mean score is highly improved in group A.

Table:-3, Showing comparison of t-test value and p-value of VAS between group A and group B

Groups	Time Periods	t- test	p-value
Group A	Pre-Post	15.03	0.000
Group B	Pre-Post	14.17	0.002

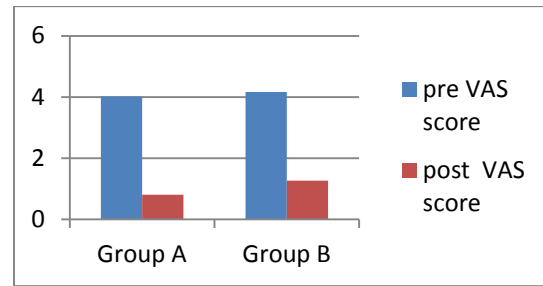
Table 3 represents the t-test value and p-value of VAS of group A and group B, by independent t-test for all the patients of group A and group B pre and post scores. It is observed that there is a significant difference present in both groups, but the group A is more significant than group B for average pre and post VAS scores at 5% level of significance.

Table:-4, Showing comparison of t-test value and p-value of ODI between group A and group B

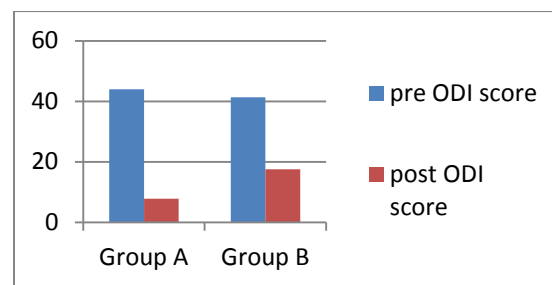
Groups	Time Periods	t- test	p-value
Group A	Pre-Post	14.37	0.000
Group B	Pre-Post	12.13	0.004

Table 4 represents the t-test value and p-value of ODI of group A and group B, by independent t-test for all the patients of group A and group B pre and post scores. It is observed that there is a significant difference present in both groups, but the group A is more significant than group B for average pre and post ODI scores at 5% level of significance.

Graph -1, Showing comparison of VAS score between group A and group B



Graph:-2, Showing comparison of ODI score between group A and group B



Discussion

This study provides data for pain and disability of persons who had complain of low back pain with radiculopathy. The data is sparse in between 20-40 age group since it was convenient to find people in this age group who could fit the inclusion criteria in this study.

In this study, data shows there is decreasing in VAS score and ODI score in patients with low back pain with radiculopathy. Both treatment neural stretchtechnique and pelvic tractionwith spinal extension exercises are effective in reducing pain and disability in patients with LBA along with radiculopathy. But neural stretch is more effective than pelvic traction in order to decrease pain and disability.

Data of VAS and ODI of two Groups, neural stretch group and pelvic traction along with spinal extension exercises program for pre and post interventional study are expressed in terms of mean, S.D and S.E.M is shown in table-1 and 2 respectively. Further application of independent t-test implemented to find the significant difference between pre and post intervention study between neural stretchand pelvic traction along with conventional exercises program, which revealed significance difference for the 15

patients each group individual at 5% level of significance.

In both groups, p-value was significant i.e., $p < 0.05$ with VAS and ODI score (0.0000) and (0.0000) respectively. The 3 weeks protocol of neural stretch technique and pelvic traction along with conventional exercises program showed difference in two groups individually in order to decrease the pain and disability but experimental group A, neural stretch technique showed statistically more significant difference in decreasing pain and disability.

A research was done by Dr. Ulhas Patil¹⁰, college of Physiotherapy, at Jalgaon. In this study, comparative effect was done between neural mobilization and intermittent lumbar traction in patients with lumbar radiculopathy. VAS and ODI were used as an outcome measure. Total number of 107 subjects were participated and allotted equally in two groups. One group received neural mobilization and other got traction. This study concluded that neural mobilization was more effective than intermittent lumbar traction in order to decrease pain in patients with lumbar radiculopathy.

Another study Clare JA et al¹¹, did a study on the effect of traction therapy in patients with low back pain with radiculopathy. Total number of 2177 patients was enrolled in their study but 1016 number of patients received traction therapy, and 1161 other treatment. There was strong evidence that there was no significant improvement in order to reduce the symptoms related with low back pain with radiculopathy.

Statistical parameters Mean and Standard Deviation were calculated and analysis of values with further application i.e. independent t-test showed considerable Mean variation. It is proved that neural stretch and pelvic traction along with spinal extension exercises were found to be effective in order to decrease pain and disability in patients with LBP along with radiculopathy. Finally, this study stated that neural stretch is more effective than intermittent lumbar traction with spinal extension exercises in order to decrease pain in patients with LBP along with radiculopathy.

Conclusion

The result of this study suggested that both the treatment method are effective in both the groups i.e.

group A and group B of patients of low back pain with radiculopathy but group A treatment method i.e. neural stretch is more effective than treatment method of group B i.e. pelvic traction along with spinal extension exercises. This study revealed that both the experimental group showed the difference in VAS and ODI scores. But group A, showed the significant difference in VAS and ODI scores. This study concludes that the patients who received neural stretch along with moist heat pack had less pain and disability. Finally, this study stated that neural stretch is more effective than pelvic lumbar traction with spinal extension exercises in order to decrease pain in patients with LBP along with radiculopathy.

Conflict of Interest: None **Financial Support & Sponsorship:** None

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How to Cite this article: Raghav S, Singh A, Meena R K, Tyagi GP, Rastogi K. Short-term effect of lower limb neural stretch versus pelvic traction along with spinal extension exercises on pain and disability in patients with lower back pain with radiculopathy: A randomized clinical trial. Subharti J of Interdisciplinary Research 2018; Vol. 1: Issue 1, 4-8

A Social Demographic Profile and Common Health Issues Of Scissor Manufacturing workers

Sartaj Ahmad¹, Saurabh Sharma², Bhawana Pant²

1. PhD (Medical Sociology), 2. M D

Department of Community Medicine, Subharti Medical College, Swami Vivekananda Subharti University Meerut UP

Abstract

Background: In India, the life of the vulnerable and the marginalized working population is at risk as there is a lack of awareness about occupational safety and environmental hazards. The scissor manufacturing workers sector is one of the important but unorganized parts of industry of India and mainly run by private establishments. The scissor manufacturing workers hardly ever follow any safety provisions as per recommended. **Aims:** The aim of the present study was to study the social demographic profile and common health issues of the workers in small scale scissors manufacturing industries in Meerut City. **Material and Methods:** The present cross-sectional study was conducted among 250 scissor manufacturing workers in urban Meerut. The data was collected after conducting the survey during the period Jan 2018 to July 2018 in different divisions (Heat treatment, Processing, Polishing, Plating, Edging, Buffing, and Packing) of the scissors industry in different areas of Meerut city. **Statistical analysis used:** The data was compiled and analyzed using Microsoft Excel and the results were expressed as proportions. **Results:** In the present study, (90.00%) respondents were males, (48.00%) workers were in the age group of 30-40 yrs. The majority (96.00%) workers were Muslims and (70.00%) were illiterate. (80.00%) respondents were ever married. 84.00 % workers were using tobacco related products. The commonest health problem present in workers was acute respiratory infection (ARI) (34.40%) followed by musculoskeletal problems in (26.00%). **Conclusion:** Scissor manufacturing workers suffer from various morbidities of acute respiratory infection (ARI) and musculoskeletal system. It is necessary to monitor the occupational environment and ergonomics in industry. Health status of the workers should be evaluated periodically. It is also necessary to create awareness regarding the ill effects of industrial hazards.

Key words: Scissor manufacturing workers, Social demographic profile, Health Problems ,

Address for correspondence: Dr. Sartaj Ahmad, PhD (Medical Sociology), Subharti Puram, Swami Vivekananda Subharti University, Meerut, UP, 250005

Mail: sartajsaleem@gamil.com

Contact: +919897093882

Introduction

In the world, one of the leading causes of morbidity and mortality is occupational health risks and they are more common in developing countries. ⁽¹⁾

In India, the life of the vulnerable and marginalized working population is at risk as there is a lack of awareness about occupational safety and environmental hazards. In small scale industries worldwide, over 1000 million people are employed. ⁽²⁾

The total economy of Meerut, scissors and sports industries holds the valuable status. Among the various small scale industries of Meerut city, scissors manufacturing industries provide employment to at least 3% population of the city. Heavy metals are chemical elements that have a specific gravity at least five times that of water. The heavy metals most often implicated in human poisoning are lead, mercury, arsenic, cadmium, corroded iron particles. Some heavy metals such as zinc, copper, chromium, iron and manganese are required by the body in small

amount, but these same elements can toxic in larger quantities. Heavy metals may enter the body in food, water or air by absorption through skin and by respiration. Once in the body, they complete with and displace essential minerals and interfere with organ system functions. People may come in contact with metals in industrial works. Scissors manufacturing industries are one of them.

Scissor manufacturing workers mostly suffer from various illnesses such as respiratory problems, musculoskeletal problems, eye diseases, skin problems. The scissor manufacturing workers hardly ever follow any occupational health and safety provisions. As they work for long hours, they may suffer from various health problems. Most of the health problems among them are due to the dust particles produced during various processes like heat treatment, processing, grinding, polishing, plating, edging, packing. The various socioeconomic factors

such as poverty, lack of education, poor diet, addictions, and poor working conditions also contribute to the ill health of the workers. [3]

The scissor manufacturing workers sector is an important but unorganized parts of industry of India and mainly run by private establishments. In India, the life of the vulnerable and the marginalized working population is at risk as there is a lack of awareness about occupational safety and environmental hazards.

