

Pentamix™ 3

Automatic Mixing Unit



Technical Data Sheet

Features

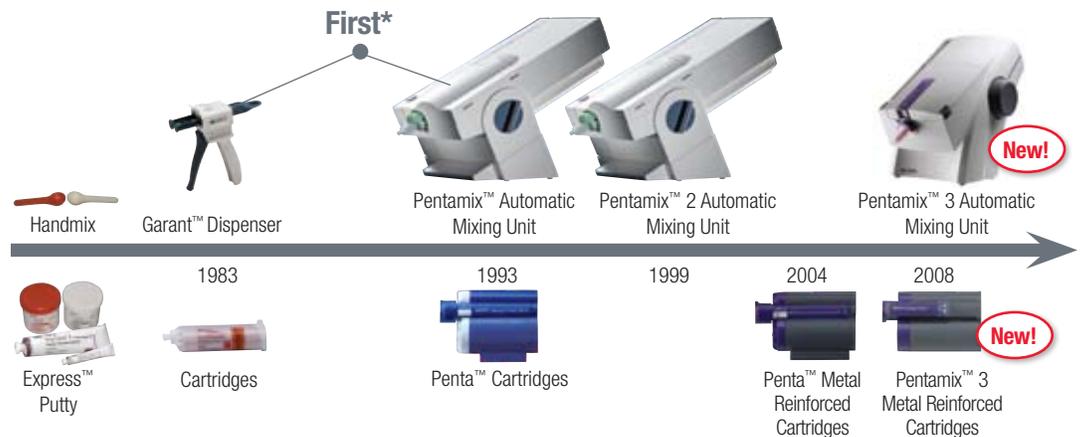
3M ESPE's third generation Pentamix device, the Pentamix™ 3 Automatic Mixing Unit, sets higher standards with the following features:

- Fastest Speed
- Smallest Size
- Easy Operation
- Reliable Timing
- High Mixing Quality
- Hygienic and Clean

Introduction/History

Taking precision impressions is a critical step in providing high quality restorations to patients. As a worldwide leader in impression materials, 3M ESPE innovations have continuously advanced impression technology for the past 40 years. These innovations did not only apply to the impression material side, but also focused on the handling and robustness of the dosing and mixing of these materials.

Important mile stones:



Since 1983 and 1993 respectively, many dentists worldwide have adopted the concept of hand and electrical automated mixing in their offices. Both the 3M ESPE hand automated dispenser and the original electrical Pentamix™ Automatic Mixing Unit replaced spatulation. The introduction of the Pentamix™ 2 Automatic Mixing Unit provided a dispensing extrusion speed twice that of the original Pentamix mixing unit.

* 3M ESPE was the first manufacturer to introduce automix dispensing in both the Garant™ Dispenser and the Pentamix™ Automatic Mixing Unit.

In 2004, new mixing tips and steel reinforced cartridges were introduced to ensure the well-established high quality of mix for putty materials, too. Now the new Pentamix™ 3 Automatic Mixing Unit, which is about twice the speed of the Pentamix 2 mixing unit, brings the impression taking procedure to the next level in mixing accuracy and convenience.

The Concept of Automated Mixing

Thousands of dentists worldwide have already taken advantage of the following benefits of the Pentamix mixing unit:

- Easy push-button dispensing relieves strain on dental assistants
- Fast and homogeneous mixing for void free impressions
- Hygienic direct filling of trays and syringes to avoid cross-contamination
- Less waste— dispenses only amount of material needed
- Cartridge exchange is required less often¹

Recent studies demonstrate the clinical and practice management advantages of the Pentamix system.

Preferred Mixing Technique²

J. Nam, A.J. Raigrosdki, et. al., J Prosth Dent 2007

The purpose of this study was to gain information regarding operators' preferences for different mixing techniques and duration of mixing and tray loading.

In this study, 30 dentists, 30 dental assistants and 30 inexperienced dental students evaluated heavy-body VPS using electronic mixing with the Pentamix 2 mixing unit compared to automixing using a hand dispenser and hand mixing.

