

Local Fabrication of Multipurpose Bronze Dental Flask and Clamps to Improve on Local Fabricated Aluminum Products

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Abstract

This research work was aimed at fabrication of a multipurpose bronze dental flask and clamp locally, and specifically to achieve an improvement on the imported ones. The research work was carried out at the foundry and machine shop in the Centre for Industrial Studies workshop at Lagos State polytechnic Ikorodu between march and august, 2024, using pure bronze materials that gave high quality to the products. This study adopted quasi-experimental design in which the flask and clamp was designed and fabricated using bronze raw materials, mild steel and copper using imported flask/clamp as the control variable.

In other to achieve the objective of this study, pure bronze was used for the complete work e.g for base, flasks and clamps. The result showed that bronze raw materials can easily be sourced for the fabrication of most instruments in dental technology. To this effect, the bronze dental flask and clamps products was achieved and it was rated excellence by dental technology professionals in the department which also indicated that this product was accepted in the field of dentistry precisely in dental technology practice.

The efficiency and functionality also were proved using the products for flasking complete and partial acrylic dentures which actually gave accuracy results of what required. Therefore, the result was far better than aluminum products fabricated in the past by senior dental technology students in the department. Then, in comparison with the bronze imported ones, this product was rated replica to the imported ones. Based on the results of this innovative work, the researchers recommended that the department should liaise with polytechnic management to support the students on innovative research works, since innovative research work is a key to improve dental technology profession in Nigeria.

Keywords: Local Multipurpose, Bronze Dental Flask, Clamps, Preference, Imported Ones

Introduction

The bronze dental flask and clamps is a set of premium grade brass alloy made with upper and lower products, the products have no corrosion, rust or defects. The main application of dental flasks and clamps is dynamic, to be precisely, flask and clamp are mainly used for flasking wax pattern dentures in dental technology prosthetic laboratories. Flasking is a process of investing the cast with the waxed pattern denture in the flask to make a sectional mold used to form the acrylic resin dentures. In the process of fabricating dentures, it is expected that heat treatment should be carried out by individual students; this will help them

to ascertain the procedures that involved in the construction of every dental appliances, specifically acrylic resin dentures.

It is necessary for all wax pattern dentures to undergo flasking process as routine jobs. In the academic learning environment, it is discovered that the rate of using dental flask are many because of the number of the students required to practice at a go. It is now confirmed that aluminum dental flask products are not advisable for the uses by multiple students, because of its durability and fragility in nature. The bronze dental flask and clamp is expected to withstand all kinds of pressures used in dental

laboratories, since the flask was made of quality materials called bronze or brass. The clamp as component part of dental flasks is necessary, the functions of the clamp is to make easy for Dental Technologists to be able to carry even when it hot.

Another function of the clamp is that, the flasks cannot be used alone without clamp because, clamp housing the flask and make it possible to be carried together with flasks at same time. The third functions of the clamps are that, Dental Technologists are using it to carry flasked jobs into curing unit. Therefore, four (4) units locally made dental bronze flask came at the right time as it was documented in the department of dental technology that innovation researches are the best to promote dental technology in Nigeria.

Review of The Related Literature

Frederick stated that regarding the fabrication of bronze dental flask, according to Japanese manufacturing company, they produce dental flask including fiber-reinforced plastic (FRP) upper lid with a middle ring, and a lower ring [1]. However, it is a method of tightening the upper lid, middle ring and lower ring of the flask with bolts and nuts after inserting the dough between the plaster split molds and repeating the test pressure, so it is not possible to supply the resin that supplements the polymerization shrinkage of the monomer., The manufactured were successful in produces more products which available in different categories.

Patrick stated that Japanese also produced open and close injection type dental flask in which part of a metal flask is removed so that a gypsum mold in the flask is irradiated with microwaves

[2]. However, in this flask, a part with microwave is shielded by the metal formed, so that the polymerization of acrylic resin becomes uniform and not deteriorated.