The present study was conducted among scissor manufacturing workers with the objective of finding socio demographic status and Health status among scissor manufacturing workers.

Material and Methods

The present cross-sectional study was conducted among scissor manufacturing workers of urban Meerut. The study period was from Jan 2018 to July 2018 .The study included of 250 workers working in scissor manufacturing units.

A pre-designed, pre-tested semi structured questionnaire was used during interview of the workers. Before interview of the workers, they were explained clearly the purpose of the study and then verbal consent was obtained from them. The social demographic profile , economical factors and common health issues of scissor manufacturing workers were analyzed. Health status of the workers was assessed by asking questions regarding their health problems in the past 3 month period followed by clinical examination that included respiratory examination, eye check up.

Workers from scissor manufacturing units were randomly selected from every division of processing such as Polishing , Edging, Buffing , Plating and packing. General health status was assessed by asking questions regarding their health problems. The data were collected after conducting the survey during the period Jan 2018 to July 2018.

Statistical analysis:

The data was compiled and analyzed using Microsoft Excel and the results were expressed as proportions.

Table1: Socio-demographic characteristics of scissors manufacturing workers (N=205)

	Characteristics	Number and %age
Gender wise distribution		
	Male	225(90.00%)
	Female	25(10.00 %)
Age wise distribution		
	< 30 years	90(36.00%)
	30-40 years	120 (48.00%)
	>40 years	40(16.00%).
Religion		

	Muslim	240 (96.00%)
	Hindu	10(4.00%)
Marital Status		
	Ever Married	200(80.00%)
	Unmarried	50 (20.00%)
Educational Status		
	illiterate	175(70.00%)
	Literate	75 (30.00%)
Addiction		
	Tobacco related products.	210 (84.00%)
	Alcohol Consumption	40(16.00%)

Table 2: Health status of scissor manufacturing workers

No.	Health Problem	Number and percentage
1	Acute respiratory infection (ARI)	86 (34.40%)
2	Musculoskeletal problems	65(26.00%)
3	Chronic respiratory tract infection	55 (22.00%)
4	Tuberculosis	6 (2.40%)
5	Skin diseases	48(19.20%)
6	Eye problems	25 (10.00%)
7	Other Diseases	20 (8.00%)

Results

In our study, 225(90.00%) respondents were males and 25(10.00 %) were female. Maximum 120 (48.00%) scissor manufacturing workers were in the age group of 30-40 yrs followed by in the age group of <20 yrs 90(36.00%) and in the age group of > 40 yrs were 40(16.00%). Religion wise, the majority 240 (96.00%) scissor manufacturing workers were Muslims and 10(4.00%) were Hindu. Maximum respondents 175(70.00%) were illiterate and 75 (30.00%) were literate. 200(80.00%) respondents were ever married. Regarding history of addiction, 210 (84.00%) workers were using tobacco related products and 40(16.00%) scissor manufacturing workers were using alcohol.

The commonest health problem present in scissor manufacturing workers was acute respiratory infection (ARI) 86 (34.40%) followed by musculoskeletal problems was found in 65(26.00%) workers. Chronic respiratory tract infection was present in 55 (22.00%) workers. Tuberculosis was present in 06 (2.40%) scissor manufacturing workers. Skin diseases 48(19.20%) and eye problems 25 (10.00%) were found in scissor manufacturing workers. The few scissor manufacturing workers 20 (8.00%) were suffering from other diseases like deafness, gastritis, hypertension etc .

Discussion

In the present study, (90.00%) respondents were males, (48.00%) workers were in the age group of 30-40 yrs. The majority (96.00%) workers were Muslims and (70.00%) were illiterate. (80.00%) respondents were ever married. The similar results of socio demographic profile of scissor manufacturing workers were found in a study of Goel K et al (2003) In our study, Tobacco related products users were found (84.00%) although study done by Goel K et al (2003) suggested that the prevalence of tobacco use was found to be 85%.^[4]

According to NFHS III, in India, 55.8% males in the age group of 12-60 years have been found to be consuming tobacco. The reasons of tobacco consumption may be low educational status, occupation involving hard labour work during night shift work and low socioeconomic status.^[5]

In our study, (34.40%) workers were having ARI followed by Chronic respiratory tract infection (22.00%) and tuberculosis was present in (2.40%) workers. According to the study done by Goel K et al (2003) on scissor manufacturing workers, 40% workers were suffering from persistent cough and asthma was present in 28% workers.^[4] Another study done by Qurratul et al (2009) revealed that maximum scissor manufacturing workers were suffering from lung diseases.^[6]

An another study conducted by Mateos, F, et al. (1998) suggested that in Polishing, Edging & Buffing division 100% of the workers were suffering from lung diseases, 75-85% of the workers were found in Processing and Plating division and minimum 50% were in Heat treatment and Packing facing lung problems. It may be due to the reason that the workers working in the scissors industry come in direct contact with the iron sparkles, suspended particles of metal (Si, Fe, Cr, Ni and Brass etc.), iron and cotton dust, and fumes of acids, kerosene oil, Mobil oil.^[7]

The reason for such high prevalence may be due to reason that the workers working in the scissors industry come in direct contact with the iron sparkles, suspended particles of metal, iron and cotton dust and fumes of acids, kerosene oil.

The high prevalence of respiratory problem is alarming due to the smoking behaviour and hazards of scissors manufacturing workers industry. This may be explained by the fact that they were working in poor ventilated, overcrowded and poorly illuminated room.

In our study apart from respiratory infections, other health complications were found musculoskeletal problems (26.00%) among the scissor manufacturing workers. The high prevalence of musculo-skeletal problems is also important issue relating to scissor manufacturing workers. Mismatch between man and machine may be one of the major factor contributing to musculoskeletal problems.

In Scissors industry, several hazardous conditions exist, which synergistically affects the

health and comfort of the workers ultimately decreasing the work efficiency and hence productivity. It is necessary to monitor the occupational environment and health status of the workers periodically. It is also necessary to create awareness regarding the ill effects of industrial hazards. Every work place should have at least the minimum first aid facilities and access to trained personnel to provide emergency medical care. First aid facilities and trained personnel are important components of health and safety arrangements. Safety measures should be checked periodically for ensuring their utility during emergency situations. Use of personal protective equipments (PPE) like masks or respirators with mechanical filters or with oxygen or air supply, ear plugs, earmuffs should be made mandatory wherever threat to workers health and safety is anticipated. All workers using PPE should be trained in their use and maintenance. All workers must be given periodic medical examination.^[8]

The working hour, weight and education played a determining key role in the study. On an average, the workers in each division of the industry works for about 10-16 hours. The average weight of the worker did not reach above 58 kg & their education was not more than primary standard. The female were found to work only in the Packing division of the industry. Regular breaks in between work hours and rotation of jobs so that exposed workers are able to reduce the duration and intensity of their exposure. In scissor manufacturing workers, commonest morbidities detected were respiratory and musculoskeletal problems. In scissor industry, several hazardous conditions exist like poor ventilation, overcrowding and poor illumination which synergistically affects the health and comfort of the workers ultimately decreasing the work efficiency and hence productivity.^[9]

It is necessary to monitor the occupational environment and health status of the workers periodically. It is also necessary to create awareness regarding the ill effects of industrial hazards. Use of personal protective equipments (PPE) like masks or respirators, ear plugs, earmuffs should be regularly used by workers. Regular medical check-ups at periodic intervals at the workplace with increased emphasis on preventing health problems rather than curing them. Immediate intervention programmes are warranted to reduce the morbidities among the scissors manufacturing workers. Exhaust systems should be provided for Scissors manufacturing workers which ensure proper ventilation and regular supply of fresh air in group work spaces.

Conclusion

As scissor manufacturing workers suffering from various morbidities, it is necessary to monitor the occupational environment and health status of the workers periodically. It is also necessary to create awareness regarding the ill effects of industrial hazards.

Ethical Clearance

Before the start of the study, ethical clearance was taken from the Institutional Ethics Committee. The written consent of participants in the study will be taken each participant after explaining clearly the purpose and method of the study.

Conflict of Interest: None

Financial Support & Sponsorship: None

Acknowledgement:

Authors thank the entire team involved in data collection. The cooperation extended by the scissor manufacturing workers by sharing the information and sparing the time during the participation in the study is duly acknowledged. We also thank Dr Manoj Kumar Tripathi and Dr Arvind Kumar Shukla for their expert suggestions during the study.

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How to Cite this article: Ahmad S, Sharma S, Pant B. A Social Demographic Profile and Common Health Issues Of Scissor Manufacturing workers. Subharti J of Interdisciplinary Research 2018; Vol. 1: Issue 1, 9-12

Granular cell Ameloblastoma of the mandible – A rare case report with brief review of literature

Vandana Reddy¹, Vishal Bansa², Vijay Wadhwan³, Arvind Venkatesh⁴

1. Reader, Oral & Maxillofacial Pathology, Subharti Dental College
2. Prof & Head, Oral & Maxillofacial Surgery, Subharti Dental College
3. Prof & Head, Oral & Maxillofacial Pathology, Subharti Dental College
4. Private Practitioner, MDS, , Oral & Maxillofacial Pathology

Abstract:

Ameloblastoma is a locally invasive neoplasm derived from odontogenic epithelium. The tumor is made up of proliferating odontogenic epithelium especially of enamel organ-type tissue that has not undergone differentiation to the point of hard tissue formation. Granular cell ameloblastoma (GSMA), a variant of ameloblastoma, has been known to be a more aggressive form of ameloblastomas, with a higher incidence of metastasis than other forms. The present case is a GSMA of the mandible in a 32-year-old North Indian male, along with the characteristic clinical, radiographic, histopathological features which was managed by segmental mandibular resection followed by immediate soft tissue reconstruction using nasolabial flap and delayed hard tissue reconstruction using iliac crest graft due to the involvement of hard and soft tissue.

