International Journal of Anatomy and Research,
Int J Anat Res 2018, Vol 6(4.2):5929-35. ISSN 2321-4287
DOI: https://dx.doi.org/10.16965/ijar.2018.378

Original Research Article

EVALUATION OF A NEW TECHNIQUE FOR SUPPORTING ANATOMICAL MUSEUM SPECIMENS: A COMPARATIVE STUDY

Nkiruka Chinonyelum Azubuike*, Kelvin Uchenna Onwusi.

Department of Medical Laboratory Sciences, Faculty of Health Sciences and Technology, College of Medicine, University of Nigeria, Enugu Campus.

ABSTRACT

Background: Museum specimens for anatomical and pathological studies are commonly mounted for display in Kaiserling's solution-filled jar. The present study was designed to demonstrate and compare a new method of supporting museum specimens in a jar known as Plastic pole method (PPM) with previous methods [Nylon tread (NTM) and Plastic bottle methods (PBM)].

Materials and Methods: Two specimens for mounting were obtained from the Teaching Laboratory of the Department of Anatomy, UNEC. The specimens were bisected and each half was supported using either of 3 mounting methods (PPM, NTM, and PBM) in museum jars using the standard Kaiserling's technique. The mounted specimens were exhibited to fifty (50) participants (10 staff and 40 students) of the Department of Medical Laboratory Sciences, University of Nigeria. Questionnaires were administered for evaluation of the exhibits under the following criteria: clarity, multi-viewing points, stability of the specimen on its support materials, transparency of the museum mounts, and aesthetic outlook. The quality index of each method was determined from the scores of the participants. Data obtained were statistically analysed and p values <0.05 were considered significant.

Results: Quality index scores of 86.82%, 69.76%, and 77.76%, for PPM, NTM, and PBM respectively. On clarity basis, PBM had the highest score of 212, while NTM had the lowest score of 172. PPM had the best scores for all other criteria.

Conclusion: The novel method demonstrated in the present study (Plastic pole method) is readily available, easy and effective for learning. Thus, it appears to be a promising technique for the mounting of anatomic pathological specimens in a medical museum.

KEY WORDS: Museum techniques, Anatomical museum specimen, Nylon thread, Plastic bottle, Plastic pole.

Address for Correspondence: Dr. Nkiruka C. Azubuike, Department of Medical Laboratory Sciences, Faculty of Health Sciences and Technology, College of Medicine, University of Nigeria, Enugu Campus. Tel.: +2348036711136 **E-Mail:** nkiruka.azubike@unn.edu.ng

Access this Article online	Journal Information
Quick Response code	**International Journal of Anatomy and Research** ICV for 2016 90.30 ISSN (E) 2321-4287 | ISSN (P) 2321-8967 **https://www.ijmhr.org/ijar.htm** **DOI-Prefix:** https://dx.doi.org/10.16965/ijar
DOI: 10.16965/ijar.2018.378	**Article Information** Received: 07 Sep 2018 Accepted: 03 Oct 2018 Peer Review: 09 Sep 2018 Published (O): 05 Nov 2018 Revised: None Published (P): 05 Nov 2018

INTRODUCTION

Museums are institutions known to conserve collections of objects of historical, artistic, cultural or scientific importance. These objects are made available for public viewing through permanent or temporal exhibitions to provide a visual revision of high-end teaching quality [1].

A typical Anatomy or Morbid anatomy department usually has a museum attached to it. The primary aim of a Pathological museum is to enhance learning for students due to the changing trends in the picture of diseases. It creates awareness into the detailed aspects of study for better diagnosis and medical knowledge [2].

Presentations of the pioneer works of medical researchers, educators, diagnosticians and therapists are making the Pathological museum partly historical, because very rare conditions or records of past states, not now encountered, are displayed [2,3]. A well-organised Pathological Museum is aimed to be a permanent exhibition of common pathological conditions for undergraduate and postgraduate self-education and research, a source of gross and histological photographic materials, and a collection of rare conditions/specimens for histological interest [4-6].

In preparing an anatomical/pathological museum specimen for exhibition, basic museum techniques are required to enhance quality display. Kaiserling's method for museum specimens remains the classical technique for preparation and it involves fixation of the specimen, colour restoration, preservation of the fixed specimen and presentation in glass, acrylic jars or transparent plastic (Perspex) jars filled with Kaiserling solution [7,8].