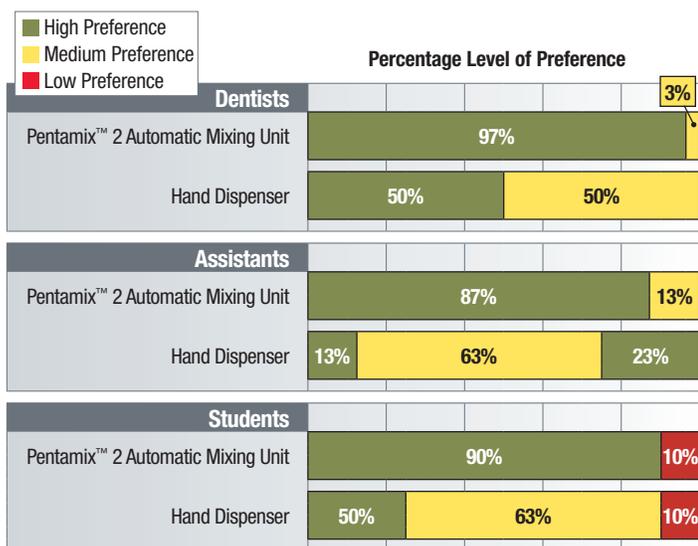


Fig. 1 Electronic Mixing (Pentamix™ 2 Automatic Mixing Unit) versus Automixing (Hand Dispenser). Percentage (frequency) of overall level of preference (low, medium, high) after 3 trials with heavy-body VPS.

All groups preferred automated mixing over hand mixing. (Fig. 1) For the dental students there was no significant difference of the duration of mixing and tray loading with a hand dispenser and mixing with the Pentamix 2 mixing unit.

Quality of mix and level of cleanliness were more highly rated when working with the Pentamix 2 mixing unit compared to the use of a hand dispenser in all three groups.

The results show that users prefer mixing with an automated device over all other mixing techniques, regardless of impression material viscosity. Use of the Pentamix 2 mixing unit also made it easier to achieve equal mixing ratios between base and catalyst, leading to an improved quality of mix.

Productivity Counts³

M. Firla, W. Bergin, DPR Europe 2007

On the basis of EN ISO 9001:2000 (Requirements for Quality Management) the effectiveness of state-of-the-art practice management is discussed, which implies productivity gains can be impacted by staff skill level and training, appropriate work environment, and processes and treatment plans designed according to patient requirements. Benefits of an optimization process in the dental office known as total production management (TPM) is based on the analysis of time consumption and subsequent improvements for the planning and scheduling process, choice of materials and treatment process. The Pentamix mixing unit device is highlighted as a key element because it dispenses the material automatically and evenly resulting in low waste, minimal training of staff, and hygienic delivery; all factors that contribute to dental office productivity.

Void-free Mixing⁴

M. Wildenhain, P. Pospiech, et. al. IADR 1998 #1062

The aim of this study was to compare the advantage offered by electronic automix systems compared to manual mixing on reducing the size and quantities of bubbles in different impression materials. Air voids occurring in the area of the occlusal surfaces or the prepared abutment teeth may result in inaccuracies of the impression.

For this test series, 30 subjects (dental students) were selected and told to manually mix three different impression materials and to fill cylinder casts comparable in size to stock impression trays. Similar casts were also filled using automix devices including the Pentamix 2 mixing unit. Cuts were made of each cast and bubbles were counted and measured using a stereo microscope.

Results showed that automix systems lead to better results over hand mix materials in regards to homogeneous mixing with fewer and smaller bubbles. The test material mixed with the Pentamix 2

mixing unit showed the best results with virtually no air voids detected. This means that for everyday clinical applications in the dental practice, using the Pentamix system offers more quality control at a decisive stage of restorative work.