Keywords: Ameloblastoma; odontogenic tumors; autograft; reconstructive surgical procedures; mandibular reconstruction; reconstructive surgery, mandible

Address for Correspondence: Dr Vandana Reddy, Department Of Oral Pathology And Microbiology, Subharti Dental College And Hospital, Swami Vivekanand Subharti University, Meerut, U P 250005

E- Mail: drvandanareddy@rediffmail.com

Contact: +91 9897728587

Introduction:

Odontogenic tumours and tumour-like lesions constitute a group of heterogeneous diseases that range from hamartomatous or non-neoplastic tissue proliferations to benign neoplasm to malignant tumours with metastatic potential. They are derived from epithelial, ectomesenchymal and/or mesenchymal elements of the tooth-forming apparatus.^[1] Based on clinicopathologic criteria, ameloblastomas are divided into three fairly distinct types: solid or multicystic (SMA), unicystic and peripheral. SMA is a polymorphic neoplasm consisting of proliferating odontogenic epithelium usually occurring in two main patterns; follicular and plexiform. Apart from these common patterns, few variants of SMA have also been documented which include, acanthomatous SMA, Granular cell SMA (GSMA), desmoplastic SMA, basal cell SMA, clear cell SMA, keratoameloblastoma, hemangiomas, mucous cell differentiation in SMA and extragnathic adamantinoma.^[2] Knowledge of various histopathological subtypes is a prerequisite for accurate diagnosis and management. Hence, here, we report a case of large SMA involving the

mandible histologically exhibiting granular cell pattern treated by segmental mandibular resection followed by reconstruction of the defect with iliac crest graft along with review of literature on clinical, histological, theories for occurrence of granularity and treatment.

Case report:

A 32-year-old man reported to our institute with a swelling in the left mandibular region. History revealed that the swelling was initially small in size and grew over time to attain the present size. The swelling was associated with continuous dull pain. No signs of paraesthesia and anaesthesia. Extraoral examination revealed a firm to hard swelling causing facial asymmetry due to the large, diffuse swelling extending from right corner of the mouth crossing midline to the left angle region. Skin over the swelling was normal. (Figure 1)

On intraoral examination, the swelling extended from the 38 to 45 region, involving the left buccal vestibule, labial vestibule and floor of the mouth.



Figure 1: Extra –oral view showing facial asymmetry due to the large, diffuse swelling extending from right corner of the mouth crossing midline to the left angle region.

Mucosal ulceration in region 35 & 36 was evident. Swelling was firm to palpate & mobility was present from 36 to 45. (Figure 2)



Figure 2: Intra –oral view showing the the swelling from 38 to 45 region. Mucosal ulceration in 35, 36 region is appreciated.

Radiographically, the orthopantomograph showed a radiolucent multilocular lesion extending from 38 to 47 region involving the lower border of the mandible in the left posterior region giving a soap bubble appearance. Associated angular root resorption was evident in all the involved teeth. (Figure 3)



Figure 3: OPG showing radiolucent multilocular lesion extending from 38 to 47 region involving the lower border of the mandible in the left posterior region giving a soap bubble appearance.

Cone Beam Computed Tomography revealed an intraosseous multiloculated cystic-solid lesion showing bucco- lingual expansion without any definite soft tissue involvement. (Figure 4)

Based on the clinical and radiographic features, a provisional diagnosis of ameloblastoma was given. The differential diagnoses included central giant cell granuloma, odontogenic myxoma, and ameloblastic carcinoma.

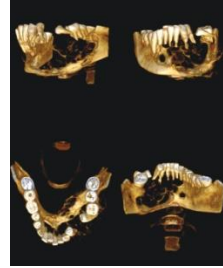


Figure 4: CBCT showing an intraosseous multiloculated cystic-solid lesion with bucco- lingual expansion.

An incisional biopsy was done in the left premolar region and sections from the specimen revealed ameloblastomatous odontogenic epithelium arranged in follicles, cords and strands.

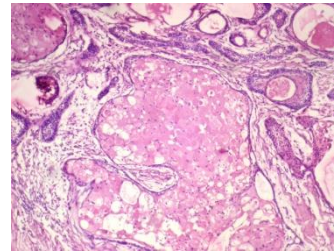


Figure 5: Ameloblastomatous odontogenic epithelium arranged in follicles, cords and strands. Transformation of the central stellate reticulum-like cells into large polyhedral cells with coarse granular eosinophilic cytoplasm, having an eccentric nucleus and poorly demarcated cell membranes. (H&E, original magnification x400)

Transformation of the central stellate reticulum-like cells into large polyhedral cells with coarse granular eosinophilic cytoplasm, having an eccentric nucleus and poorly demarcated cell membranes was evident in a majority of ameloblastomatous follicles. In addition, focal areas showing extensive squamous metaplasia, and keratin formation were evident within the islands of tumor cells. Based on these features, a diagnosis of Granular cell ameloblastoma was made. (Figure 5)

The tumor was managed by segmental resection from left body to left angle of mandible with 1 cm margins under general anesthesia via apron incision. Involved ulcerated mucosa was also excised along with bony resection and immediate soft- tissue reconstruction was done with right side nasolabial flap. (Figure 6)



Figure 6: Intra –oral view showing immediate soft-tissue reconstruction with right side nasolabial flap.

Although, mandibular reconstruction using iliac crest graft was intended taking the extent of the defect into consideration, due to the compromised nature of the soft tissue overlying the defect, immediate hard tissue reconstruction could not be performed. The proximal and distal segments were stabilized with locking titanium reconstruction plates and screws. (Figure 7)

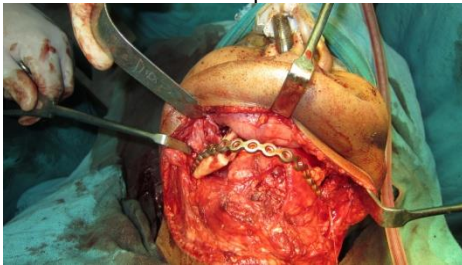


Figure 7: Intra –operative photograph showing stabilized proximal and distal with locking titanium reconstruction plates and screws.

Post operative healing was uneventful. The patient was advised for hard tissue reconstruction after 6 months, but he did not turn up for treatment. 18 months later, the patient reported with reconstruction



Figure 8: OPG showing reconstruction plate fracture.

plate fracture (Figure 8) which was removed and mandibular reconstruction was performed using an iliac crest graft.

Histopathological examination of the soft tissue harvested during reconstruction from the resection site was negative for recurrence of the tumour.

Review of literature and Discussion:

Ameloblastoma is a locally invasive neoplasm derived from odontogenic epithelium. The tumor is made up of proliferating odontogenic epithelium especially of enamel organ-type tissue that has not undergone differentiation to the point of hard tissue formation. Characteristically, the tumor lacks enamel and dentin. It has been postulated that the epithelium of origin is derived from one of the following sources: (a) epithelial lining of odontogenic cysts, (b) dental lamina or enamel organ, (c) disturbances of developing enamel organ, (d) basal cells of surface epithelium, or (e) heterotopic epithelium of other parts of the body. [3, 4, 5]

Granular cell ameloblastoma (GSMA), a variant of ameloblastoma, has been demonstrated in one series to be a more aggressive form of ameloblastomas, with a higher incidence of metastasis than other forms. It has been compared to the granular cell basal cell carcinoma. [6,7, 8] It was first observed by Krompecher in 1918 and was called pseudoxanthomatous cells. [9]

Hartman in the largest reported series, found it to represent 5% of all ameloblastomas.[6] In the clinicopathologic study of Kameyama et al, only 1 out of 77 ameloblastoma cases was classified as the granular cell subtype.[10] Reichart et al reviewed all available literature on ameloblastoma of the jaws from 1960 to 1993 and reported that out of a total of 1593 cases with available data on histologic subtypes, there were only 56 (3.5%) cases of the granular cell variant.[11]

Hartman studied 20 cases of GSMA from the files of Armed Forces Institute of pathology and suggested that the granular-cell ameloblastoma occurs predominantly at the posterior regions of the mandible, with no gender predilection and demonstrates a marked propensity to recur (73%) following conservative therapy. The average age of the patients in this series was 40.7 years (age range 21-65 years). Its age distribution is considered to be quite similar for which an average median age of 35 years old, ranging from 4 to 92 years, is reported. Subsequent reviews confirmed the strong propensity for involvement of the mandible.[6] The present case was reported in a 32 year old male patient in the left mandible.