Prior to mounting of specimens in museum jars, they are initially supported by stitching with needle and nylon thread on plastic/acrylic plates [3]. The major disadvantage of this method of specimen support is damage of tissue from the stitching points due to weight of specimens over time [9]. Plaster of paris, paraffin wax and transparent plastic soda bottles have been used previously to mount or support museum specimens [9,10]. Once a specimen is not supported adequately in the jar, there is a chance of the specimen changing position or becoming disfigured, and these will eventually reduce the aesthetic outlook of the specimen upon display. Jain *et al* [9] described that specimens should be rendered totally immovable in the jar on display to encourage ease of transfer among students in the learning environment. Natarajan *et al,* [11] documented on the use of polyethylene terephthalate (PET) as a better alternative to the centre plates which requires hard work, time and skill in drilling prior to mounting of specimens.

Specimen support still remains a vital step in the preparation of specimens for display in the medical museum. The beauty of the museum specimen depends on how properly it is prepared, presented (mounted) and maintained as stable as possible even if the jar is moved in the course of teaching students. The present study was aimed to explore a new method of specimen support using a moderately hard plastic pole. The effectiveness of this new method in comparison with the nylon thread and plastic bottle methods was also determined.

MATERIALS AND METHODS

Materials: The materials used include: reagents (formol saline, Kaiserling solution I, Kaiserling solution II, Kaiserling solution III, 1% pyridine, Thymol crystals), Instruments (Butcher's knife, Dissection knife, drilling machine, Tape, nylon thread, needle, circular saw, slitting saw, Plain Perspex sheets, centre plate, ALLPLAST glue, chloroform) and specimens (Kidney and Spleen samples).

Specimen collection and preparation: Two whole organs (Kidney and Spleen) which were ready-to-dispose specimens, collected from completely dissected cadavers in teaching laboratory of Anatomy department, University of Nigeria were used. The specimens were received in fixed state. Adequate fixation, colour restoration and immersion in mounting fluid using Kaiserlings's solutions I, II and III respectively as previously described [8] were performed.

Construction of museum jars: Construction of four (4) Perspex museum jars was done as previously described [12] using a high quality transparent plastic Perspex sheet (UK). Prior to construction of the jars, each specimen was measured after orientation into its anatomical position where feasible. Additional lengths of about 2cm to 2.5cm were allowed from top to bottom, and left to right of the jar so as to produce reasonably sized jar which will contain sufficient volume of mounting fluid used. Full plain Perspex sheet was measured and cut into six pieces and all pieces except the top piece were assembled using special transparent plastic filling glue (ALLPLAST).

Mounting of specimen: Three techniques were employed to support the specimens: Plastic pole (a new method), Plastic bottle and Nylon thread methods.

Plastic pole method: Preparation of the specimen for mounting with the plastic pole method is as shown in figure 2. One half each of bisected kidney and Spleen specimens were mounted in two separate jars. Plastic poles detached from car flags (Figure 2a) mounted with vaccum stickers (Figure 2b) were washed in running water. Using a surgical drill, a hole was carefully drilled through the centre of the specimen for the plastic pole to pass through (2c). The drilled hole was narrower than the circumference of the pole so that the specimen remains immovable on standing. Vacuum stickers were attached to both ends of the plastic pole. The base of the pole was attached with the aid of the glue to the centre of the Perspex jar (while it was still empty).

Plastic bottle method: The other part of the bisected spleen specimen was mounted using a similar technique as previously described [9] using plastic transparent bottles (Figure 2d). The bottles were stripped of labels, washed properly and cut to required lenghts using scapel and scissors. The cut bottles were used to support the specimen enough to permanently hold the specimen in good position (arrows in Fig. 2e) and also immobile.

Nylon thread method: The procedure for mounting specimen using the conventional nylon thread mounting procedure as previously described [3,12] were adopted. An opaque centre plate was thoroughly washed and dried on a fluffless cloth. The specimen was placed in proper anatomical position and the nylon thread, soaked in glycerine, was used to stitch the specimen unto the centre plate. Specimen sewn onto the centre plate was inserted following standard techniques [12].

Sealing of Museum jars, Presentation and Exhibition: The jars bearing the specimens were filled up to 1cm above the specimen height with a mixture of Kaiserling's solution III and 0.4% sodium hydrosulphite. The last pieces of cut Perspex sheet which will form the top of the jars were drilled to obtain a 3mm hole on each piece. Each jar was covered with the piece and sealed with a Perspex cement (ALLPLAST or chloroform). A syringe was used to fill the jar through the drilled hole up to 1cm from the top of the jar. Air bubbles present were carefully removed. The jars were appropriately labelled and stored in the Morbid anatomy section of the Department of Medical Laboratory Sciences Laboratory, University of Nigeria, Enugu Campus until the exhibition day.

