



MIXPAC™ T-Mixer Colibri Plus Mixing Tips Laboratory Evaluation

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Introduction:

The Swiss company, Sulzer Mixpac's release of the new version of **MIXPAC™ T-Mixer Plus** mixing tips (with the bendable and rotatable Colibri cannula) presented our biomaterials lab with the opportunity to determine if they have the same setting characteristics as the previous helical design. We also looked at the difference in the amount of material wasted in the mixing process.

Experimental Design:

METHODS:

Material Waste Comparison n=3:

An accuSeries 224 precision analytical balance (Fisher Scientific) accurate to 0.1 mg was used to measure the mass of unused mixing tips. This was subtracted from the mass of used mixing tips which had any excess wiped from the outside of the cannula. Means with standard deviations of material waste are reported in the results section along with percent change compared to the helical tips with the formula $(mt-mh)/mh*100$.

Working Time and Setting Time n=5:

Was performed according to ISO 4049:2009 using a HH306 data-logger thermometer and a Type K cone shaped thermocouple. Material was expressed into an 8 mm x 4 mm Ø Teflon split mold maintained at 23 +/- 1°C and 37 +/- 1°C and the resultant temperature curve was recorded and exported into Microsoft Excel for analysis.

Elastic Recovery n=5:

Was performed with an Instron 5866 Universal Tester programmed to deliver the deformation and measure change in specimen height according to ISO 4823:2015 specifications. This test deformed a cylindrical specimen 20 mm in height by up to 6 mm, and is allowed to recover back to its original shape. The difference between the original height and the recovered height after deformation is calculated to be the % elastic recovery.



MIXPAC T-Mixer Colibri Plus MLT 2.5-08-N11



MIXPAC Helical Colibri ML 2.5-10-N11

| Mixing Tip | Test Material | ISO 4049 Working Time, s | ISO 4049 Setting Time, s | Material Wasted, mg | % change in material wasted |
|----------------|---------------|--------------------------|--------------------------|---------------------|-----------------------------|
| MLT 2.5-08-N09 | NX3 | 225 (18) | 145 (4) | 228 (1) | -38% |
| ML 2.5-10-N09 | NX3 | 229 (13) | 145 (5) | 368 (0) | |
| MLT 2.5-08-N11 | NX3 | 229 (12) | 145 (6) | 236 (2) | -37% |
| ML 2.5-10-N11 | NX3 | 223 (7) | 144 (5) | 375 (2) | |
| MLT 2.5-08-N14 | NX3 | 232 (10) | 142 (9) | 273 (2) | -32% |
| ML 2.5-10-N14 | NX3 | 237 (5) | 141 (10) | 400 (2) | |

Small variations in working and setting time can be attributed to small variations in the temperature of the apparatus holding the material. ISO 4049 allows a range of 2°C in baseline temperature before insertion of the test material. The cement used in the bulk of the tests, **NX3 Nexus Third Generation Universal Adhesive Resin Cement** (Kerr Dental) showed an approximately 12-15 second difference in setting time per 1°C change in temperature. Given this, the largest mean difference in setting time of 4 seconds is well within the uncertainty inherent in the test method and is considered equivalent. This line of tips reduced waste by 32-38% compared to the **MIXPAC Helical Colibri** tips.

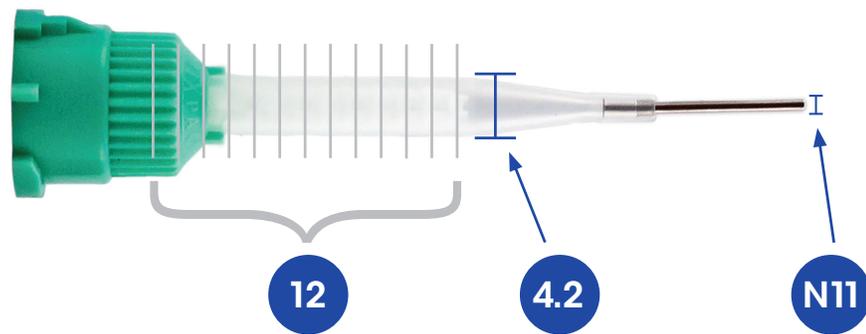
“This line of tips reduced waste by 32-38%”

The main difference in this line of tips was the diameter of the cannula, and it was shown that this didn't affect the setting properties of NX3. The larger diameter cannula can make it easier to express the material with a larger bead size, while the smaller diameter cannula can give greater control in placement.

Mixing Tip Specifications

4.2 - 12 - N11

Inner diameter of mixing portion, mm Number of mixing elements 1.1 mm diameter of cannula



MIXPAC T-Mixer Colibri Plus MBT 4.2-12-N11



MIXPAC Helical Colibri MB 3.2-12-N11



MIXPAC Helical Colibri MB 4.2-12-N14

The **MBT 4.2-12-N11** is a versatile tip which replaces both the **MB 3.2-12-N11** tip and **MB 4.2-12-N14** helical design tips

and is indicated for impression of root canals and preparations, core build-ups and cementation of root posts and post cores. As the tip has a larger diameter to support the mixing of impression materials, it has a moderate increase in the material waste compared to the helical MB 3.2-12-N11 tips, but showed equivalent setting properties.

Aquasil Ultra+ (Dentsply Sirona) was used as the impression material and **Rebilda DC** (VOCO) was used as the dual-cure core material.

| Mixing Tip | Test Material | ISO 4049 Working Time, s | ISO 4049 Setting Time, s | Material Wasted, mg | % change in material wasted | ISO 4823 Elastic Recovery, % |
|----------------|----------------|--------------------------|--------------------------|---------------------|-----------------------------|------------------------------|
| MBT 4.2-12-N11 | Rebilda DC | 320 (4) | 149 (8) | 1155 (3) | 28 % | |
| MB 3.2-12-N11 | Rebilda DC | 312 (10) | 153 (11) | 902 (3) | | |
| MBT 4.2-12-N11 | Aquasil Ultra+ | - | - | 726 (1) | -29 % | 99.1 (0.1) |
| MB 4.2-12-N14 | Aquasil Ultra+ | - | - | 1028 (3) | | 99.2 (0.0) |

For the comparison including **Aquasil Ultra+**, elastic recovery was tested as an adjunct test to determine if the material is setting properly as the test requires precise timing and is sensitive to any changes in setting characteristics. This test also showed no significant difference when mixed with either the T-Mixer or Helical Mixing tips, while wasting 29% less material than the MB 4.2-12-N14 tip.

Conclusion:

Three different materials mixed with the **MIXPAC T-Mixer Colibri Plus** tips showed equivalent setting properties to **MIXPAC Helical Colibri** tips while reducing material waste by 29-38% for tips with the same mixing diameter. The diameter of the cannula doesn't affect the setting properties of dual-mixed materials.