In keeping with the morphological picture we were able to demonstrate the expression of cytokeratin in

the granular cell ameloblastoma. Slootweg et al and DeWilde et al obtained identical results in their studies. [12, 13]

Granular cells are associated with granular cell tumor, solid/multicystic ameloblastomas, ameloblastic fibroma, odontogenic fibroma, odontogenic cysts, and congenital epulis of the newborn. [14]

Numerous theories have been proposed on the origin and nature of these granular cells in ameloblastomas. These granular cells are epithelial in origin and several ultrastructural and histochemical studies have described them as lysosomes. Lysosomal aggregation within the cytoplasm is caused by dysfunction of either a lysosomal enzyme or lysosome-associated protein involved in enzyme activation, enzyme targeting or lysosomal biogenesis. [15]

It is evident from the literature, there exist two main lines of interpretation in that some consider it as a metabolic, whilst others of the view that it represent a degenerative process. More recent observations support the later view to be more tenable based on the increased expression of death signaling molecules. [15]

Nasu et al speculate that with age, the unnecessary/aged components progressively increase in the cytoplasm of some of the tumor cells, but the ability of lysosomes to dispose of these materials decrease, hence their cytoplasm becomes packed with lysosomal granules. [16] Tandler and Rossi in 1977 proposed that these lysosomes might have been a result of some genetic alteration in the granular cell. [17] An ultra- structural study by Kumamoto et al suggests that the cytoplasmic granularity might be attributed to the increased apoptotic cell death of the neoplastic granular cells and their subsequent phagocytosis by the adjacent granular cells. [18]

Ara et al suggested that the synthesis of signaling molecules, such as b-catenin and Wnt-5a is upregulated in the granular cells of GSMA, transportation or secretion is impaired, resulting their accumulation with granular cells, as autophagosomes. [19]

Reichart et al reported a 33% recurrence rate for granular cell ameloblastoma, which was higher, compared to the more common follicular, plexiform and acanthomatous subtypes. [11] In Hartman's study, 73% of the patients developed recurrent lesions. [6] However, similar to the other types of SMA, the prognosis is more dependent on the method of surgical treatment i.e. GSMA treated by enucleation

or curettage exhibit a high recurrence rate due to the fact that the border of the tumor within cancellous bone lies beyond the apparent macroscopic surface and the radiographic boundaries of the lesion. [20]

The aggressiveness of this has been correlated with an enhanced DNA synthesis and can also be attributed to the similarity of behavioural features between ameloblastoma and the dental lamina; complete surgical excision is the treatment of choice. Ameloblastoma is a tumor that frequently recurs after conservative treatment. The rate of recurrence ranges from 45% for en bloc resection to 54.1% for conservative therapy. [20]

Considering the behavior of the GSMA, in order to minimize the risk of recurrence, in the present case, segmental resection along with excision of the involved mucosa was performed which resulted in a large soft tissue and mandibular defect. The functional and aesthetic outcomes after segmental mandibular resection are closely related to the technique used during mandibular reconstruction with bone graft. In patients with large soft tissue and mandibular defect, free fibula mucocutaneous flap is the method of choice for reconstruction. Surgical skills and the availability of facilities are the limitations for such reconstructive procedures. At first, soft tissue reconstruction was carried out using nasolabial flap to facilitate a successful delayed reconstruction and to avoid graft exposure and resorption. Patient is under follow- up till date and shows no signs of recurrence. In order to improve the functional ability, prosthetic rehabilitation with implants is intended in future.

Conclusion:

The granular cell ameloblastoma is a rare condition with unique histopathologic and immunohistochemical findings; its treatment and prognosis do not significantly differ from those of other subtypes of the solid/ multicystic ameloblastoma. However, it should be differentiated from the other granular cell lesions primarily because of its higher recurrence rate. A better understanding of the molecular pathogenesis of ameloblastoma and its subtypes is under way and may provide diagnostic and therapeutic benefits.

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Conflict of Interest: None

Financial Support & Sponsorship: None

Acknowledgement: None

How to Cite this article: Reddy V, Bansal V, Wadhwan V, Venkatesh A. Granular cell Ameloblastoma of the mandible – A rare case report with brief review of literature Subharti J of Interdisciplinary Research 2018; Vol. 1: Issue 1, 13-17

Development and Validation of docking method for the generation of potent ligand as a PPAR δ agonists: Structure guided computational approach

Ganesh Prasad Mishra¹, Rajesh Sharma², Lubhan Singh², Umesh K Singh²

1 Kharvel Subharti College of Pharmacy, Swami Vivekanand Subharti University, Subhartipuram Delhi-Haridwar Meerut Bypass Road, NH-58, Meerut-250005

2 School of Pharmacy, Devi Ahilya Vishwavidyalaya, Takshshila Campus, Khandwa Road, Indore, M. P., India-452 001

Abstract

Molecular modeling plays a key role in identification of fundamental bimolecular events such as enzyme-substrate, drug-protein and drug-nucleic acid interactions. In the present communication, it deals with the docking study of para-alkylthiophenoxy acetic acids analogues. Accuracy of enzyme-ligand docking was validated on a set of 15 PPAR δ -ligand complexes for which crystallographic structures were available and generating root-mean square deviations below 2.0 Å. For designed compounds where the interactions and dock scores are being considered for evaluation, compound 19 and 20 exhibited best MolDock score -183.43 and -187.33 Kcal/mol respectively against PPAR δ than the remaining. Furthermore, molecular docking can be useful tool in the identification of novel molecule targeting specific amino acid residue and also provide novel insights in the discovery of novel PPAR δ agonistic agents.

Keywords: Moldock scores, RMSD, PPAR δ , ligand design, Validation

Address For Correspondence: Dr. Ganesh Prasad Mishra, CADD Division, Kharvel Subharti College of Pharmacy, Swami Vivekanand Subharti University, Delhi-Haridwar Meerut Bypass Road, Meerut-250005

E-mail: gmrDMishra@rediffmail.com

Contact: +91 9926866696

Introduction

The peroxisome proliferator-activated receptors (PPARs) are ligand-activated transcription factors that belong to the nuclear hormone receptor family [1,2] and acting as metabolic sensors regulating the expression of genes involved in glucose and lipid homeostasis [3,4]. Agonists of the PPAR α subtype [5] such as clofibrate and fenofibrate, and agonists of the PPAR γ subtype [6], such as rosiglitazone maleate and pioglitazone HCl, are used for the treatment of dyslipidemia and diabetes, respectively. PPAR δ subtype [7,8] is also involved in lipid metabolism and, unlike the other two PPAR receptors, is ubiquitously expressed, but the highest expression levels are found in tissues with high lipid metabolism including adipose, skeletal muscle and intestine.

X-ray crystallographic study revealed that PPAR δ has an exceptionally large ligand binding pocket, which is considerably larger than other nuclear receptors displaying a total volume of ~ 1300 Å³ [9]. The pocket forms a 'Y' shape comprised of three arms approximately 12 Å in length [10]. The Y-shaped molecules are potent and selective PPAR δ agonists.

Independently of the chemical class they belong to, typically PPAR agonists (Fig 1.) usually possess an acidic head group and hydrophobic tail group, connecting through a linkage group [11,12].

Compared with the PPAR α and γ subtypes, reports on selective PPAR δ agonists remained limited, and reported PPAR δ included 1,3,5-trisubstituted aryls, benzothiophenes, benzofuran and indole based compounds [13], 3,4,5-trisubstituted isoxazoles [14], The phenoxy acetic acid derivatives GW501516 and GW0742 are the highly selective PPAR δ ligands with nanomolar affinity over other isotypes PPAR α and PPAR γ [15]. The other PPAR δ agonists KD3010, MBX-8025, L796449 and L165461 are currently in clinical development. However due to lack of specificity and low degree of selectivity against PPAR δ , now it is need to design more potent and highly selective PPAR δ agonists through molecular simulation techniques.

Drugs are usually discovered by trial and error by means of high-throughput screening techniques that use in vitro experiments to evaluate the activity of a large number of ligands against a known biological

target. This procedure is very costly and time consuming as well. If crystallographic structure is available for the target protein, then molecular docking simulations can be a helpful computational technique in the drug-discovery process. This computer simulation can generate many possible positions for the ligand in the receptor-binding pocket. Therefore, a criterion is necessary that will allow comparisons of all possible positions of ligand, and then a selection can be made for the best position.

Materials and methods

Computational Methodology

The biological activity data were taken from [16] the biological activity is given in the form of h-PPAR effective concentration (EC_{50}). The Program Molegro Virtual Docker (MVD 2012. 5.5, Molegro Bioinformatics, Aarhus C, Denmark) employed to generate grid, calculate dock score and evaluate conformers. The structures of the compounds were drawn using Chemdraw ultra v 10.0 (Cambridge software), copied to Chem3D ultra v 10.0 to create A3D model and, finally subjected to energy minimization using molecular mechanics (MM2). The minimization was executed until the root mean square gradient value reached a value smaller than 0.001 kcal/mol. Such energy minimized structures are considered for docking and corresponding pdb files were prepared using Chem3D ultrav 10.0 integral option (save as /Protein Data Bank (pdb)). The selection of protein for docking studies is based upon several factors i.e structure should be determined by x-ray diffraction, and resolution should be between 2.0- 2.5Å, it should contain a co-crystallized ligand. Among 15 entries of PPAR δ proteins deposited in Protein Data Bank (PDB), 1Y0S was selected for docking analysis based on ramachandran plot statistics as it showed 170-441 amino acid residues in most favored regions in chain A and B and none of the residues in disallowed regions.