On the exhibition day, the specimens in museum jars were displayed at the Display section of the Laboratory. Fifty (50) respondents (10 staff and 40 students) participated in the exhibition programme. Questionnaires were administered for their individual judgements on the three methods of supporting anatomical museum specimen under the following five (5) criteria: Clarity, multi-viewing points (i.e. front, sides, top, rear), stability of the specimen on its support materials, transparency of the museum mounts and aesthetic outlook. Each of the criteria was scored per mounting method as either best, good and fair with points of 5, 3 and 1 respectively. The total maximum score for a method taking cognizance of the five criteria is 25. The quality index for the individual mounting method used was calculated by finding the ratio of actual score obtained to the maximum possible score.

$$\text{The quality index} = \frac{\text{Actual score obtained}}{\text{Maximum score possible}}$$

The Quality index for each of the three mounting methods was then compared.

Statistical analysis: The Statistical Package for Social Science (*SPSS*) computer software version 20 was used for data analysis. The results of the tests were analyzed using analysis of variance (*ANOVA*) and student's *t*-test at 95% confidence interval with *p* value of $\leq$ 0.05 and 0.01 were considered significant.

RESULTS

Out of the 50 respondents 5(12.5%), 5(12.5%), 19(47.5%), and 21(52.5%) were the teaching staff, technical staff, junior students and final year students respectively. The results obtained from estimating the efficacy of the PPM as a mounting method and its comparison with the NTM and PBM are as shown in Table 1. Based on clarity of details on the specimen, PBS scored the highest followed by PPM. PPM gave the highest scores in all other parameters studied.

Figures 3, 4 and 5 shows the different views of the exhibits of the three methods (NTM, PBM and PPM respectively) demonstrated in the

Fig. 1: Showing pictorial demonstration of stages in Perspex jar construction. I: Assembling of the construction materials; II: Measurement of the Perspex sheet; III: Filing of the edges of the cut piece; IV: Assembling and gluing of the cut pieces; V: Different sizes of finished museum jar; VI: Peeling-off of the protective paper cover of the Perspex jar.

Fig. 2: Mounting using Plastic poles and Plastic bottles methods. (a) Car vacuum flags attached on a vehicle; (b) Plastic poles with vacuum stickers detached from flags; (c) Plastic pole inserted into the specimen after drilling; (d) Transparent Plastic water bottles stripped of their labels; (e) Cylindrical pieces of plastic bottles (arrows) placed horizontally to support specimen.

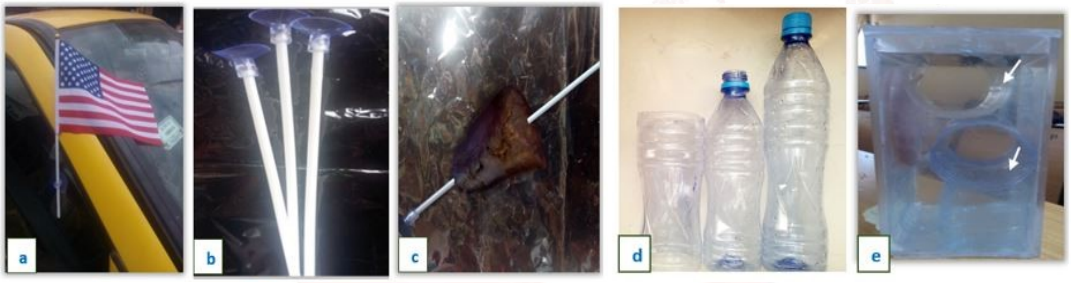

Fig. 3: The front, side and back views of the specimen mounted using the Nylon thread [Traditional] method of supporting anatomical museum specimen.

Fig. 4: The front, side and back views of the specimen mounted using the Plastic bottle method of supporting anatomical museum specimen.