However, the aluminum dental flask work same with bronze dental flasks but the aspect that make it different from each other's is durability and cost. Every company made their own products as good as possible for dental uses age Godwin explained that wax denture made in accordance with the conventional method were first embedded in the bronze dental flask in both lower and upper including clamp [3]. There are some flasks in which the plaster material is injected from the open part of the flask upper ring. Then, it is used by a method of covering the material with compressor, and later clamp together.

Quality of Dental Bronze Flask and Clamps

- It possessed high-quality and natural features that proved it long span and durable.
- It works well for the fabrication of dentures in dental laboratories.
- It also appeared in gold color attractive made of corrosion-resistant metal.
- It compresses the denture well and produces porosities-free dentures in a dental laboratory.
- Denture flask is used for both upper and lower arches and it's quite economical for use in a dental lab.
- Dental Bronze flask made of Brass metal not aluminum product.

Feature of Bronze Denture Flasks and Clamps:



- Simple structure and reasonable design
- Easy to operate, High temperature disinfection
- Thickened pure brass, easy to disassemble
- Beautiful appearance and durable, reusable
 - Humanization design

Usage Way of Dental Bronze Flask and Clamp

In most situations, use the upper and lower flask at the same time. In some situation, the clamp can be used alone without been place under hydraulic bench press. It given room to tighten the knots and also loosen the bolts of the clamp when necessary. Then when not in used, put the flask into clamp and kept for next use.

Specification of Bronze Dental Flask and Clamp

- **Material:** pure Brass not painted product

- **Packing Quantity:** 1 pc upper flask, 1 pc lower flask and 1 clamp
- **Weight:** 15 kg per one set

Materials

pure brass material with high requirements, expensive materials, they are the basis materials for the production of bronze dental flask products to ensure its excellent corrosion resistance while having high hardness and environmental standards.

Process

No coating is demanding on the surface treatment of the product, there is no coating concealer, completely clear. Therefore, no defects, fine cracks (crazing) in the surfaces of the products.

Durability

The rust resistance of the bronze dental flask and clamp free and it is excellent surface, treatment process make it have an unparalleled service life. The use of pacobath equipment is for a long time compatible, the surface coating is not allowed as coating will cause rust to the products, and once rust is out of control. No coating corrosion resistance does not depend on the surface coating, the corrosion resistance of the substrate itself is the basis of rust prevention, so it can be as new for a long time.

Non-toxic Brass Metal

highly toxic substances are easily absorbed by rusts and spoiled, as this product will not cause toxic to any fabricated dentures Ahmed, Japanese and Chinese has made a huge advancement in the production of bronze dental flasks and clamps for the fabrication of acrylic resin dentures [4, 5].

In the 20th century, injection bronze dental flask was introduced into the construction of false teeth. Modern teeth are constructed of a blend of acrylic resin, metal, and sometimes porcelain using bronze dental flasks and clamps.

According to Jalingo proved that the present innovation of bronze dental flask and clamp can improve the drawbacks of the aluminum dental flask [6-8].

Research Methods

The experimental research design was used for this study, using the mould of foreign dental flask and clamp by main of duplicating in order to get new mould for the products [9, 10]. The research was carried out at the foundry and machine shop in the Centre for Industrial Studies workshop at Lagos State polytechnic (LASPOTECH) Ikorodu. The focus departments for this study are engineering departments where different equipment and instruments are been fabricated with local raw materials.

The Raw Materials Used are

Materials Required

- Clay sand
- Splint material
- Tin & copper
- Patching powder /patching sand
- Sand paper

Equipment Required

- Grinding machine
- Pyrometer

Local Production Process of Bronze Dental Flask and Clamps

The bronze multipurpose dental flask and clamp was fabricated in a foundry metallic laboratory section. The engineering apartments are divided into two sections, they are;

- Foundry apartment and
- Metallic apartment

In the construction of the multipurpose bronze dental flask and clamp, the researchers make use of moulding sand, this moulding sand have a composition of silicon sand, benzonite and water. The molding sand can be natural or synthetic, the synthetic is an artificial in which benzonite is been added and mixed with water [11, 12].