Validation of Docking Method

Software validation was performed in MVD using PDB protein 1Y0S [17]. The x-ray crystal structure of PPAR δ complex GW2331 (331_479) was recovered from PDB. The bioactive co-crystallized bound ligand (2s)-2-(4-[2-(3-[2,4-Difluorophenyl]-1-heptylureido) ethyl]phenoxy)-2-ethylbutyric acid (GW2331) was docked within the active site region formed by the Tyr 473, Thr 288, His 323, His 449, Cys 285, Thr 253, Tyr 437, Lys 319, Glu 471 residues, respectively (Fig 2.). The RMSD of all atoms between the two conformations is 0.98 Å displayed that parameters for docking simulation are good in reproducing X-ray crystal structure. Similar software validations were performed for the rest of the PDB proteins i.e. 1Y0S, 2J14, 2ZNP, 2ZNPQ, 2B50, 2AWH, 2BAW, 3D5F, 3GWX, 3ET2, 3GZ9, 3DY6, 2Q5G, 3TKM respectively. The RMSD values were

ranging from 0.98- 1.91 Å as shown in Table 2. In addition another validation was carried out based on the key interactions made by the bound ligand with active site residues of all PPAR δ proteins from PDB. In order to get possible outcome, the H-bond interactions and van der Waals contacts formed by various bound co-crystallized ligands of PPAR δ protein structures such as 1Y0S, 2J14, 2ZNP, 2ZNPQ, 2B50, 2AWH, 2BAW, 3D5F, 3GWX, 3ET2, 3GZ9, 3DY6, 2Q5G, 3TKM and 3OZO were collected from Ligplot interactions, deposited in PDB summary (PDB sum, <http://www.ebi.ac.uk>) database and given in Table 2. Further the study may help to identify either similar or novel active site residues that participate in H-bond formation and van der Waals contacts with the designed ligands. These two validation approach indicated that docking simulation was successful and that the protocol is good enough to rationalize the ligands for a particular protein or receptor.

Flexible Molecular Docking

As we know, that macromolecules often undergo conformational change, or induced fit, upon ligand binding in order to maximize energetically favorable interactions with the ligand or solvent. The driving force behind most induced fit mechanisms is hydrophobic interactions or hydrophobic collapse of the receptor around the bound ligand. MolDock is based on a new hybrid search algorithm, called guided differential evolution. The guided differential evolution algorithm combines the differential evolution optimization technique with a cavity prediction algorithm. Differential evolution (DE) was introduced by Storn and Price [18] in 1995 and has previously been successfully applied to molecular docking [19]. The use of predicted cavities during the search process, allows for a fast and accurate identification of potential binding modes (poses). During docking, a pose is typically generated, scored and compared to the previous pose(s). The current pose is then accepted or rejected on the basis of the score for that pose. A new pose is then generated, and the search process iterates to an endpoint. Thus, searching and scoring can be tightly coupled in docking. We used MVD because it showed higher docking accuracy than other stages of the docking products (MVD: 87%, Glide: 82%, Surflex: 75%, FlexX: 58%) in the market (Thomsen et al., 2006). The X-ray crystal structure of receptor PPAR δ complexed with ligand (331_479) was downloaded from the RCSB protein data bank (www.pdb.org/pdb/explore/explore.do?structure=1Y0S). The complexed ligand was removed and protein refined with removal of water. The refined geometries were finally exported in .mol2 format for use with MVD. Flexible docking was performed using MolDock docking engine of molegro software. All calculation were carried out using the default setting of MolDock score (Grid) including a resolution of 0.30 Å and a 15 Å radius from the template as the binding site and the number of runs was set to 10. A population size of 50,

maximum iteration of 1500 parameter settings was used. For pose generation energy threshold 100. Tries 10, quick 10, maximum 30, simplex evolution maximum step 300 and neighbour distance factor 1.00, RMSD threshold 2.00, RMSD calculation by atom ID and energy penalty 100.00 were chosen and the poses from each run were saved in .mol2 format.

Results and discussion

In molecular docking simulations, the best binary complex (protein-ligand) is the one closer to the crystallographic structure. For that reason we must establish a methodology that assesses the distance from the computer-generated solution (pose) to the crystallographic structure. This distance can be calculated using the root-mean-square deviation (RMSD), which is a measure of the differences between values predicted by a model and the values actually observed from the object being modeled or estimated (protein-ligand complex). In docking simulation, it is expected that the best results generated RMSD values less than 2.0 Å compared with crystallographic structures (Friesner *et al.*,2004). This procedure of obtaining the crystallographic position of the ligand is often called redocking which is fundamentally a validation method that determines whether the molecular docking algorithm is able to recover the crystallographic position using computer simulation. In this work, all RMSD calculations were calculated for non-hydrogen atoms. In order to validate our docking method, we used the 1Y0S crystallographic coordinates available at the protein data bank (PDB).

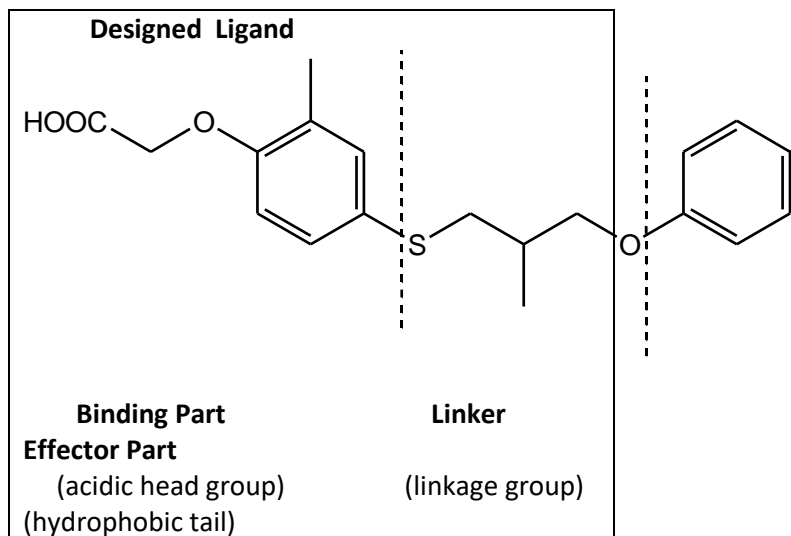
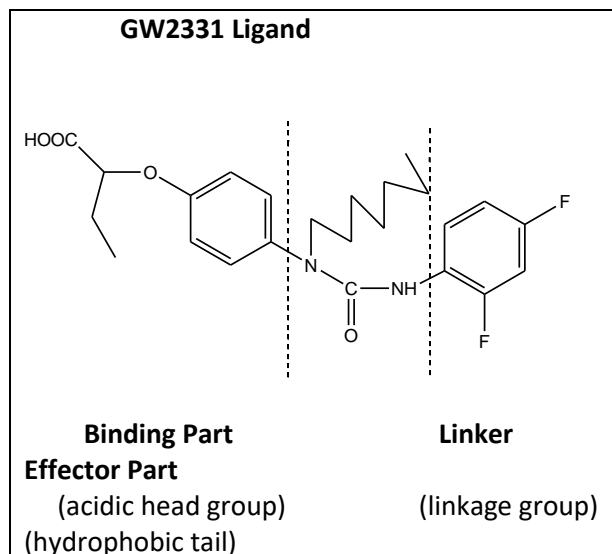


Fig. 1 Schematic representation of the common parts of PPAR δ agonists

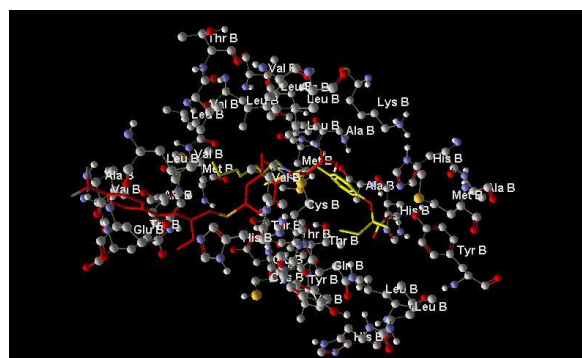


Fig.2 Superimposed binding orientation of designed ligand 20 (red) and the agonist GW2331 (yellow) from the X-ray crystal structure complex 1y0s. These ligands are relatively different but share some structural features. The most important amino acids for ligand binding are valine, tyrosine, threonine, alanine, histidine etc.

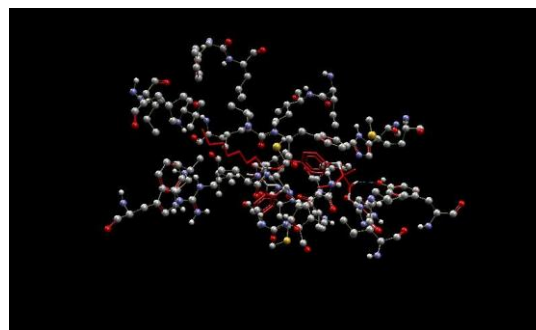


Fig. 3 Docking pose of ligand at active binding site showing hydrogen bonding as dotted line

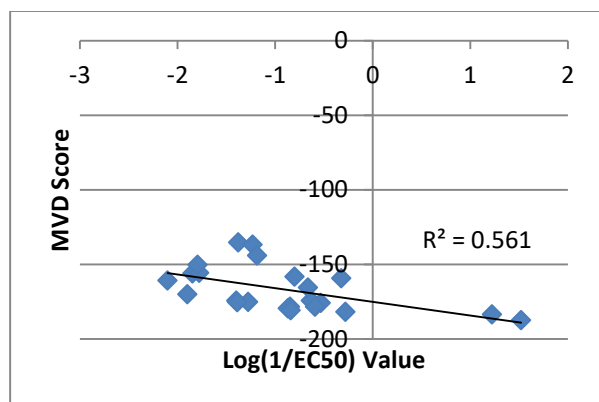


Fig.4 correlation graph between Log (1/EC₅₀) values of compounds from the data set and their corresponding dock scores (kcal/mol).