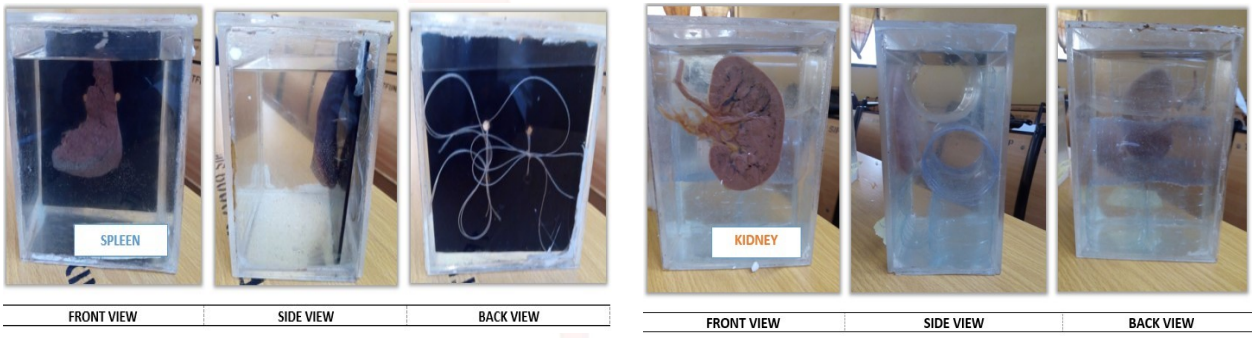

Fig. 5: The front, side and back views of the specimens mounted using the new method [Plastic pole method] of supporting anatomical museum specimen .

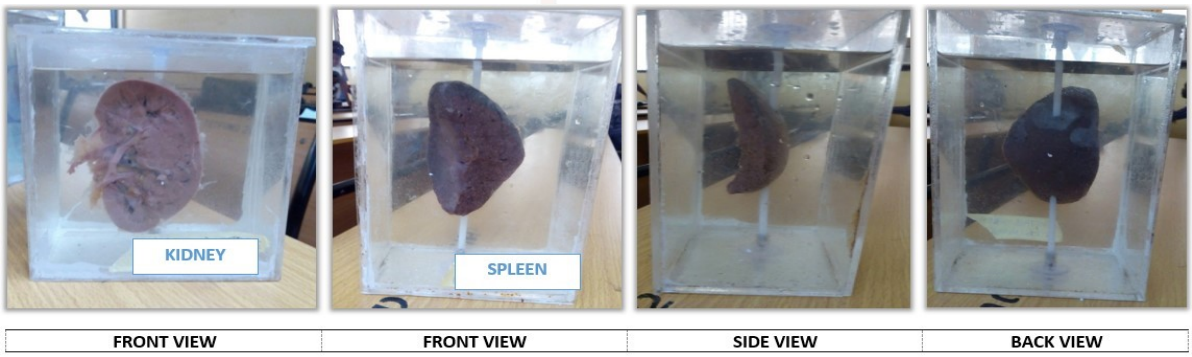

Fig. 6: Quality indices of the three mounting methods as determined from responses of the staff and student categories during the exhibition. (a) All participants; (b) Staff and students; (c) Technical and Teaching staff; and (d) Junior and final year students.