Pentamix™ 3 Automatic Mixing Unit Features

3M ESPE's third generation Pentamix™ device, the Pentamix™ 3 Automatic Mixing Unit, sets higher standards with the following features:

- **High speed:** twice as fast as the Pentamix™ 2 Automatic Mixing Unit; faster tray loading provides more effective working time— which is particularly beneficial when loading full arch trays or when using fast-setting impression materials (i.e. Imprint™ 3 Quick Step Impression Material). (Fig. 2)
- **Small size:** smallest automated mixing device on the market— saves valuable counter space; it also includes a wall mounting option
- **Easy operation:** fully automatic opening of foil bags; Penta™ Cartridges display product name and times (Fig. 3); faster cartridge change when two different viscosities (HB/LB) are used with one mixing unit; optimized design for left- and right-handed operators; easy change of mixing tip through improved cartridge and cover design. (Fig. 4)
- **Reliable timing of clinical work-flow;** minimizes operator variability (shorter tray loading time)
- **High mixing quality:** void-free and consistent mixing of impression material— including putty materials
- **Hygienic and clean** dispensing of all types of impression material
- **Operation security:** built-in sensor (Fig. 5a) detects Penta Authentication Label (Fig. 5b) on each base paste foil bag guarantees optimized mixing parameters.

More Effective Working Time

The use of the Pentamix 3 mixing unit does not impact impression material's working and setting time as recommended by the manufacturer. Because of the individually optimized mixing parameters, the Pentamix 3 mixing unit has a very high quality of mix and no loss in performance when extruding high viscous materials like putties. In combination with the shorter lead time, tray filling with the Pentamix 3 mixing unit now takes only about half the time it used to take with automatic mixing devices in the past. Examples of filling times for standard metal upper and lower jaws are shown in Fig. 2.

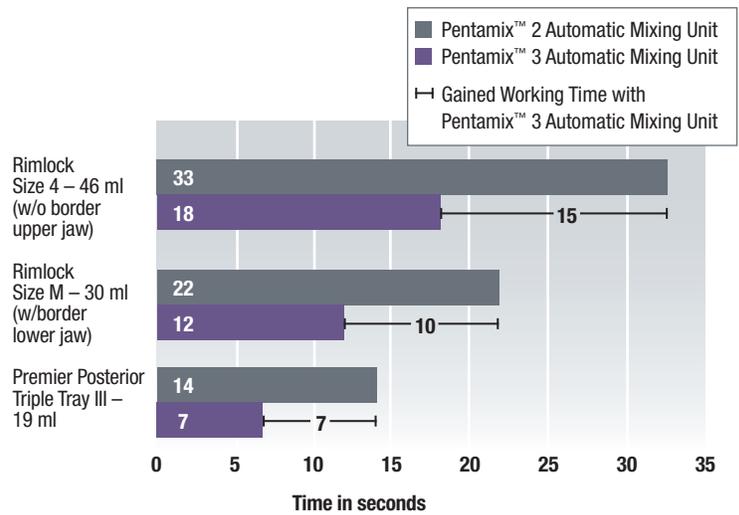


Fig. 2 Tray loading and gained working time with Pentamix 3 mixing unit.



Fig. 3 Penta™ Cartridges display product name and times.

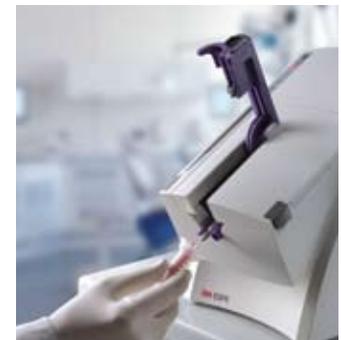


Fig. 4 Changing the Penta™ Mixing Tip is even easier.



Fig. 5a Sensor and Authentication Label detects ineligible cartridges/material.



Fig. 5b Penta™ Foil Bag with Authentication Label.

Shorter tray filling times translates into benefits for the clinical procedure by having more working time available to the dentist while seating the impression. This is most apparent with fast-setting impression materials. Additional working time enables the dentist to take better advantage of the fast-setting materials to enhance office productivity and patient convenience. Additional usable working time is an important safety factor, especially for taking impressions of multi-preparations or when working in warmer climates.

Additionally, when the Pentamix 3 mixing unit is located centrally, the syringe and the tray can be delivered to the operatory side by side. This adds to the patient's and the office staff's convenience during the impression making procedure.

Ultimate Procedure Efficiency

The Pentamix 3 mixing unit offers effortless exchange of loaded cartridges through an improved cartridge design and its manual plunger retraction. The replacement of an exhausted cartridge, even while filling a tray, or the use of Penta impression materials with two different viscosities (HB/LB) in one mixing unit is facilitated.