A comparison among the MOLDOCK score values obtained for these ligands, is not enough yet to predict activity, since in vitro assays are necessary to conclude this. Therefore it is not possible to say that the selected compounds, the ones with the best MOLDOCK score, would be the most potent ones. We could observe, only, that among the selected compounds the best score mean a greater potential to interact with the PPAR δ binding cavity. The docking simulation results corroborate the importance of PPAR δ active site residues as responsible to establish intermolecular interactions with the substrate as well as with the tested ligands. These residues are essential to the ligand binding and, finally, to the reaction catalyzed by the enzyme or receptor.

Docking studies on experimental compounds were showed that most of the PPAR δ agonists are involved in hydrogen bonding with residues Tyr 473, Thr 288, His 449, Thr 292 and Cys 285 in the binding site region of 1Y0S. It was given in table 2. Among the compounds, only compound **4**, **19**, **20** and **21** have shown good MolDock score, H-bond score and RMSD value less the 2.0 as well than the others. Interestingly, compound **20** was predicted to form most favourable contact with docking score -187.33 and H-bonding score -2.7252 on active amino acid residue. A satisfactory correlation ($r^2 = 0.561$) between MolDock score (kcal/mol) and Log (1/EC₅₀) values (Fig 4) was also obtained which suggests better adhesiveness during ligand-protein interaction in post docked pose.

Conclusion

In the present work, para-alkylthiophenoxy acetic acids derivatives were investigated using Molegro Virtual Docker (MVD 2012.5.5, Molegro Bioinformatics, Aarhus C, Denmark) software to outline the structural requirements on ligands to discover and design the most effective compound as potent PPAR δ agonist. The binding modes exhibited by various

designed ligands illustrate the importance of specific residues forming H- bonds within the active site of 1Y0S. Eventually it is clear that the efficiency of binding of agonists towards PPAR δ would definitely get enhanced when H-bond and van der Waals contacts are favoured with Tyr 473, Thr 288, His 323, His 449, Cys 285, Thr 253, Val 263, His 413, Tyr 437, Lys 319, Glu 471 residues, respectively. Therefore, this study demonstrates utility of computational tools in the discovery of novel agonists to PPAR δ can save the time; reduce the bench work of a chemist and eco-friendly as well.

Conflict of Interest: None

Financial Support & Sponsorship: None

Acknowledgement:

We are also thankful to Dr. Rene Thomen and to Molegro ApS, Denmark, for giving us the possibility of using the trial version of MVD.

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How to Cite this article: Mishra G P, Sharma R, Singh L², Singh U K. Development and Validation of docking method for the generation of potent ligand as a PPAR δ agonists: Structure guided computational approach *Subharti J of Interdisciplinary Research* 2018; Vol. 1: Issue 1, 18-22

Hashimpura Massacre: A brutal and bone – chilling action of custodial killings

Sartaj Ahmad¹, Vaibhav Goel Bhartiya², A.K.Agarwal³, Manoj Kumar Tripathi⁴, Sarika Tyagi²

1. PhD (Sociology) 2. LLD (Law) 3. Former District Judge 4. PhD (Political Sciences)

Faculty of Law, Sardar Patel Subharti Law College, Swami Vivekananda Subharti University Meerut UP

Abstract

On October 31st, 2018, the Delhi High Cour reversing the judgment of Sessions Court convicted the 16 personnel of the UP Provincial Armed Constabulary (PAC) for the massacre of Muslims committed 31 years ago. It is one of the rare instances of the justice delivery system responding to the long pain and suffering of a community and sentencing 16 police personnel together to life imprisonment.

Keywords: Hashimpura, (PAC), Massacre, High Court Judgment

Address for correspondence: Dr. Sartaj Ahmad, PhD (Medical Sociology), Subharti Puram, Swami Vivekanand Subharti University Meerut UP

E-mail address: sartajsaleem@gmail.com

Contact: +91 9897093882

Introduction

Hashimpura is a mohalla, i.e. a small area of Meerut city in Uttar Pradesh. It is a colony of Muslim ansari weavers. Many people earn meager sums as artisans, weavers and daily wages labourers to keep themselves and their families going.

Those days in 1987, Meerut and other cities in Uttar Pradesh were on the edge after Rajiv Gandhi had ordered the locks of the Babri Masjid in Ayuodhya (District Faizabad), to be opened for prayers by Hindus . There had been sporadic incidents of violence and the Army and paramilitary forces had been called in. A company of the 41st battalion of the Provincial Armed Constabulary (PAC) had been posted in Meerut.

In April 1987, a Shab-e-baraat (a festival of Muslims) procession had been stoned and a few shops on the road outside Hashimpura had been set on fire. The area had been tense for days thereafter.

In May, 1987 communal riots took place in Meerut District. As a result, the police, paramilitary, military forces and 'C-Company' of the 41st Battalion of the Provincial Armed Constabulary (PAC) had been posted at mohalla Hashimpura for riot control and security.

On 21st May 1987, the brother of an Army Major was killed in the mohalla adjacent to Hashimpura and two rifles belonging to the PAC personnel were looted by certain anti social elements. This led to the registration of FIR No. 204/1987 at Police Station Civil Lines, Meerut under Sections 147, 148, 149, 302, 307,336, 347, and 436 of the Indian Penal Code (IPC).

In the afternoon of 22nd May 1987, the administration decided to raid in Hashimpura and the area had been sealed. It was a Friday in the month of Ramzan and people were hours away from breaking their fast. Late afternoon, the security forces arrived — some barged in, others trooped down from terraces, and raided homes.^[1]

The Incident

On 22nd May 1987 post noon, around 644 Muslim men, were arrested under Sections 107, 116 and 151 Cr PC. They were first rounded up under a Peepal tree in Hashimpura and divided into two groups. The first group comprised elderly men and adolescent boys and the second group comprised young men. They were to be sent to the Police Station Civil Lines and Police Lines in Meerut in the trucks of the PAC, the Army, the Central Reserve Police Force(CRPF) and the local police on the directions of the Meerut District Administration. However, about 42 to 45 able bodied elderly men and youth were separated and

asked to board a yellow coloured truck with PAC written on it in white paint. Mr. Surender Pal Singh was the Platoon Commander of the C-Company of the 41st Battalion of the PAC. It is stated that about 18 to 20 PAC jawans also got into the same truck having registration No. URU-1493, belonging to the same Company of PAC. The truck, driven by Constable Mokam Singh, moved away from Mohalla Hashimpura towards the Delhi road and after about 1 to 1½ hours reached the patri (unconstructed road) of Gang canal (river) in Murad Nagar (District Ghaziabad) . Then travelling for about 1½ kilometers on the patri, the truck was brought to a halt. The lights of the truck were then switched off. After stopping the truck, the accused personnel of the PAC started bringing down the persons from their hold one by one. Each of them was shot by the PAC personnel with .303 rifles in cold blood and their bodies thrown in a watery grave in the upper Gang canal.

The first person to be brought down - Mohd. Yasin, was shot with the rifle of one of the PAC jawans and his body was thrown into the Gang canal . The next one, Ashraf, was similarly brought down, fired at and killed and his body was thrown into the canal. The third person brought down was Zulfiqar Nasir , who became the 1st prosecution witness in the trial. He too was shot by the accused and thrown into the canal. However he deliberately stopped breathing, feigning death and managed to survive by concealing himself in the bushes around the water and later escaping on foot from the canal. Those inside the truck started shouting "Bachao – Bachao" but the PAC personnel started indiscriminate firing on them. However , noticing the headlights of a vehicle approaching them, they stopped firing and the PAC truck URU-1493 was then driven back to the main road and taken at the *pull/culvert* of the Hindon Canal near Makanpur village in Ghaziabad district itself, where the remaining abducted persons were pulled down from the truck and fired at point blank range one by one . 15 to 20 persons, who were thus killed, were thrown into the Hindon canal. However, Babuddin and three others Mohd. Naeem, Mohd. Usman and Muzib-ur-Rehman who were also similarly shot at and thrown into the canal, miraculously survived to recount the horrific tale as prosecution witnesses. ^[2]

Identification Of Deceased

Out of the 38 deceased, in these incidents only 16 dead bodies were recovered and out of those 16, only 11 persons could be identified by their respective relatives. The 22 bodies of the abducted persons could never be found. Many of the identified dead bodies recovered were labelled as "unknown persons".

Their post-mortems were nevertheless conducted. It is shocking that the dead bodies recovered were never shown to the families of the deceased/missing persons. This means that there was no identification of the aforementioned dead bodies and deceased/missing persons were identified by the witnesses from the photographs exhibited by photo journalist Mr Praveen Jain (working as Chief Photographer of the 'Sunday Mail' at that time) present at the spot. Leela Dhar, an accused, who was part of the PAC jawans also suffered an injury by a ricocheting bullet in the indiscriminate firing at Gang Nahar in the Truck.

Aftermath

As the news of the incident spread across the media, minority rights organizations and human rights organizations voiced their outrage. ^[3]

Former Prime Minister Rajiv Gandhi also visited the city and the riot affected areas on 30th May 1987 along with Former Chief Minister of UP Mr. Vir Bahadur Singh. ^[4]

The human rights body, People's Union for Civil Liberties(PUCL), appointed an investigation committee comprising the then PUCL President, (former Justice) Rajindar Sachar, I. K. Gujral (who later became Prime Minister of India), and others, and the committee brought out its report on 23 June 1987.

On 24th May 1987, the Government of Uttar Pradesh ordered an inquiry by the Crime Branch Central Investigation Department (CB-CID) of Uttar Pradesh Police. ^[5] In its report, submitted in 1994, the CB-CID recommended prosecution of 37 employees of the PAC and the police department, but the government gave permission for 19 of them only to be prosecuted and charge sheet was submitted in Ghaziabad court in 1996.