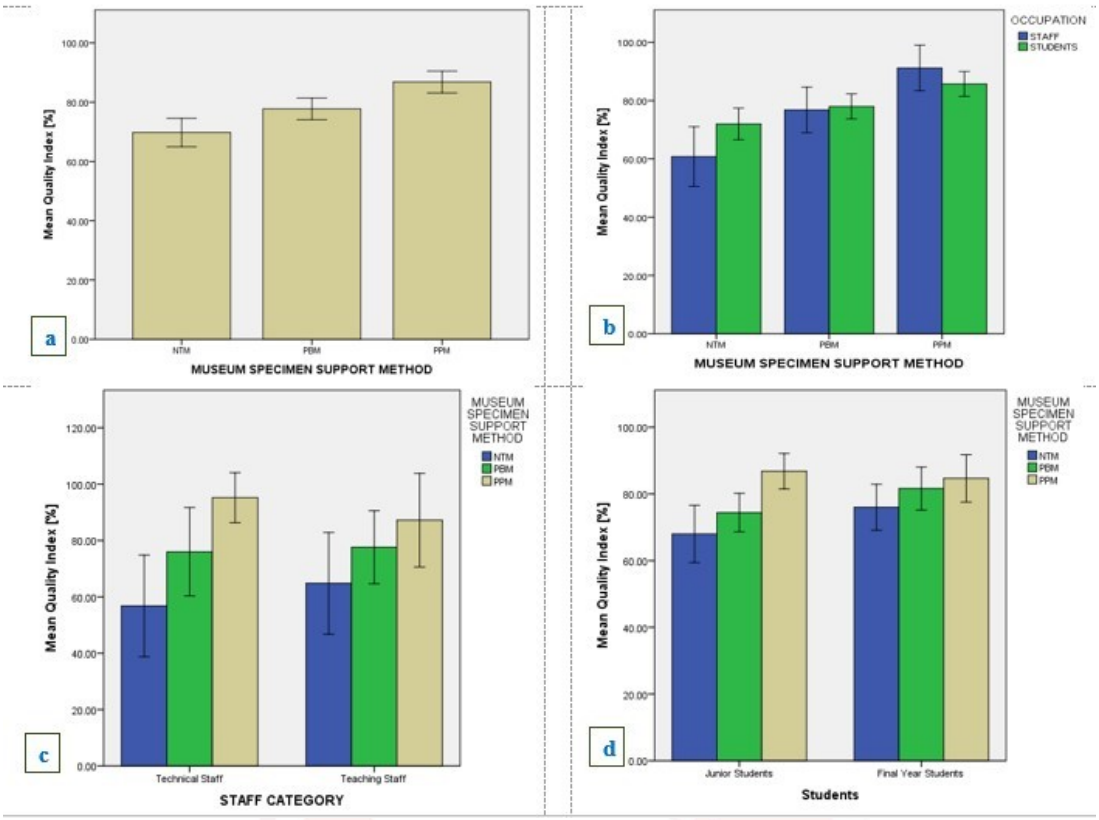

Table 1: Summary of participants' grading of the three mounting methods with respect to criteria.

CHARACTERISTICS	MOUNTING METHOD	GRADING						Total points
		BEST		GOOD		FAIR		
		N	Points (x5)	N	Points (x3)	N	Points (x1)	
Clarity	NTB	17	**85**	27	**81**	6	**6**	**172**
	PBM	32	**160**	17	**51**	1	**1**	**212**
	PPM	33	**165**	15	**45**	1	**1**	**211**
Multi- viewing points	NTB	10	**50**	22	**66**	18	**18**	**134**
	PBM	15	**75**	32	**96**	3	**3**	**174**
	PPM	40	**200**	8	**24**	0	**0**	**224**
Stability	NTB	36	**180**	13	**39**	0	**0**	**219**
	PBM	30	**150**	18	**54**	2	**2**	**206**
	PPM	32	**160**	13	**39**	2	**2**	**201**
Transparency	NTB	16	**80**	18	**54**	16	**16**	**150**
	PBM	24	**120**	25	**75**	0	**0**	**195**
	PPM	35	**175**	14	**42**	0	**0**	**217**
Aesthetic Outlook	NTB	16	**80**	28	**84**	2	**2**	**166**
	PBM	23	**115**	24	**72**	2	**2**	**189**
	PPM	27	**135**	20	**60**	2	**2**	**197**

Key: NTM: Nylon thread method; **PBM**: Plastic bottle method; **PPM**: Plastic pole method

present study. Table 2 shows the differences in the scores and quality indices of NTM, PBM and PPM mounting methods as determined by theparticipants (staff and students). The quality index values of the three methods as determined from the responses of the teaching staff, technical staff, junior students and final year students are as shown in Figure 6.

Table 2: Differences in scores and quality indices of NTM, PBM and PPM mounting methods as determined by the participants.

MOUNTING METHOD	PARTICIPANTS	NUMBER	SCORE	QUALITY INDEX
NTM	STAFF	10	15.20±3.58	60.80±14.34
	STUDENTS	40	18.00±4.23	72.00±16.92
	Total	**50**	**17.44±4.23**	**69.76±16.92** [b]
PBM	STAFF	10	19.20±2.74	76..80±10.96
	STUDENTS	40	19.50±3.35	78.00±13.40
	Total	**50**	**19.44±3.21**	**77.76±12.86** [a]
PPM	STAFF	10	22.80±2.74	91.20±10.96
	STUDENTS	40	21.43±3.32	85.73±13.29
	Total	**50**	**21.70±3.23**	**86.82±12.95** [a b]

Data expressed as mean±SD; [a] and [b] are $p<0.01$ when compared to total values for NTM and PBM respectively.
NTM: Nylon thread method; **PBM**: Plastic bottle method; **PPM**: Plastic pole method

DISCUSSION

The present study has revealed that an overall quality index score (QIS) of 86.82% was determined for the Plastic pole method (PPM) whereas the Nylon thread method (NTM) which is the traditional method of specimen support in anatomical museum [12] yielded the lowest QIS of 69.56%. The high score for PPM can be attributed majorly to the multi-viewing points of the specimen, transparency and best aesthetic outlook as judged by the participants than those offered by PBM and NTM support techniques.

