

# The Right Tools to Improve Tablet Production

*In this case study, a variety of challenges encountered when producing a stimulant laxative in the form of a 5mm round tablet are addressed.*

## The Companies

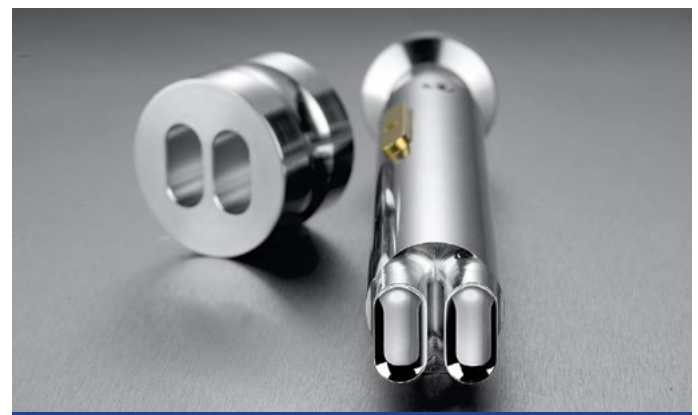
Novartis, is a company that provides innovative healthcare solutions that address the evolving needs of patients and societies. Headquartered in Basel, Switzerland, Novartis offers a diversified portfolio to best meet these needs: innovative medicines, eye care, cost-saving generic pharmaceuticals, preventive vaccines, over-the-counter and animal health products.

I Holland has origins that date as far back as 1910 when it was established as a general engineering and machining company by Mr Israel Holland. It is now a global manufacturer and supplier of tablet compression tooling.

## The Problem

The Italian division of Novartis approached I Holland with a variety of challenges they encountered when producing a stimulant laxative in the form of a 5 mm round tablet.

Novartis reported a number of key issues when using tools from their existing supplier, including wear, alignment and interchangeability problems. There were also difficulties with tip breakage under high compression force and consistency of the working-length of the punch.

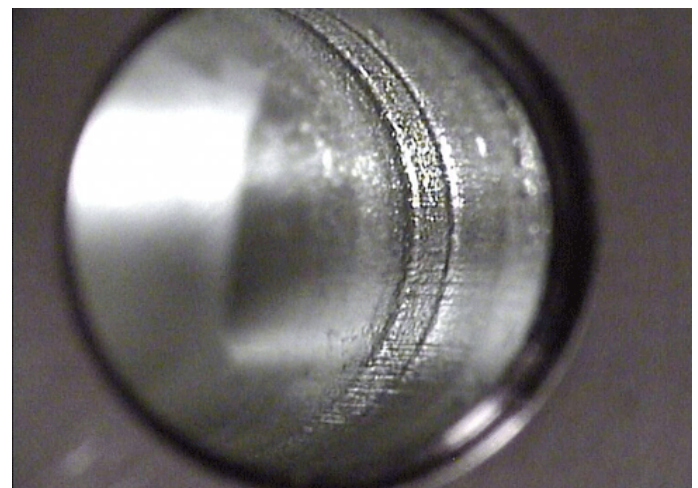


**FIGURE 1:** Monoblock multi-tip tooling helps to increase productivity

## The Key Issues

### Technical Issue – Wear to the Tooling

Novartis Italy's tooling from their existing supplier, was seen to wear very quickly with an average of 300 million tablets produced per tooling set and dies having to be turned after just 150 million tablets.



**FIGURE 2:** Excessive wear to the tooling

### Technical Issue – Breakage

Breakage was another major issue during production. With a maximum force of just 15–17 KN, breakage was still occurring. The lower tip was fracturing regularly, with lateral forces and excessive clearance contributing to the problem.



FIGURE 3: Lower tips were breaking easily



FIGURE 4: Tip breakage

### Technical issues – Alignment

It was found that some of the long-standing presses being used had wear on the turret guides and die bores. This is a challenge that many manufacturers face. These presses had many years of working life to come, but the problem needed a creative engineering solution.

### The Trial

With many issues being encountered during production of the tablet, it was important to find a comprehensive solution. I Holland started their analysis by investigating the tablet design being used and suggested a new design, which would help improve downstream manufacturing problems such as tablet sticking, picking, lamination, capping and premature tooling failures. Due to restrictions on the design; acceptance of the proposed design could not be accepted.