Also, changing the Penta™ Mixing Tip has been made easier and faster by the redesigned cartridge and the design of the device cover. (Fig. 4)

Easy-to-attach mixing tips and effortless cartridge exchange combined with fastest dispensing speed results in noticeable time savings.

Innovative Technology for Maximum Robustness

The Pentamix™ 3 Automatic Mixing Unit dispenses even putty (ISO type 0) materials twice as fast as its predecessor. While shorter tray filling times result in many clinical advantages, they imposed significant technical challenges for the 3M ESPE engineers.

The extrusion force during dispensing with the Pentamix 3 mixing unit typically reaches 6.500 N*. To manage such immense forces it is essential to use 3M ESPE's metal-reinforced cartridges, as older Penta plastic cartridges would deform, resulting in excessive dripping during and after finishing of the tray loading, or in the worst case in breakage of cartridges and rupture of the foil bags. To avoid any damage to the material, the Pentamix 3 mixing unit is equipped with a sensor to detect ineligible cartridges. (Fig. 5a)

The mixing of highly viscous impression materials at high dispensing speeds also requires adjustment of the mixing parameters of the device to the rheological properties of the

impression material to ensure that the mixing energy does not alter any material characteristics. Insertion of genuine Penta™ Impression Materials into the Pentamix 3 device will transfer material specific information via radio frequency identification tags and the device will set its mixing parameters accordingly.

If either the tag is damaged or the sensor cannot detect a metal-reinforced cartridge, the Pentamix 3 mixing unit will revert to a Pentamix 2 mixing unit speed, ensuring that any impression material required for the clinical workflow can be dispensed, but also avoiding potential damage caused by excessive forces.

Pentamix™ 3 Automatic Mixing Unit with Dental Practitioners⁵

3M ESPE Clinical Survey with US Dental Practitioners

During the development of the Pentamix 3 automatic mixing unit, customer requirements played a major role in defining the product features. As with all new 3M ESPE products, Pentamix 3 mixing unit was tested extensively in dental offices before market introduction. More than 150 dental offices of general practitioners and universities in the United States, Canada and the EU evaluated the new Pentamix 3 mixing unit.

Asked about their main likes with the new Pentamix 3 mixing unit, its high "speed" was the feature mentioned most often followed by "size" and "design". All of these directly translate into advantages for the dentist, the assistant and the patient.

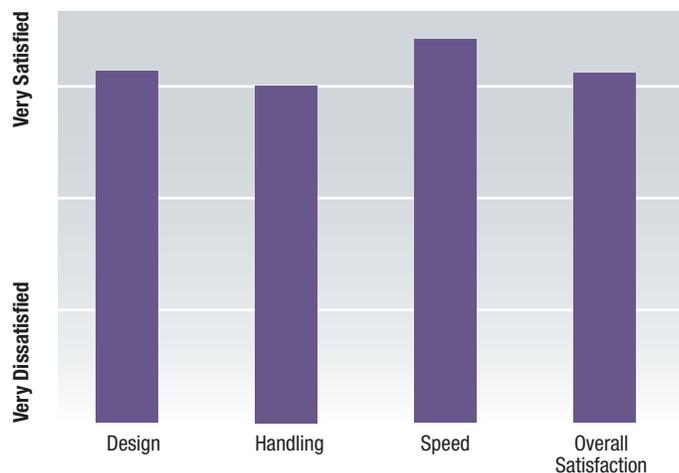


Fig. 6 Satisfaction levels for Pentamix™ 3 Automatic Mixing Unit attributes (3M ESPE Clinical Survey with U.S. Dental Practitioners).

* The overload protection of the device will switch off at forces exceeding 10.000 N.