From the present study PBM yielded an overall highest score of 212 based on clarity of the displayed specimen while PPM had a similar score of 211 for the same criteria. A plausible explanation for the best score observed with the use of PBM could be as a result of a better projection of the specimen towards the walls of the jar since the specimen was supported behind by horizontally placed cylindrical pieces of the transparent plastic bottles. Hence, the clarity of the specimen was aided by the adherence of the specimen on the inner walls of the front glass. There is, however, a need for periodical evaluation of the specimen to determine the effect (if any) of this adherence over a long time.

In terms of stability, PPM of mounting was observed to have supported the specimen more firmly than NTM and PBM. Previous researchers affirmed that use of plastic soda bottles for mounting, rendered the specimens immobile and stable [9], however our research has shown that the use of the plastic pole offers better stability for solid organs. Jain *et al.* [9] further highlighted several other advantages of plastic bottle technique such as ease of transport, less expertise needed and less chance of damaging of tissue when compared with the conventional method. However, under the category of transparency, all the sides of the jar were clearly transparent except the back view which appeared rather obscured by the plastic bottles. This back-view obscurity was not present in PPM thus being an added advantage of the technique compared to the other methods. The PPM also shares similar advantages as those offered by the PBM.

Based on the responses of staff and students during the exhibition process, most of the staff and students felt that the new technique (Plastic pole method) of supporting anatomical museum specimen is the best method. There were similar patterns of scoring the different criteria among the staff and student categories. Junior students also responded in a similar manner like final year students, although more junior students favorably scored PPM higher than the final year students. However, the reason for this was not deduced in the present study.

CONCLUSION

The use of the novel method demonstrated in the present study (Plastic pole method) is considered easy, quick, cost effective and reproducible technique. It gave the highest score in the overall display quality compared to the nylon thread and plastic bottle methods. Being an *easy-to-do* technique, Plastic pole method requires no specialized skills and can be used to mount anatomical and pathological specimen for multi-viewing in the learning environment. Further studies are on-going on further modifications of the new technique for enhanced student learning.

ACKNOWLEDGEMENTS

The authors wish to express their profound gratitude to the volunteers (Staff and Students) of this study for their candid cooperation during the exhibition.

Conflicts of Interests: None

REFERENCES

[1]. Plunkett O. The museum in postgraduate teaching. Postgrad Med J 1966;42:115 – 119.
[2]. Parshwanath HA. Reorientation of Pathology Museums. Journal of Educational Research and Medical Teacher 2017;5(1):3 – 9.
[3]. Pulvertaft RJV. Museum techniques: a review . J. Clin. Path. 1950;3:1 – 23.
[4]. Daws JJ. Museum techniques. In: Bancroft JD, Stevens A, Eds. Theory and Practice of Histological Techniques. 4th ed., Churchill Livingstone, New York 1996.
[5]. Marreez YMAH, Willems LN, Wells MR. The role of medical museums in contemporary medical education. Anat. Sci. Edu. 2010;3(5):249 – 253.
[6]. Alberti S. Medical museums. Past, Present, Future. The Bulletin of the Royal College of Surgeons of England 2011;93(2):56 – 58.
[7]. Culling CF, Allison RT, Barr WT. Cellular Pathology technique. S.I. London: Butterworth and Cooperations 1985.
[8]. Patil S, Rao RS, Ganavi BS. The museum maze in oral pathology demystified – Part 1. The J. Contemp. Dent. Prac. 2013;14(4):770 – 776.
[9]. Jain LT, Babel H and Vijay N. New technique to mount specimen in the formalin filled jar for anatomy with almost invisible support. Int. J. Curr. Res. Rev. 2013;5(12):45 – 50.
[10]. Nim VK. Wax mounting of specimen in anatomy museum. J. Anat. Soc. India. 2012;61:41 – 43.
[11]. Natarajan S, Ranjan J, Boaz K. Museum mounting techniques: Revisited econo-mode 2012;55(2):260 – 261.
[12]. Drury RAB, Wallington EA. Carleton's histological technique. 5th ed. Oxford University Press 1980.

How to cite this article:

Nkiruka Chinonyelum Azubuike, Kelvin Uchenna Onwusi. EVALUATION OF A NEW TECHNIQUE FOR SUPPORTING ANATOMICAL MUSEUM SPECIMENS: A COMPARATIVE STUDY. Int J Anat Res 2018;6(4.2):5929-5935. **DOI:** 10.16965/ijar.2018.378