This has an advantage than that of natural because, it is easily controlled. Core is the inner shape of the desire casting, there are different types of a core, they are, self-core, the self-core does not require artificial core. Then, the pattern line is where the two patterns are joined together and it is been cut into two parts.

1. Design section: which is done before the project started
2. Pattern

A frame packed full of sand, used in foundry to make a mould on the other hand, clamp is known to be a holding device, also regarded as a mechanical device with movable jaws, it used to hold two frame part firmly together.

Step by Step Procedures for The Fabrication of Bronze Dental Flask and Clamps

The step by step procedures for the fabrication of bronze dental flask and clamps are presented below

The image A and B Demonstrated the Moisturizing the Patching Sand for Easy Molding of the Pattern for Bronze Flask and Clamps.



Image A image B

This image C has Demonstrated the Sieving Patching Sand to Separate Particles of Bigger Sand from Soft Sand why Image D Demonstrates the Finishing of Sieving Patching Sand Inside Pan Ready to use for the Experiment.



Image C Image D

The image E Demonstrates the Molding Process of the Pattern While Image F Exhibits Ramming in order to make the Patching Sand Compressed in the Moulds to Give Appropriate Shape Required for the Products.



image E Image F

The image G Demonstrated the Placing of the Pattern on the Mould to get the Imprint of the Products While Image H Demonstrated the use Rammer for Proper Adaptation of the Pattern.



Image G Image H

The image I Demonstrated already Placed pattern ready for application of separating medium e while image J and K demonstrated applied separating medium on the pattern. Then, Image L demonstrates the topping of the mould.



Image I Image J



Image K Image L

This image M has demonstrated the process of creating channel for the molting metal while image N exhibit channels on the pattern for molting metal to flowing in.



Image M Image N

The base of the clamps was constructed using same bronze metal sheets, which was also cut to shape and size 15inches to 20inches diameters using cutting disc machine. The adjustment screw for the clamps was designed and constructed using same bronze metal sheets which were threaded to fit into bar for easy screwing. The iron rod of 3/2 thickness was used for handle, which also carried designed wood for each handling.

The image O was demonstrated the stage where researchers are receiving instructions on the casting procedures while image P revealed the process of removing casting metal from the casting oven.



Image O Image P

The image Q revealing the use of tongue to remove the pot of molten metal from the oven , then into carrier ready for pouring, while image R displaying the process of pouring the molting metal into the prepared mold.



Image Q Image R

Note: The clamp is a component parts of the flask that enables the two halves of the flask to be held in place during processing of given jobs. This clamp was designed and constructed using same bronze raw materials (brass) for the bar of the clamps, the two poles was constructed using brass rod which actually cut to shape and size 20inches using cutting machine.



Image S Image T

The Image U Has Demonstrated the Cross Sectional of the Groups of Researchers While Image V Displaying the Opened Bronze Dental Flask Without Clamps.



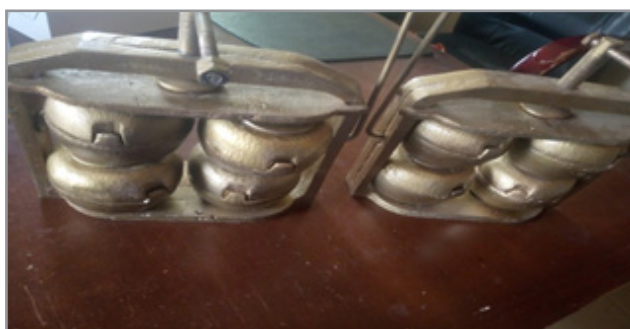
The Image W Has Demonstrated the Second view of the Researcher's Groups While Image X Displaying the Closed Bronze Dental Flask Without Clamps.



The Image Y Has Exhibiting the Third Sectional of the Groups of Researchers While Image Z Displaying the Opened Bronze Dental Flask Without Clamps.