Pentamix™ 3 Automatic Mixing Unit Features for Optimized, More Convenient, Comfortable Handling

- The Pentamix™ 3 Automatic Mixing Unit operates at twice the extrusion speed compared to the Pentamix™ 2 Automatic Mixing Unit. This reduces the tray filling time by half.
- The Pentamix 3 mixing unit can be turned off with the main switch on the front. (Fig. 7)
- Readiness is signaled by the solid green LED. The LED blinks when the device is doing a self-check after turning it on and during operating conditions that do not allow safe clinical use. (Fig. 7)
- The Pentamix 3 mixing unit automatically detects when suitable Penta™ Foil Bags with Penta™ Authentication Label (Fig. 5b) and metal-reinforced cartridges are inserted. The Pentamix 3 mixing unit then operates with optimal mixing parameters.
- After releasing the start button, the Pentamix 3 mixing unit automatically releases the plungers, which can be recognized by the sound of the drive.
- 5:1 systems without Penta Authentication Label and/or non-reinforced metal Penta cartridges cannot be dispensed safely with full extrusion speed. In this case, the Pentamix 3 mixing unit will extrude the materials with the speed of the Pentamix 2.
- The locking lever of the Penta cartridge for the Pentamix 3 can be opened without opening the cover of the Pentamix 3 mixing unit. The mixing tip can be changed more easily. (Fig. 8)
- The lever of the Penta cartridge for Pentamix 3 snaps in to place in the completely opened position to allow easy change of the mixing tip. (Fig. 9)
- Hand wheels as well as start buttons are located on both sides of the device for convenient operation by left- and right-handed people.
- Insertion of the cartridges is simplified because the plungers snap into the uppermost position and the locking lever of the cartridge serves as a convenient handle. (Fig. 10)

Technical Data

Pentamix™ 3 Automatic Mixing Unit	
Main Voltage	100–240 V/47–63 Hz
Power Input	max. 2A
Plunger forward speed	max. 45 mm/min.
Plunger retraction	manual, typically 3 sec.
Mixer shaft speed	380–760 rpm
Rate of dispensing	> 150 ml/min.
Extrusion Force	up to 6.500 N, electronically limited to 10.000 N (+/- 20%)
Weight	9,8 kg
Dimensions	L 283 mm x W 225 mm x H 280 mm

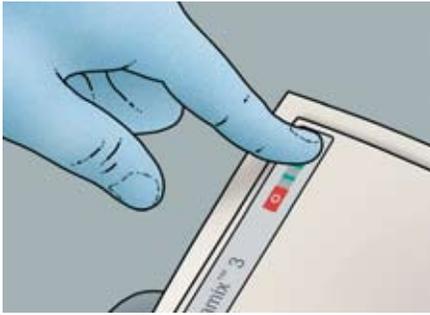


Fig. 7 On/off switch.

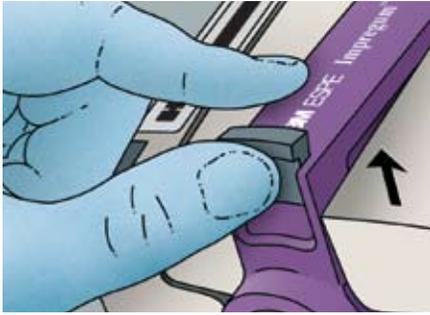


Fig. 8 The locking lever can be opened (to change mixing tip) while the cover the of Pentamix™ 3 Automatic Mixing Unit is closed.



Fig. 9 Locking lever snaps into the uppermost position.

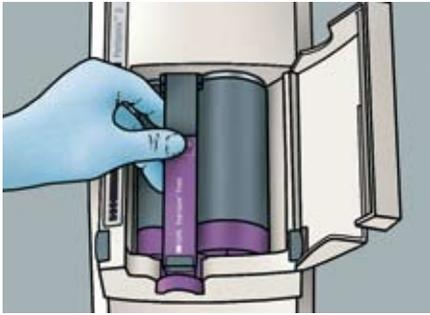


Fig. 10 The locking lever of the Pentamix™ 3 Automatic Mixing Unit cartridge serves as a convenient handle.

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 2. "Assessment of preference of mixing techniques and duration of mixing and tray loading for two viscosities of vinyl polysiloxane material", J. Nam, A. J. Raigrosdki, J. Townsend, X. Lepe, L.A. Mancl, *J Prosth Dent* (2007), 12–17, School of Dentistry, University of Washington, Seattle, WA.
 3. "Productivity count\$", M. Firla, W. Bergin, *DPR Europe*, (2007), 43–44.
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