The Criminal Justice Process

The criminal justice process in connection with the murders commenced with the registration of two first information reports (FIRs). FIR No.110/1987 registered at Police Station Link Road, Ghaziabad on 22nd May, 1987 itself and FIR No.141/1987 registered at Police Station Murad Nagar, Ghaziabad on 23rd May, 1987. On 24th May, 1987 the investigation of both FIRs was transferred to the Crime Branch, Criminal Investigation Department (CB-CID), Uttar Pradesh. After the inquiry, a charge sheet was filed with the Chief Judicial Magistrate (CJM), Ghaziabad in 1996 who 23 times issued Bailable and non Bailable warrants for the accused policemen to appear before the court between 1996 and 2000. Eventually, under public pressure, 16 of the accused surrendered before the Ghaziabad court in

2000, and were subsequently released on bail and were back in service. [6]

In 2001, after an inordinate delay in pre-trial proceedings at Ghaziabad, kin of victims and survivors filed a petition before the Supreme Court for transferring the case from Ghaziabad to New Delhi stating that the conditions there would be more conducive, which the Supreme Court granted in September, 2002. But the case couldn't start, as the state government didn't appoint a Special Public Prosecutor for the case till November 2004, though he was later replaced by S. Adlakha, as the former was found to be under-qualified. [7]

Finally, in May 2006, charges were framed against all the accused PAC personnel for murder, conspiracy to murder, attempt to murder, and tampering with evidence, etc. under Sections 302/ 120B/ 307/ 201/ 149/ 364/ 148/ 147 of the Indian Penal Code, and the trial was scheduled to begin in July. On 15 July 2006, the day the trial was to begin, it was deferred to 22 July by Additional Sessions Judge N P Kaushik of Delhi Sessions Court, after the prosecution said authorities in Uttar Pradesh had yet to send important case material to Delhi. He also issued notices, both to the Chief Secretary and Law Secretary of Uttar Pradesh state, seeking an explanation as to "why this case has not been dealt with appropriately on an urgent basis". [8]

Later, when on 22nd July 2006, the trials began, and one of four survivors, Zulfikar Nasser deposed at the Tis Hazari court, three of the 19 original accused including platoon commander Surender Pal Singh, under whose instructions the massacre was allegedly committed, were already dead. Later on the second day, when the case property was sought by the judge, it was revealed that the rifles used had already been redistributed amongst the *jawans* of 41-B Vahini Battalion of the PAC (to which the accused belonged), after forensic analysis by CFSL Hyderabad. [9]

As per survivor witness Mohamad Usman, who deposed in February 2007,.. "after three boys were pulled out and shot point blank, the others in the truck started screaming so the PAC jawans opened fire to quiet them". [10]

By May 2010, 63 of the 161 persons listed as witnesses, by CB-CID had been examined. However, none of the eyewitnesses could recognize any of the accused PAC personnel. [11]

The Tis Hazari Court, Delhi on 21 March 2015 acquitted all the 16 accused in the Hashimpura massacre case of 1987, due to insufficient evidence. [12]

The Court emphasized that the survivors could not recognize any of the accused PAC personnel. The Uttar Pradesh Government challenged the order of the trial court in Delhi High Court by way of appeal and announced a compensation of Rs. 5 lakh to

family of each victim.[13] Appeal were also filed by the victims and their families and all three have been decided together.

Justice for Victims of custodial killings

On October 31st 2018, the Delhi High Court convicted the 16 personnel of the PAC and sentenced them to life imprisonment, overturning the trial courts verdict. [14]

After about 31 years, which included two state ordered probes and a long legal battle, families of about 40 Muslim men who were victims of custodial killings received justice through the judgment of a division bench of Hon'ble Justices S Muralidhar and Vinod Goel The Hon'ble High Court itself observed, **"We are conscious that for the families of those killed, this is perhaps too little, too late. They have had to wait for 31 years for justice. The monetary compensation they have received cannot make up for the lives lost. This case points to the system failure those results, upturning a lower court's acquittal of the accused in 2015"**.

According to earlier reports 42 Muslims were said to have been killed. However, after carefully perusing all documents on record, the Hon'ble Delhi High Court concluded that 38 innocent and unarmed Muslims were killed and so the Court setting aside the impugned judgment of the trial Court acquitting the 16 accused convicted each of them for the offences under Section 120-B and Sections 302, 364, 201 all read with Section 120-B IPC and considering the entire facts and circumstances of the case including period of trial, the age of accused and compensation paid to the victims, the Hon'ble Court sentenced each of the 16 accused to life imprisonment for the offence punishable under Section 302 read with Section 120 B IPC making it clear that the life imprisonment will mean the remainder of the persons natural life.

For the other offences, the sentence awarded to each of the 16 accused is as under:

- (i) For the offence punishable under Section 120B IPC, to imprisonment for life;
- (ii) For the offence punishable under Section 364 IPC read with Section 120B IPC, to rigorous imprisonment (RI) for 10 years and fine of Rs. 10,000 and in default of payment of fine to six months' simple imprisonment (SI);
- (iii) For the offence punishable under Section 307 IPC read with Section 120B IPC, to RI for 5 years and fine of Rs.10,000 and in default of payment of fine to six months" SI; and
- (iv) For the offence punishable under Section 201 read with Section 120B IPC, to RI for 3 years and fine of Rs. 10, 000 and in default of payment of fine to six months' SI. The above sentences have been directed to run concurrently.

The High court directed to all the convicts to surrender on or before November 22, 2018, failing which the station House Officer concerned will immediately take them into custody for serving out the sentences awarded to each of them .^[15]

Conclusion

The Hashimpura massacre case will always be remembered by not only the families of those killed, but also by people of the area as they have had to wait for 31 years for justice but it is also a reminder that there is a constant need for reassurance that policing and the criminal justice process in the country and will remain fair and free from all the prejudices. The monetary compensation they have received though cannot make up for the lives lost but sending the guilty/PAC personnel to jail for whole of their life will wipe out the tears of victims to a large extent.

However, this judgment is not yet final as the accused PAC personnel convicted in this case have got the right of appeal to Hon'ble Supreme Court and all the eyes will now be on Hon'ble Supreme Court's final verdict: We hope that this verdict will do ultimate justice with the victims and their families.

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Source of Support: Nil

Conflict of interest: Nil

Acknowledgement: Authors thank Mr. Justice Rajesh Chandra Former Judge Allahabad High Court for his expert opinion and suggestions during the study.

How to Cite this article: Ahmad S, Goel V B, Agarwal A K, Tripathi M K, Tyagi S. Hashimpura Massacre: A brutal and bone – chilling action of custodial killings. Subharti J of Interdisciplinary Research 2018; Vol. 1: Issue 1, 23-6

Eco-friendly Dentistry- Need of the Hour

Suhasini Palakshappa Gotur¹, Vijay Wadhwan², Shalini Malik³, Ashutosh Yadav³

1. Senior Lecturer 2. Prof. & Head 3. Undergraduate student

Department of Oral Pathology, Subharti Dental College, Swami Vivekananda Subharti University Meerut, UP

Abstract

Traditional dentistry produces waste materials that are very hard to dispose off and toxic dental materials, causing harm to the soil and to the biosphere. To reduce this damage, the field of dentistry is budging towards eco-friendly dental practices, which is the need of the hour. Eco-dentistry or "green dentistry" refers to the delivery of oral health care and dental treatments using technologies, procedures and materials that promote environmental and planetary health. This paper provides useful suggestions for reducing the impact of our profession on the environment.

Keywords: Green Dentistry, Bio-Hazard, Environment

Address for correspondence: Suhasini Palakshappa Gotur, Senior Lecturer, Department of Oral Pathology and Microbiology, Subharti Dental College, Swami Vivekanand Subharti University Meerut UP

E-mail address: suhasrajukk@gmail.com

Contact: +919760996963

Introduction

The condition of our environment is getting worse day by day because of the industrialization, deforestation, technological development, global warming, pollution, etc. Unfortunately dental profession also aids in the production and release of wastes that can potentially damage the environment. As health professionals, we the dentists should be concerned with promoting not only human health and well-being but also that of the environment. Being in a healing profession, it is not only our duty to provide dental services, but also our social responsibility and moral obligation to lessen the environmental impact.

Traditional dentistry produces waste materials that are very hard to dispose off and toxic dental materials causing harm to the soil and to the biosphere.¹ To reduce this damage, the field of dentistry is budging towards eco-friendly dental practices. Dr. Malden Kralj, the founder of Oral Dental Studio, America's first green dental group coined the term "eco-friendly dentistry".² "Eco-friendly" dentistry is an idea that implements sustainable practices in dentistry by keeping resource consumption in balance with nature's economy and protecting the external environment by eliminating and reducing the amount of outgoing wastes and by promoting the well being of

all those in the clinical environment by consciously keeping chemicals out of the air that we breathe.³

There are two main avenues for implementing eco-friendly dentistry: (1) appropriate policy development and implementation and (2) dentists taking responsibility/ ownership in the absence of policies and regulations. Worldwide, various organizations have recognized the need to regulate and monitor the dental offices on an environmental basis. Leadership in Energy and Environmental Design (LEED) was developed in 2000 by the US Green Building Council. In June 2009, the eco- friendly dentistry association was launched internationally.²

Benefits Of Eco-Friendly Dentistry¹

1. Minimize dental waste and pollution
2. Step toward high-tech dentistry
3. Saves energy, water and money
4. Pillar to wellness and lifestyle

Why should we care?