With this in mind, I Holland made new proposals on the die's outer diameter. Due to the wear in the die pockets, an increase in the outer diameter was used to improve the fit, together with an increase in the upper die clearance to allow inter-changeability with the guides being used.

In addition to the above measures, I Holland's R&D department conducted an in-depth steel analysis. This concentrated on the tool steel and coating being used by the existing supplier to see why it was failing. Trials took place using a variety of coating solutions to observe the effect on the end-product. I Holland advised the use of its premium ESR grade steel with PharmaCote CN+ (Chromium Nitride Plus) and HPG-TC (Tungsten Carbide) dies.

PharmaCote CN+ has impressive anti-stick properties combined with excellent wear and corrosion resistance. It was found to be the best coating solution to combat the challenges being encountered. Together with HPG-TC dies, a material with extremely high wear resistance and compressive strength, the results were outstanding.

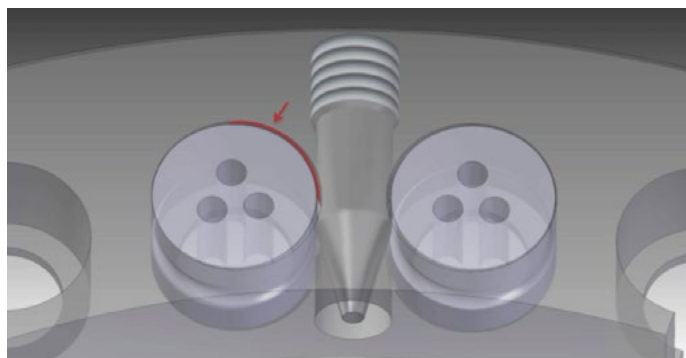


FIGURE 5: Alignment issues were found on the press, with wear of the die pockets

## The Results

Due to the proactive approach taken by the tablet compression specialists at Novartis and an excellent working partnership with I Holland's technical support staff and local agent Vis Viva, tooling was integrated which incorporated the coating solutions and the superior monoblock multi-tip; this resulted in much improved productivity.

Alongside the change to the dies and the coating used, modifications were made to the clearance and radius on the lower tips. With these adjustments the problems previously encountered were solved completely.

The application of the improved use of coating PharmaCote CN+ was trialed and the wear on the tooling was much reduced, this was after increasing compression by 20%. Results also saw no breakage during production. The increased tooling life saw output increase from 300,000 tablets to 400,000 tablets per set.

Use of PharmaCote HPG-TC saw a three-fold reduction on die wear. By changing to the recommended improvements, I Holland helped to increase the working life of the dies by three times, producing one billion tablets.

The new monoblock multi-tip, with the suggested coating, helped to reduce the overall cost, increase productivity and ensure the consistency of the punch length.

## The Conclusion

Compressing these tablets brought with it many issues, but with a thorough investigation from I Holland, the key problems of wear, alignment, interchangeability and tip breakage were all overcome with a sophisticated solution.

The correct choice of punch and die treatment had a huge impact on productivity. When coatings are developed correctly, and their beneficial characteristics are matched to those of the formulation, they can help to increase corrosion resistance, wear resistance and prevent other problematic factors like formulations adhering to the punch tip faces.

In this instance a resilient coating solution was found that worked with the correct high-quality steel tooling choice to effectively and efficiently optimise the production process.

With a monoblock multi tip tool chosen as the best solution to help increase productivity, it was important to use a die alignment tool to check the wear of the die pockets and the alignment of the turret.

If setting of the die is not performed correctly, then both the upper and lower punch can be misaligned when entering the guide causing punch tightness. This will result in contact between punch tips and the die wall causing friction and heating resulting in premature wear.

The size of the die pockets is also important. Dependent on condition, the die table may have to be replaced, or a revised tolerance to the die specification would need to be applied. Die pockets must also be clear of any foreign objects or burrs and the die fixing bullets should be in good condition to ensure the multi tips work to their full capacity.

With the combination of well manufactured multi tip tooling, using the correct raw material and coatings, the use of multi tips help to see greater productivity, and a reduction in run-time per output of tablets, leading to less maintenance per batch and reduced press set-up time.