(a) Before Polished (b) After Polished



© Aluminum dental Flasks and Clamps (d) Bronze dental flasks and Clamps

The Resultant (Bronze Dental Flask and Clamps has Same Properties When Compared to the Imported. The Characteristics include

- Heavy in weight with standard quality, these make the technologists to be comfortable with its usage.
- It is nontoxic to human hand when handling
- It is not easy to recycle like aluminum products
- The metal to metal easily achieved even without using bench press
- It doesn't require bronze color paint, it is made of bronze metal sheets and natural bronze color.
- It cost than aluminum products.
- It cannot easily deform like aluminum products
- The clamps components were proved to be standard because, it cannot easily fracture or deform

Maintenance and Caring for Bronze Dental Flask and Clamps

- Use appropriate robber mallet to hitting the bronze dental flasks during deflasking dentures process
- Assemble the components part together immediately after used
- Oiled the flask before used it and after used it in order to prevent rusting and to promote long span of the flasks
- Be proactive with preventative maintenance.
- Don't allow a plaster mould to over stayed long inside the flask for a period of time before it removed
- Establish a routine maintenance schedule and checklist.
- Have a professional dental laboratory janitor to be in charge of dusting and service equipment in the departments.
- Follow these instructions as manufacturer's recommendations for dental flask care and maintenance.

Table .1. Presented the Products Assessment Rated by the Experts

S/N 1	Quality of Bronze materials used	Excellent	Very-Good	Average	Poor
2	Durability assessment	5	2	0	0
2	Finishing Bronze dental flasks assessment	5	2	0	0
3	Finishing clamps assessment	5	2	0	0
4	Tested and functionality	4	3	0	0
5	Painting compatibility	4	3	0	0
6	Products Package	4	3	0	0
7	Acceptable in dental profession	5	2	0	0
	Total	32	17	0	0

Table 2 Presented the Analysis of the Rated Products (Bronze Dental Flask)

S/N	General assessment results	Frequency	Percentages
1	Excellent	32	65.3%
2	V.Good	17	34.7%
3	Average	0	0
4	Poor	0	0
	Total	49	100%

From the table 2 above, it revealed that 32(65.3) % professionals rated the general quality of the products excellence while 17 (34.7) % professionals rated the general quality of the products Very, Good. None of the experts rate the products average or poor. Therefore, this product was excellence and also acceptable in dental technology practice.

Discussion of Findings

The results of this experimental work revealed that 32(65.3) % of dental technology professionals rated the general quality and acceptable of the products excellence while 17(34.7) % of dental professionals rated Very, Good. None of the experts rate the products average or poor. Therefore, this product (multipurpose bronze dental flask and clamps) was excellence and also acceptable in dental technology practice.

Conclusion

The bronze dental flask and clamp was designed and constructed using experimental reach design method in collaboration with

specialist engineer. The engineer concept and principles were followed. In the research of this nature, various steps are taken to find solution to identified problem. The researchers identified the problem of high cost of importation of some dental instruments and equipment and decided to find out possible ways of producing these multipurpose bronzes dental flask using local source materials. In the course of these study, various literatures were reviewed such as aluminum products constructed by senior graduated students for the purpose of having an in-depth knowledge about engineering designing, construction and quality products. Even the frame work of the foreign bronze products also was used to get the imprint on the mould. The final products were validated by dental Technologists professionals in the department, and it was approved for the practice of dental profession.

Recommendation

Based on the results of this experimental work, the researchers recommended that

- The department should liaise with polytechnic management to support the students on innovative research works, since innovative research work is a key to improve dental technology profession in Nigeria.
- It is also recommended that the incoming dental Technology students should pick bronze dental flask and clamp for their project topic in order to have more products, since the bronze flasks and clamps components was proved to be quality.
- Finally, the departmental staff should collaborate with polytechnic management in order to showcase all local production of instruments and equipment to the State Media, so that the world will know what is happening in dental technology, this also will be of helps to the dental technology profession in Nigeria.

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