The alarming numbers: per annum dental waste production from a conventional dental clinic is as follows:⁴

- 4.8 million lead foils

- 28 million liters of toxic x-ray fixers
- 3.7 tons of mercury waste
- 1.7 billion sterilization pouches
- 680 million chair barriers, light handle covers and patient bibs.

How to Bring a Change?

Change, something that has never been easy and it always demands efforts. As dental professionals we should lead an effort for change as a team and make sure that each member knows the importance of each step and has a general acceptance of the initiative. It is necessary to involve the entire dental healthcare team in green initiatives. Making the initiative important, fun and reasonably convenient is critical to a successful outcome.⁵

Initial Steps includes⁵

- Appoint a coordinator.
- Develop ideas for the best way to incorporate the initiative.
- Assign specific staff to tasks (i.e. office recycling team).
- Take before and after pictures of initiatives.
- Include information on the efforts in the practice newsletter and website.
- Get local press coverage of the initiatives.

Waste Reduction; Adopt 4 R's Agenda^{5,6,7,8}

Eco-friendly dentistry uses a sustainable approach to encourage dentists to implement new strategies to try and reduce the energy being consumed and the large amount of waste being produced by the industry. Health professionals are on the leading edge of helping to heal our planet by introducing the four R's; Rethink, Reduce, Reuse, and Recycle. By implementing these four easy steps, dentists are beginning to transform the dental industry into a more sustainable one.

Rethink

Redeveloping a mindset is a strategy for change. Environmentalism and sustainability are both considered states of mind. Rethinking the way that dentist offices are run is the initial step towards environmental stewardship.

- Proper sun illumination and use florescent lighting
- Promote indoor plantation
- Inclined roof for water harvesting

- Solar water heaters
- Use paint that does not include Volatile Organic Compounds (VOCs)
- Use eco-friendly office cleaning products like tea tree oil and thyme in dental office.
- Carpool to work with colleagues

Reduce

The easiest way to have more of a resource is to use less of it.

- Substitute autoclave wraps with sterilizable cassettes and plastic syringes with glass syringes
- Use of biodegradable disposable cups
- Steam sterilization over chemical sterilization
- Use biodegradable or enzymatic cleaners instead of chlorine bleach for cleaning water lines
- Proper disposal of amalgam
- Dry Dental vacuum
- LED lights with motion detectors

Re-Use

By reusing items instead of throwing them away, resources and energy necessary to manufacture new products are saved

- Switch to cloth sterilization bags & patient barriers
- Wear cloth apron instead of paper ones
- Switch to stainless steel impression trays and suction tips
- Provide glass or ceramic "rinse & swish" cups
- Use reusable glass irrigation syringe as a substitute for disposable plastic
- Use rechargeable batteries

Recycle

Recycling products is a viable way to reduce overall contamination of the environment. It is a crucial component of the management of waste hierarchy. Always segregate the waste and recycle.

- Use a sharps disposal service that recycles them into building materials
- Exercise recycling bins in dental clinics
- Instrument recycling program
- Recycle x-rays fixer and developer solution and lead foil from x-rays

- Recycle computer parts and electronics

How to green our dental practice?

Being responsible professionals, it is our obligation to our patients and our planet to take every possible measure to help protect our environment, our resources, and our neighbours.

The following are some of the High-Tech, Eco-Friendly, Wellness-Based Dental Technologies which also aid in waste reduction:⁹

- Oral Detoxification with Laser Hygiene Technologies
- Digital Oral Cancer Screening Digital Impressions
- Digital Patient Charting
- On-site Biomedical Waste Disposal Systems
- CAD/CAM Systems in office laboratory restorations
- Use liquid crystal display (LCD) instead of cathode ray tube (CRT) computer monitors.

USE DIGITAL X-RAYS: By switching to digital x-rays, you can use less film and reduce waste from chemicals and lead-lined film packets. Digital x-ray systems are well known to reduce patient exposure levels of radiation. The systems use less energy and can reduce your monthly expenses.¹⁰

Recycling Of Dental Material

DENTAL WAXES: About 80 – 90 % of wax can be recycled without affecting their properties using a simple laboratory procedure of removing the impurities. As this is an in vitro procedure, no biocompatibility issues exist.¹¹

GYP SUM: In U.K., gypsum to gypsum recycling projects have been started which include demolition waste and other gypsum products. It is claimed that the recycled gypsum powder is 99 per cent as good as virgin gypsum.¹¹

CASTING ALLOYS: Wasted materials can be effectively reused for fabricating new restorations or appliances by proper cleaning techniques (sand blasting, electro polishing). There is only 5 - 10% decrease in their mechanical properties even after 20th recast, thus these materials can be redirected to other engineering areas for the fabrication of cutting tools, valves, etc.¹¹

AMALGAM WASTE: Currently it has been estimated that dentists contribute between 3 and 70% of the total mercury load entering waste water treatment facilities.⁸ However few authors raised doubts on that and believe that over the past decades the use of dental amalgam has declined and considered dental mercury as a minor world polluter.¹² The dental professionals are encouraged to use new dental materials that do not contain mercury, or to switch to precapsulated dental amalgam to prevent the release of mercury in dental amalgam into the environment. "Mercury spill kit" should be used if there is a spill of elemental mercury. React unused elemental mercury with silver alloy to form scrap amalgam. Elemental mercury should never be washed down the drain. Use a sponge type mercury disposal container to store the scrap amalgam, which can be recycled. Use an amalgam separator on the suction lines to remove over 95% of the contact amalgam prior to entering the sewer system. Amalgam separators pull the mercury out of our vacuum waste and prevent it from going down the drain and contaminating our waste water or the water bodies in our areas and also reducing the chance of biomagnifications of mercury and hence protecting biosphere.^{2,5,6}

OTHER HEAVY METALS: Silver is another heavy metal that can enter our water system via improper disposal of dental office waste, mainly as a component in radiographic fixer. The best way to manage silver waste is through recovery and recycling. Dentists can install in-house silver recovery units to salvage the silver.¹³

LEAD: By product of traditional radiography is the lead shields contained in each film packet. Dental practitioners can reduce environmental lead contamination by recycling which is an inexpensive and easy task. The lead shields from film packets merely have to be collected and returned periodically to the manufacturer for recycling. Unfortunately, some manufacturing companies report that only about 5% of products sold are returned. In part, it appears that this is due to a lack of awareness of the offered service.¹³

Disposal of E-Waste: Reusing and recycling raw materials from obsolete electronic products is the only way to reduce air and water pollution. Companies like Dell and HP accept used/waste computers and other electronics for recycling.

Reduce water usage: Water is wasted by letting it run when doing something and leaving it running while they dry their hands instead of turning it off. So it's important to turn the water off when it is not in use.

To remind everyone, it is good to put a sign at each sink in the office which says "Please turn off the water when not in use". Hand washing sink with motion activated sensor taps. Steam-based sterilization equipment uses less water. Participate in the "Save 90 A Day" Campaign. Educate the patients to turn off the water while brushing. Use a water free hand disinfectant to clean brush.^{1, 4, 14}

Go for less Chemical Contamination and Fewer Disposables: Green dental practices also use high-quality, biodegradable disinfectants and steam sterilization methods that don't require ventilation for chemical vapour, or a hazardous waste permit for disposal of toxic chemicals into a water supply.¹

Go paperless: By switching to digital patient files and billing, we can increase staff efficiency and reduce the material costs of folders, labels, and pre-printed forms. We can also try using electronic forms on which patients can enter information. When paper cannot be avoided, use recycled paper products and this protect environment from exploitation.¹ Patients should be advised to use bulk-prophy paste to reduce the waste from single-serving packaging. Encourage local purchase over online shopping which reduces the packaging materials used.

Reduce phantom energy: switching off the lights when not in use. Use a programmable thermostat that is inexpensive and easily installed. Install solar or tinted window shades. Purchasing appliances that have an ENERGY STAR® label and rating, will conserve energy and save the practice up to 1/3 on energy costs. Lights can be motion activated to turn on when someone enters the room. Replace incandescent bulbs with Compact Fluorescent Light (CFL) bulbs. Use high-efficiency T-8 or T-5 fluorescents. Purchase computers based on the Electronic Product Environmental Assessment Tool (EPEAT). Light Emitting Diode (LED) Monitors can cut energy consumption in half. Turn off computers at night to save on electricity consumption, as computers in sleep mode still use energy. Replace the old 30-gallon hot water heater with an efficient ten gallon.^{4,5,7}

While establishing an eco-friendly dental workplace, the dentist needs to assess his choices in planning the infrastructure and purchasing of equipment and dental materials which require little extra efforts and money too. Although the commitment of one small dental clinic cannot save the planet, but collective

efforts of many small dental clinics, hospital and colleges can ensure to make the dentistry green or eco-friendly. General dental practitioner can start with small steps that work on any budget and don't require a lot of effort!

Conclusion

Reducing waste, improving treatment technique, reducing the exploitation of resources and limiting the amount of adverse chemicals and waste materials entering the environment whether it is dental office or outside are achievable and realistic goals. We as dentist should take a leading role in society by implementing "eco-friendly" initiatives to lessen the inflict on the environment. All we need to do is to start the "green" journey with little efforts and planning on a daily basis to make sure we are environmentally friendly while meeting the primary goal of providing excellent dental care as "the future will either be Green or not at all".

Source of Support: None

Conflict of interest: None

Acknowledgement: None

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How to Cite this article: Gotur S P, Wadhwan V, Malik S, Yadav A. Eco-friendly Dentistry – Need of the Hour. Subharti J of Interdisciplinary Research 2018; Vol. 1: Issue 1, 27-31